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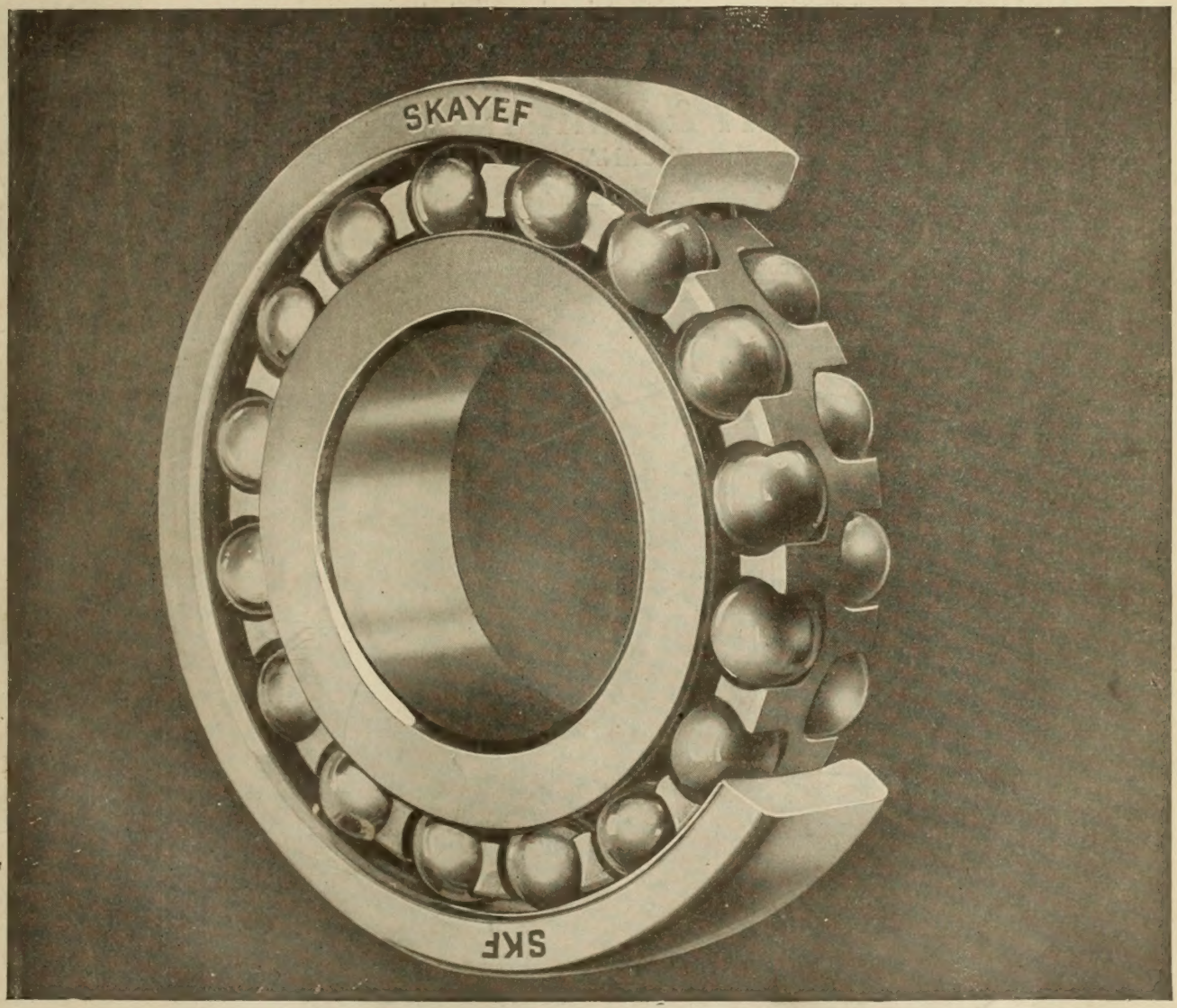
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CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVII. No. 1 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Jan. 5, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page



The world-wide studies of our Engineers, and our experience in every part of the industrial world, have made possible the development of the SELF-ALIGNING bearing. This same study and experience is at your disposal for the solving of YOUR bearing problems.

Canadian SKF Company, Limited

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You Need a Good Die Stock Set

If you need one at all.

Because a **GOOD** Die Stock Set embodies:

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2. Adjustment for wear.
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BETTER than most because of the interchangeable feature in their chasers. A broken chaser in a P. & W. Die doesn't mean a new set of chasers. You can get a new chaser to replace a breakage and the new one "fits in" perfectly in your old set. That's the 6th point, **"ECONOMY IN OPERATION."**

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VANCOUVER	WALKERVILLE	HALIFAX
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PRATT & WHITNEY.

The BERTRAM Page

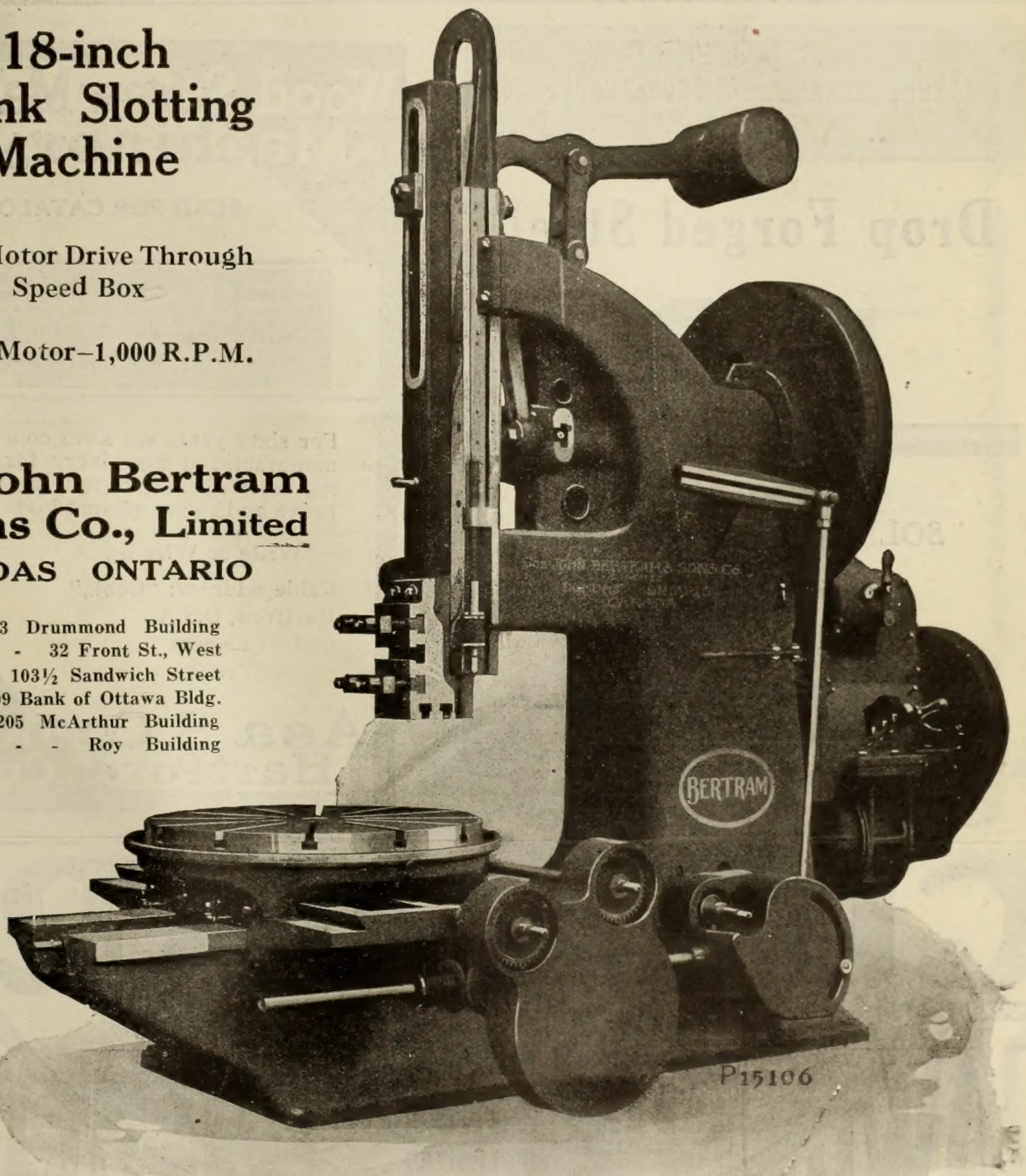
MACHINE TOOLS

J.B.&S.CO.

18-inch Crank Slotting Machine

A. C. Motor Drive Through Speed Box

10 H.P. Motor—1,000 R.P.M.

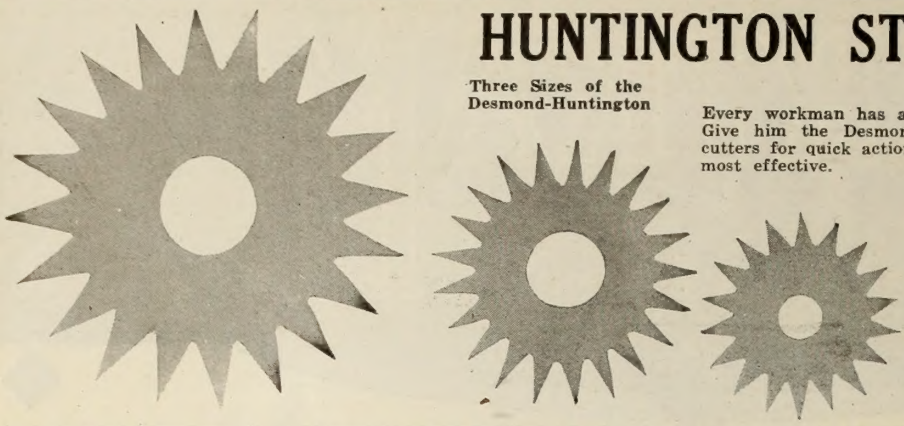


The John Bertram & Sons Co., Limited

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Vancouver, 609 Bank of Ottawa Bldg.
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Three Sizes of the Desmond-Huntington

Every workman has a "warm spot" in his heart for good tools. Give him the Desmond-Huntington Dressers. They're the right cutters for quick action. On large, hard grinding wheels they are most effective.

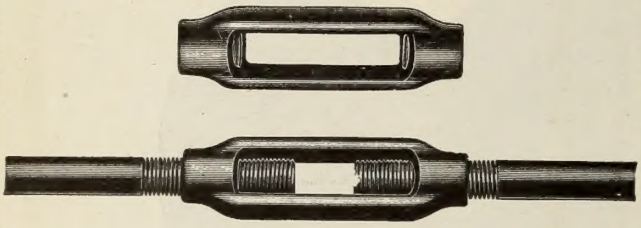
All Desmond-Stephan Cutters are made of the highest grade steel, hardened and toughened. Write for catalogue.

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Drop Forged Steel



SOLID—NOT WELDED

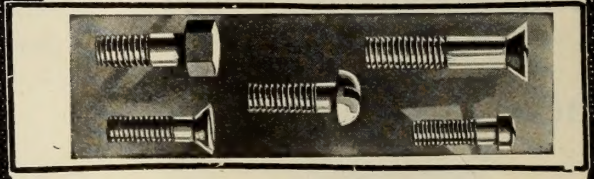
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Welland, Ont.

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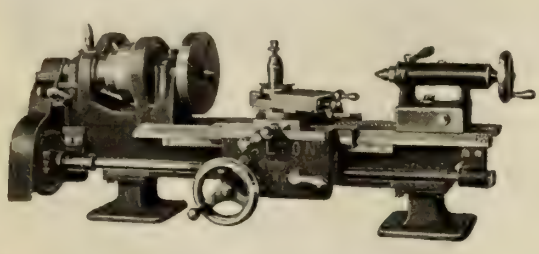
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"The Small Lathe for the Big Job"



Type B-4

Actual Swing 7¼ Inches

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Also Manufacturers of Type B-6 Lathes

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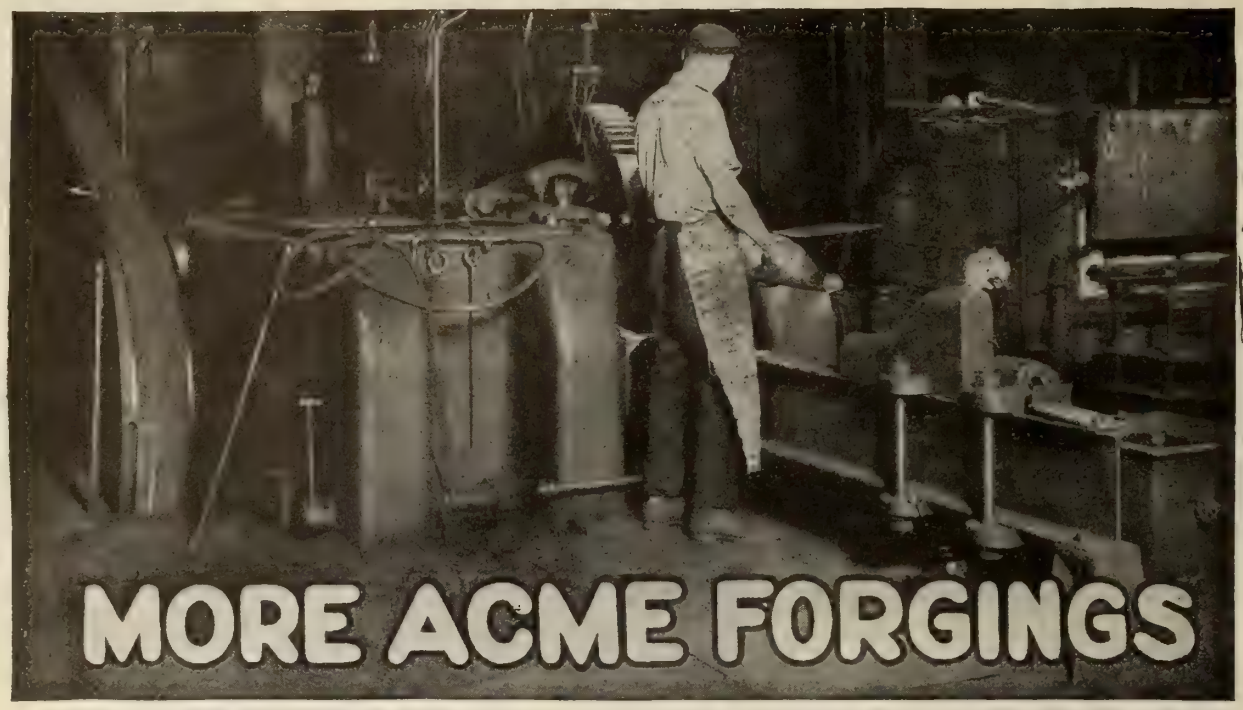
After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

HANNA

M.A. HANNA & CO.

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Unusual Jobs at Lower Costs

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Include within their range all kinds of bolts and forgings possible on ordinary Forging Machines as well as many intricate shapes *not possible* on ordinary types. They are practically universal, producing with the same movements bolts and forgings.

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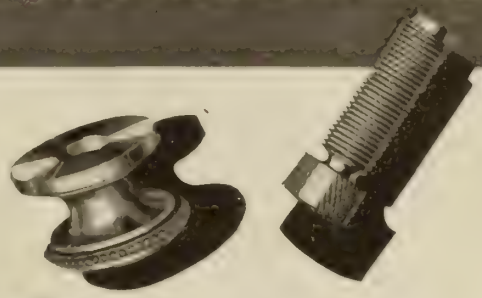
The Acme Machinery Company

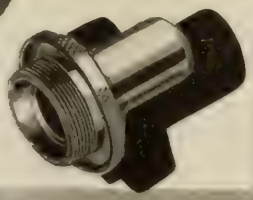
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Canadian Agents: **The John Bertram & Sons Co. Ltd., Dundas**

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For Auto Accessories



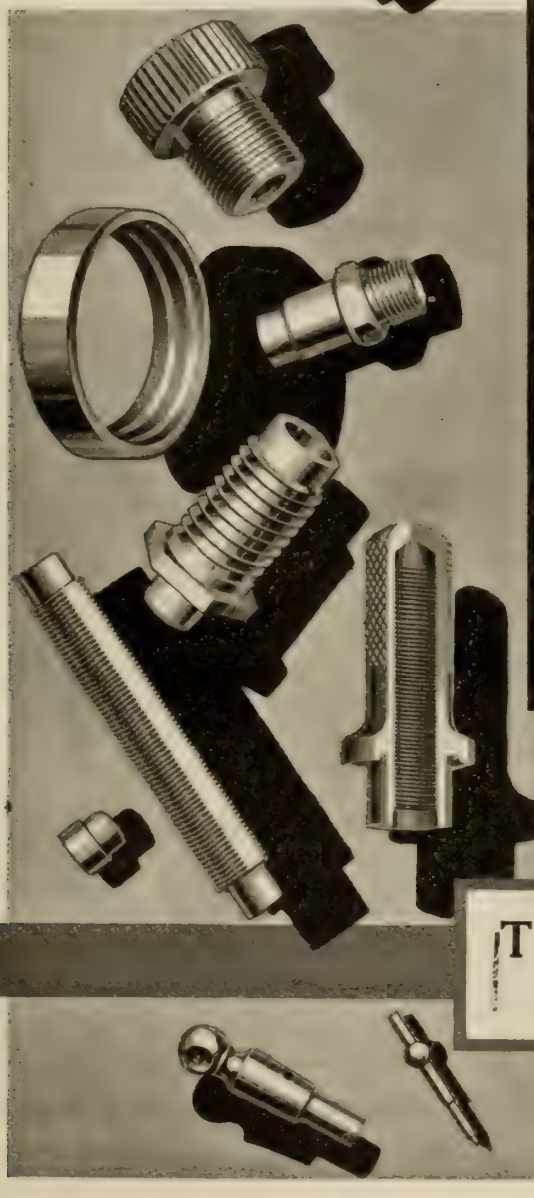




It makes no difference whether you need—One thousand tiny Adjusting Screws—Ten thousand Hardened and Ground Spring Bolts—or any other kind of milled parts up to 2¼ in. diam. Our well-equipped product plant is at your service.

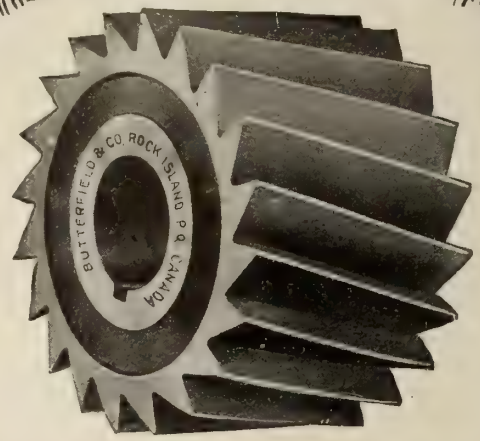
Extensive knowledge of special operations and a mechanical equipment for practically every variety, enables us to take care of new and highly specialized products without the loss of time caused by slower methods, or the cost of experimenting to find quicker ones.

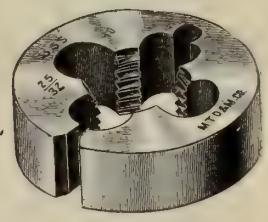
Standard Cap and Set Screws, also Finished Nuts and Studs from stock.



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BUTTERFIELD



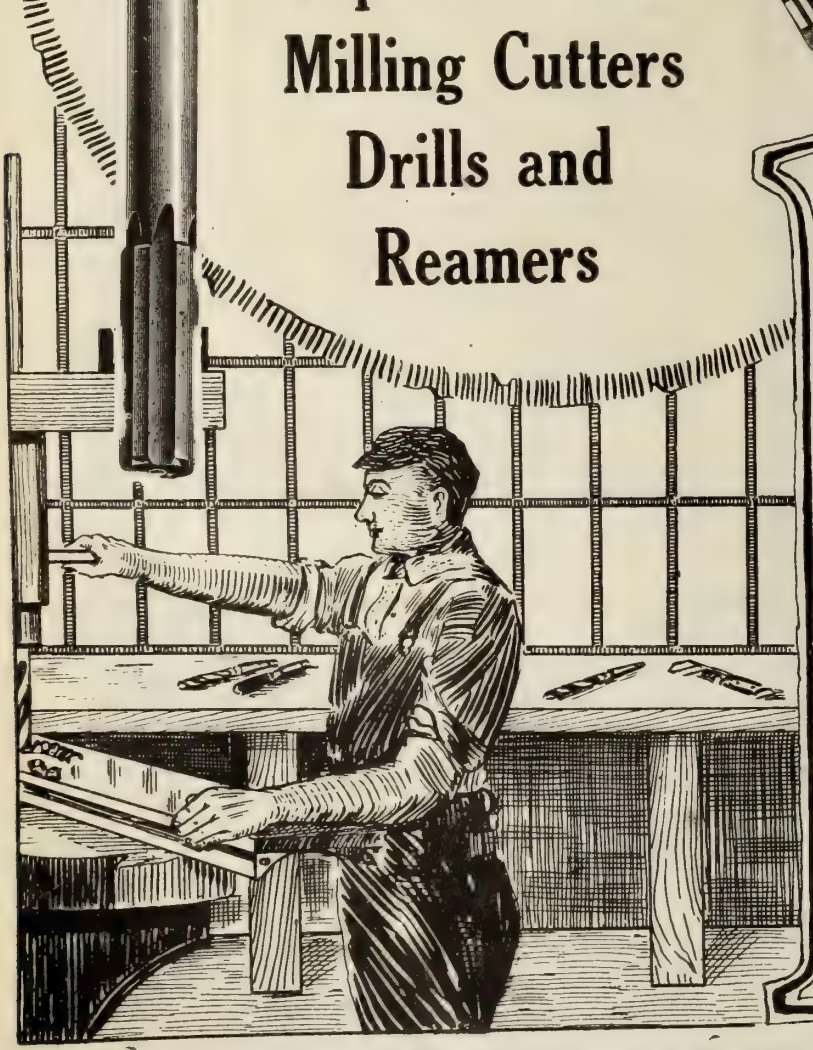








Taps and Dies
Milling Cutters
Drills and
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THE workman who is supplied with Butterfield tools tackles his various jobs with confidence; he does his work deftly and quickly, and at the end of the day can show far greater production than if he used an indifferent line of tools. Butterfield Taps and Dies, Drills, Reamers, and Milling Cutters are noted for their strength and keen cutting qualities. **"They are the Tools You Buy Again."**

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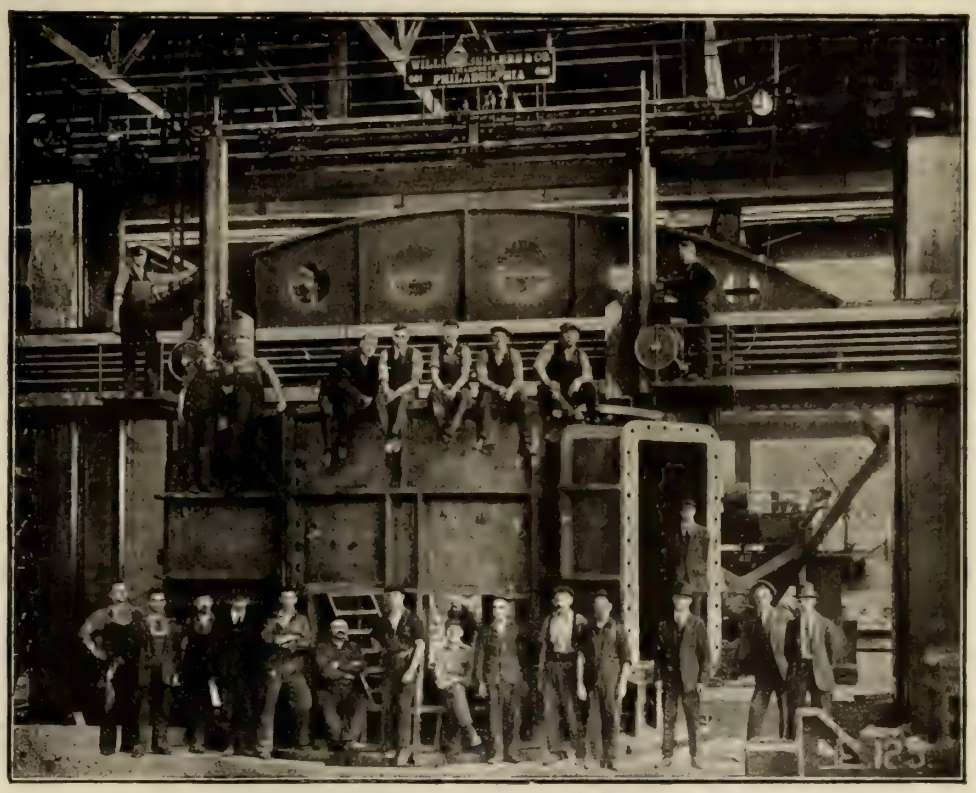
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enable us to render exceptional service where large, difficult Foundry and Machine Work are required. We can handle pieces up to 75 tons weight in Grey Iron or Semi-Steel.

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We build fast-running modern Fourdrinier Paper Machines, also Harper, Cylinder and Wet Machines, Millspaugh Suction Rolls, Stuff Pumps of Fan or Plunger types, Spangenberg Screens, Granite Press Rolls, etc. Existing Paper Machines remodelled on modern lines.

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Friction Clutches From Stock

Johnson Clutches, both single and double, can now be obtained from stock in our standard slow speed type to fit all common shaft diameters and all standard pulley bores, within the range of light and medium horse powers that we cover.

State definitely —

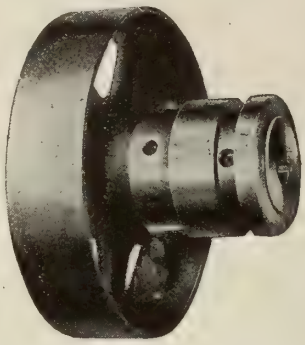
Just what the clutch must drive.
Actual maximum horse power.
Speed of clutch shaft.
Diameter of shaft.
Diameter, width and bore of pulley.

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Friction Control Means Better Machinery

And the Johnson Clutch is supreme among friction clutches. Adopt it as your standard — always dependable and always promptly obtained.

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THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN



ARMSTRONG
TOOL HOLDERS

—Real Economy



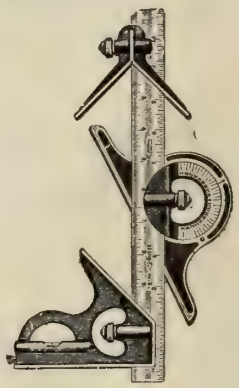
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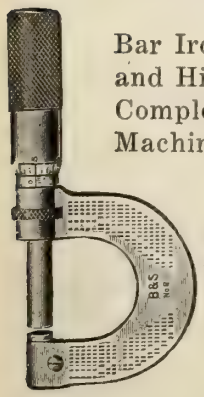
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ARMSTRONG BROS. TOOL CO.
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STRONG STRONG

RICE LEWIS AND SON
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TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

Heat Under Accurate Control

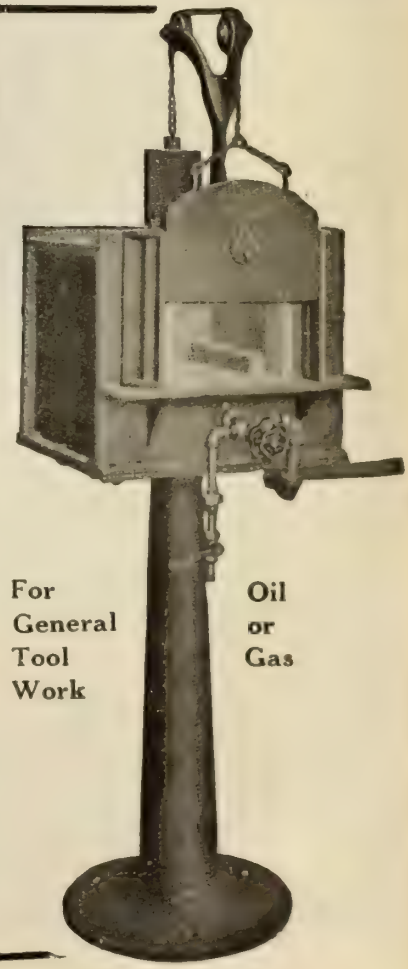
Here is an important factor in the heat treatment of metals. An intense heat, rapidly developed, and always under accurate control of the operator, is a feature that distinguishes

BELLEVUE FURNACES

These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

Combustion is perfect and no flames come in contact with material. Built to stand the highest temperature. Doors are properly counterbalanced. In every way BELLEVUE FURNACES meet with the demand for durability, efficiency and convenience.

Let us advise you about your heat-treating problems



For General Tool Work

Oil or Gas

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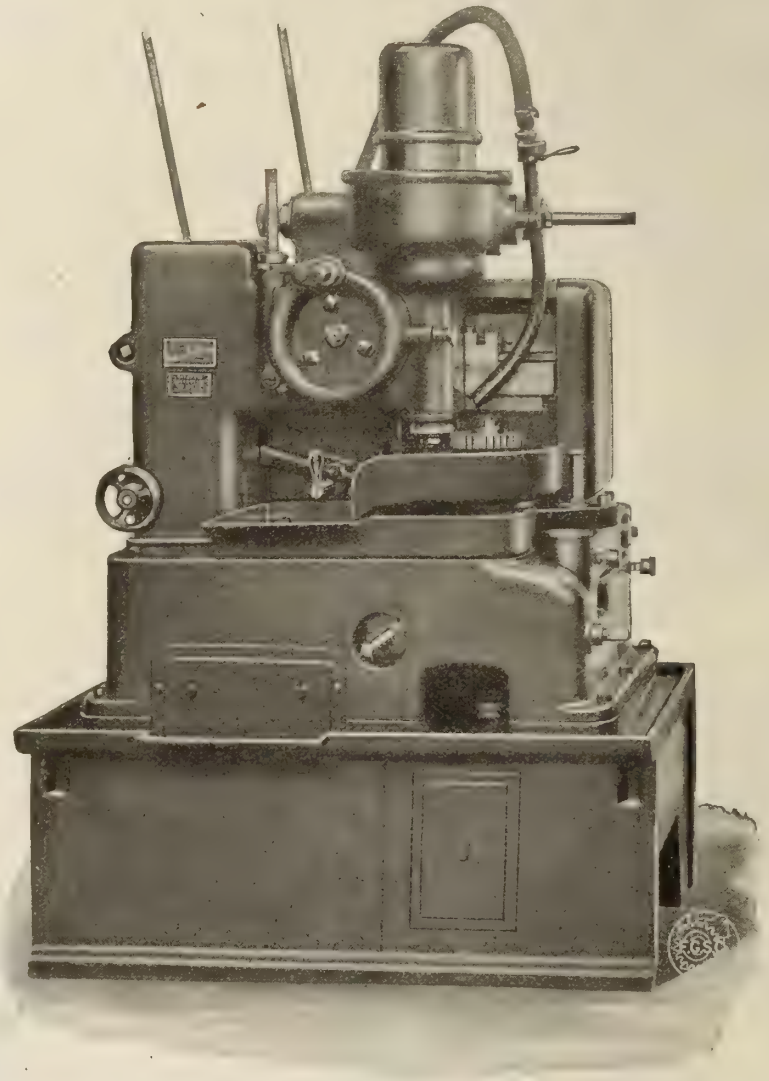
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WITH THE
New Production Gear Shaper



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It is designed to cut one gear at a time and at a speed which eclipses all other methods.

All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines.

It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.

See illustrated article in all technical magazines.

Send for our booklet, "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now.

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B B

Make Sure of the "B-B" Trade Mark



It is a Guarantee of Reliability

The "B-B" trade mark on power presses, shears, tinsmiths' tools and canners' evaporators, and sheet metal working tools of every description, is an iron-clad guarantee that it will give satisfaction on the work for which it is built. And because every tool before it leaves the factory is rigidly tested, we *know* that its merit is beyond question.

We shall be glad to send you catalogs fully describing those machines in which you are interested.

THE BROWN-BOGGS CO. LIMITED

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Open Hearth and Electric Furnace

Bars—Hot Rolled and Cold Drawn

BILLETS—SLABS—BLOOMS

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When you purchase or specify our Alloy Steels for your product, you get with the steel the assurance that a competent metallurgist is at your service in the working and treatment of that steel.

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Avail yourself of our consultatory service:—If you have any place in your manufacture where you think you could use an Alloy Steel to advantage, give our engineers the opportunity of assisting you in the selection of the proper grade and type.

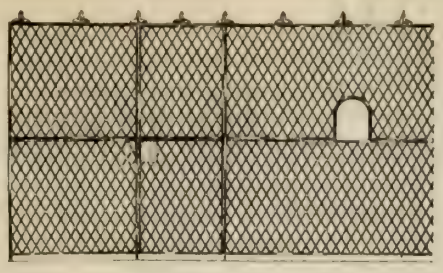
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Is your stock in danger of being looted by thieves or meddlers?
You can keep things under lock and key by having a wire enclosed stockroom.
Where space and natural lighting are at a premium the wire partitions have come into favor.
We supply wire partitions of a standard size, or make special sizes at your order.

We Also Make

Window Guards, Elevator Enclosures, Machinery Guards, Steel Lockers, Steel Cabinets, Steel Shelving, etc.,

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No. 3 BURKE

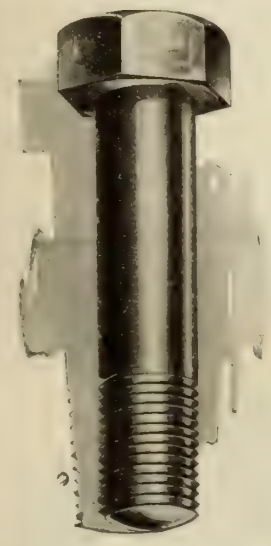


This little milling machine will do a lot of work usually done on large and expensive machines. It is accurate and convenient, a space saver and a cost saver. Fitted with slotting attachment, vertical milling attachment index centres either stationary or tilting heads, etc. It is a high-grade machine in every particular. Write for full description.

Bench type $155; with pedestal $171 Canadian Money

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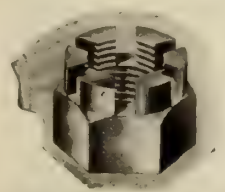
Canadian Dealers:—H. W. Petrie, Ltd., National Machinery & Supply Co., A. R. Williams Machinery and Supply Co., Canadian Fairbanks-Morse Co., Williams & Wilson, Garlock-Walker Machinery Co., Yeates Machinery Co., Cope & Sons,



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Your rush orders filled promptly by



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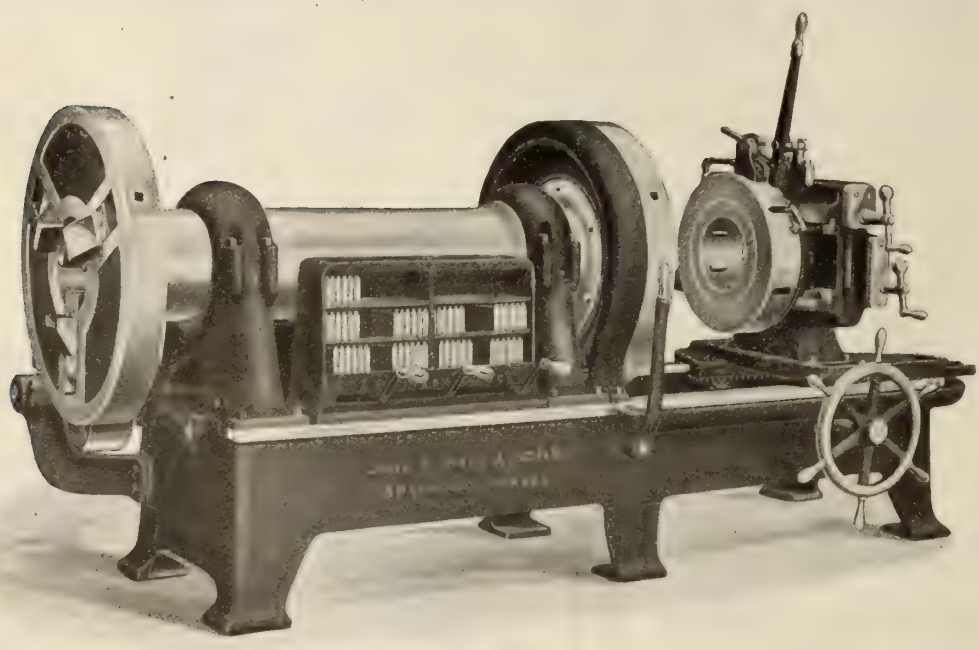
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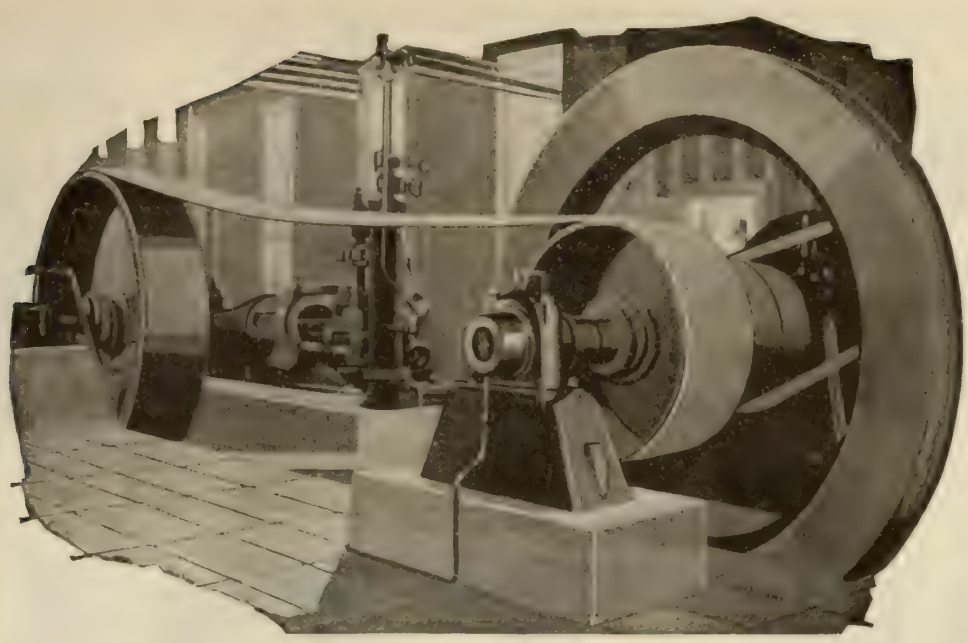
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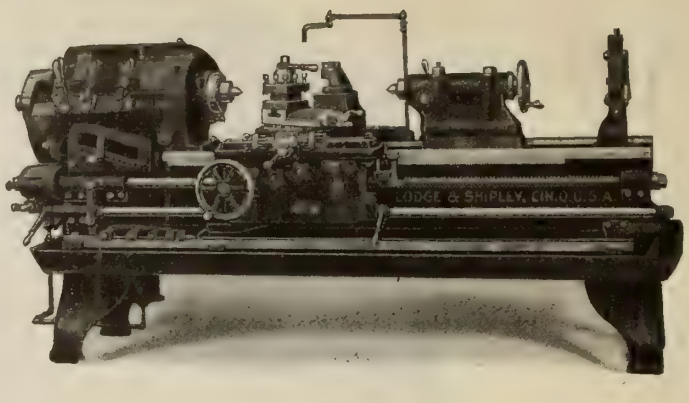
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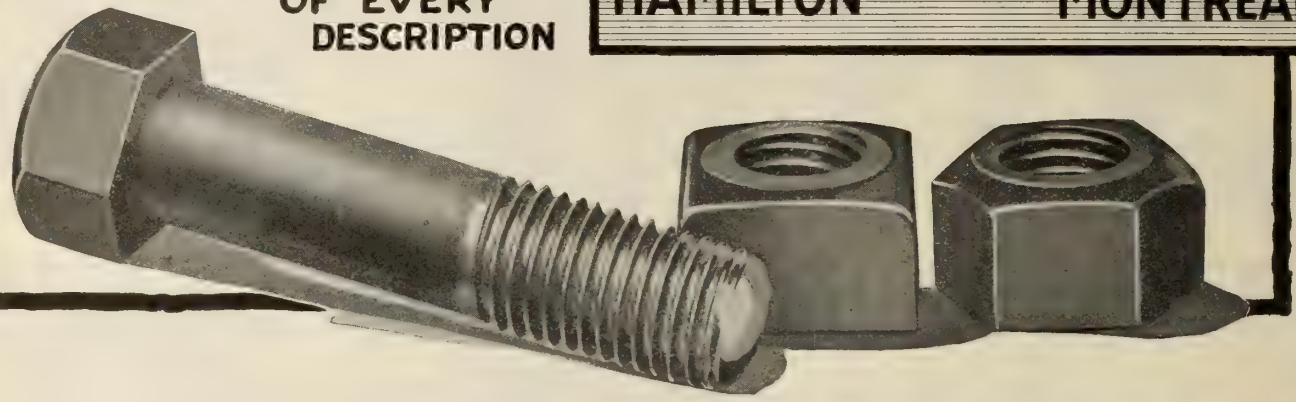
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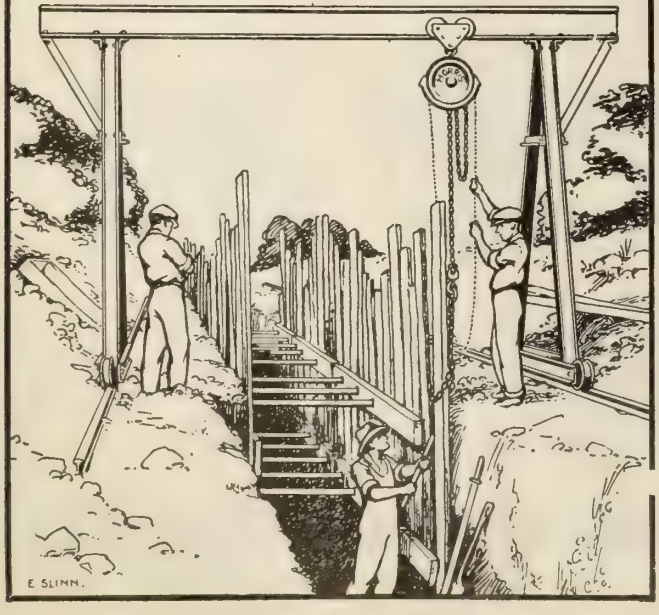
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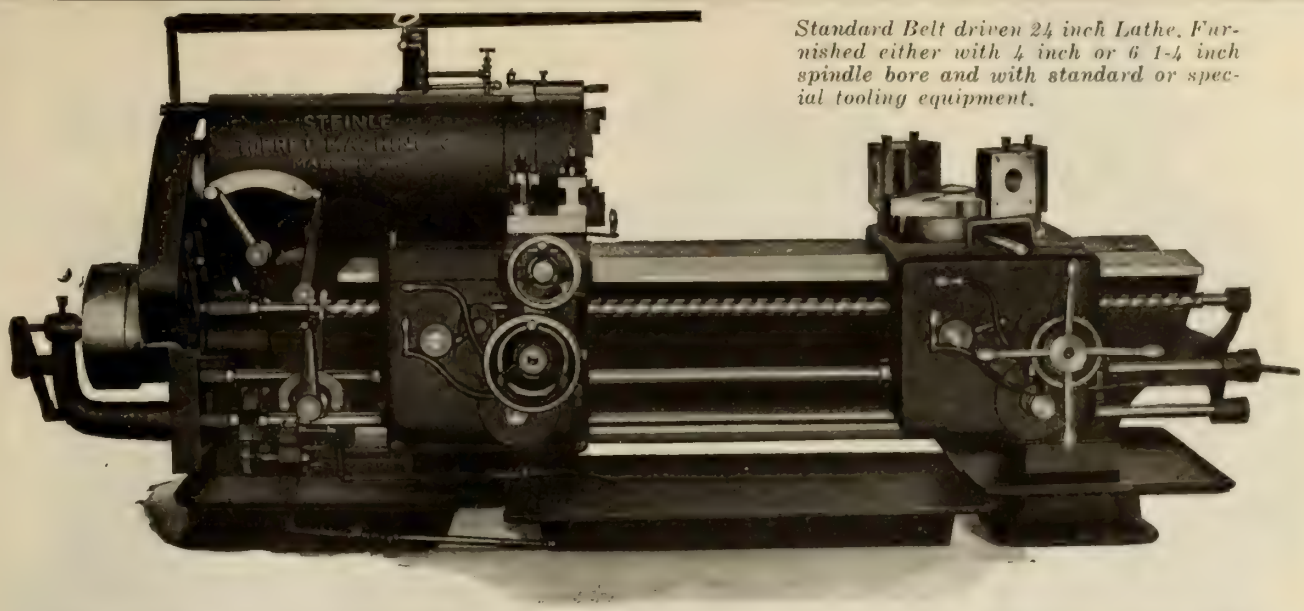
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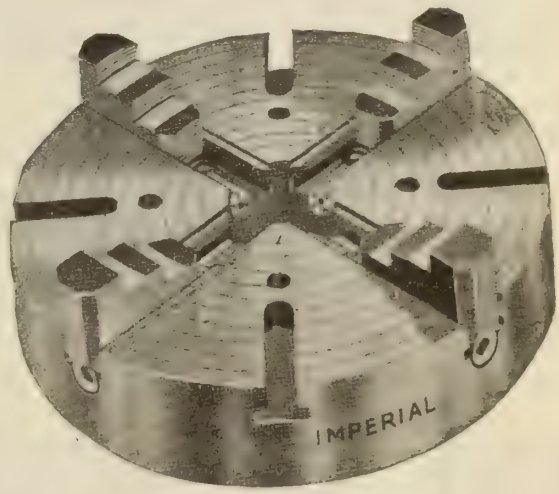
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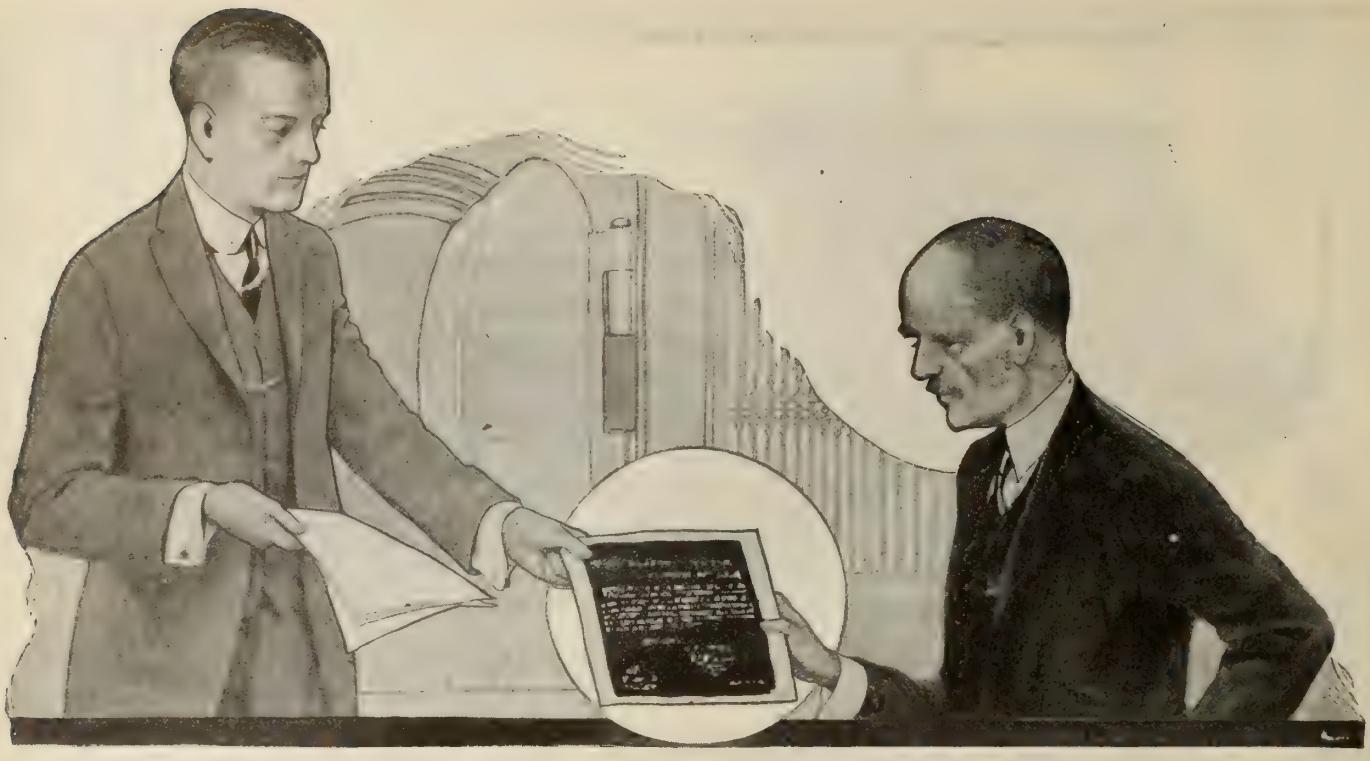
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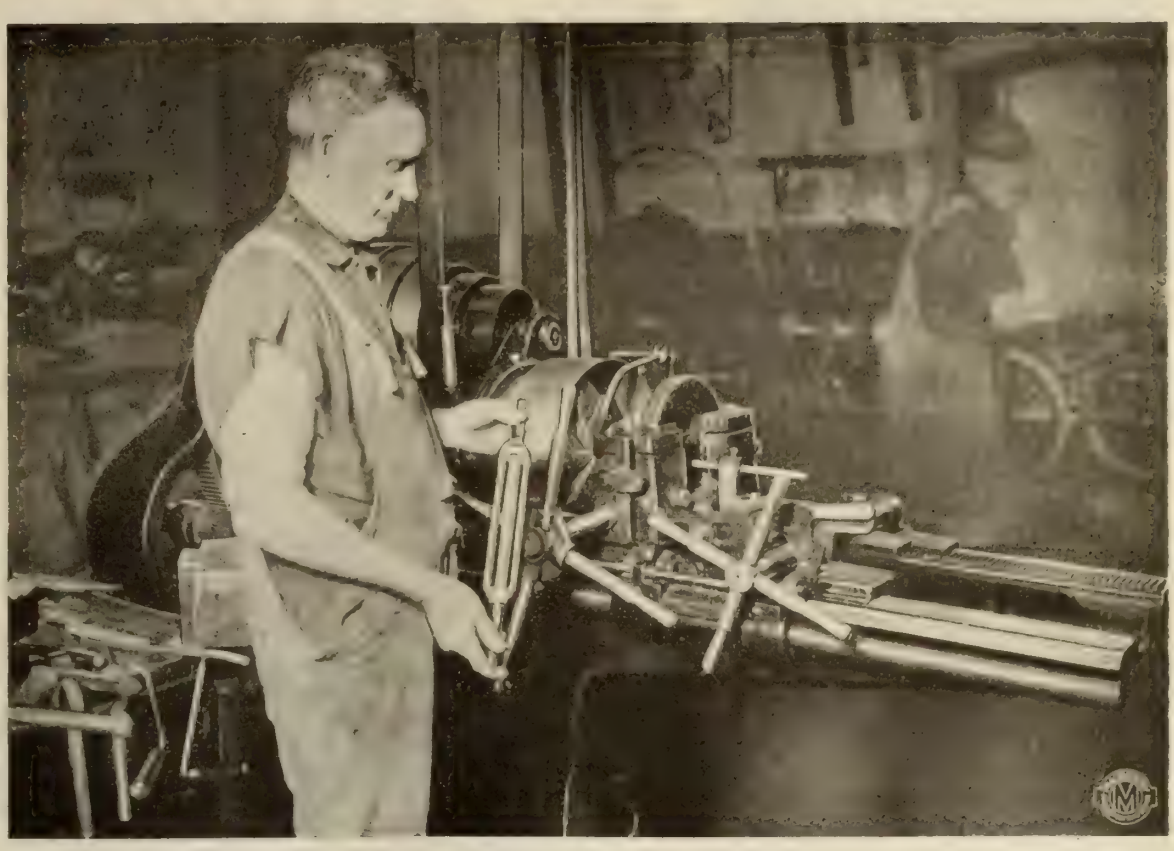
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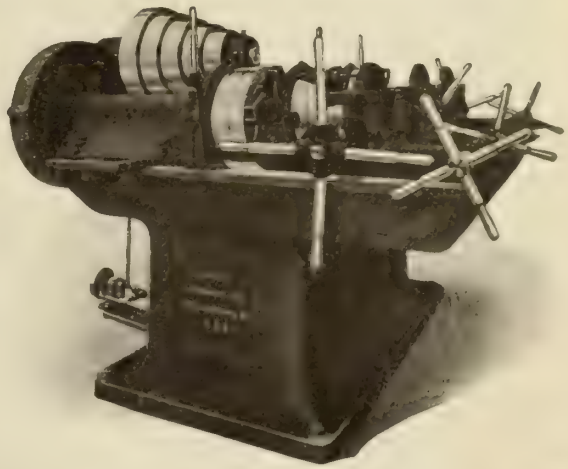
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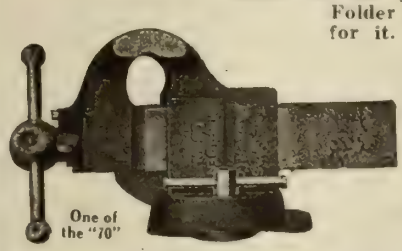


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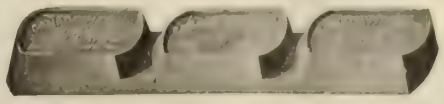
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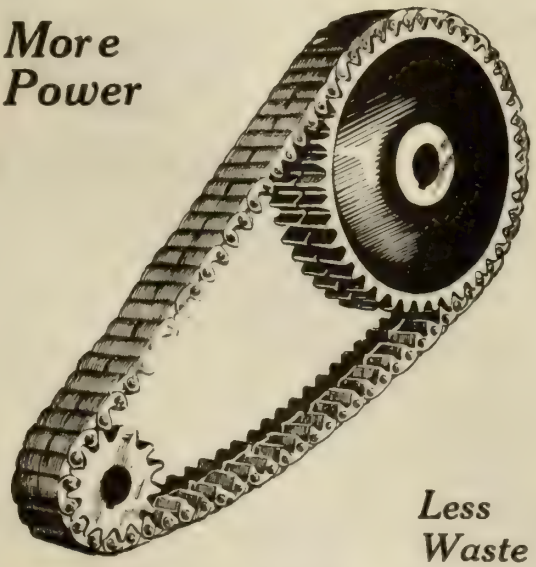
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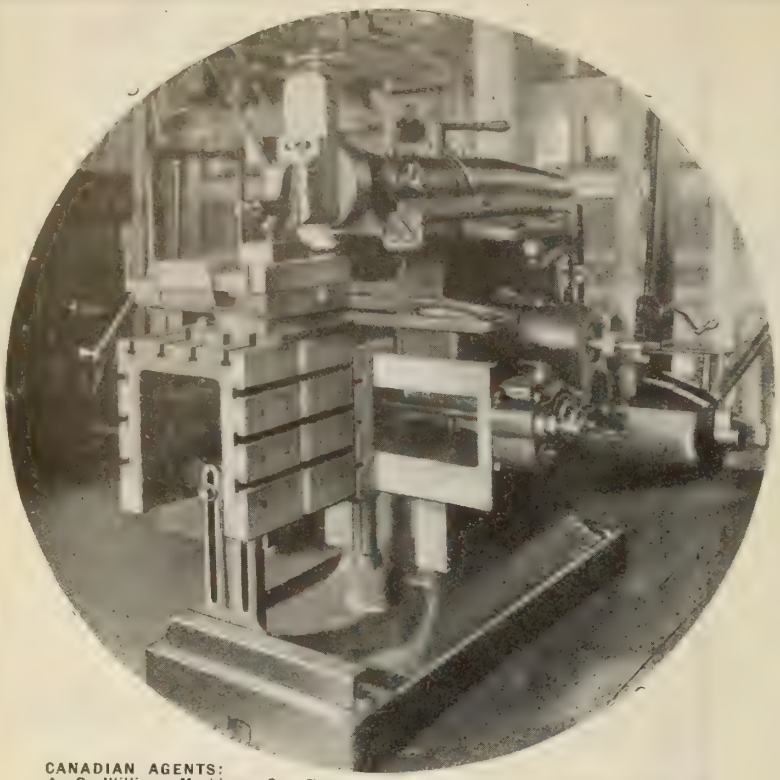
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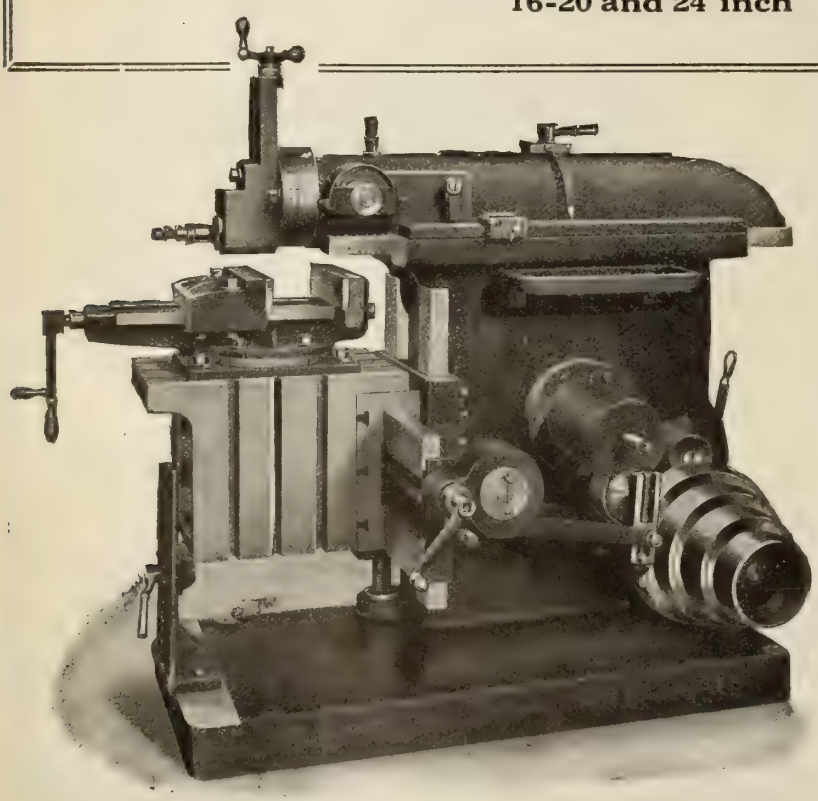
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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXVII No. 1 JANUARY 5th, 1922

Hints and Suggestions for Speeding up Filing

Development of File Industry Has Covered Lengthy Period—Different Types of Files and Their Uses——Proper Height of Work To Allow Workman Free Swing of His Arms

*By J. H. MOORE

THE AVERAGE machinist, toolmaker, or in fact anyone using a file, seldom thinks of the development work which has been expended on the product in his hand. To produce a modern file, many operations are entailed, and viewed in the light of the earlier methods of file manufacture, they show great progress. Delving into the early ages we find that the rasp was the forerunner of the later types.

Before iron and steel were even known, man had thought of rubbing away soft surfaces with a harder material than the surface to be rubbed. Nature helped development in this respect, as it provided several so-called rasping surfaces, some of which are still in use among primitive races. For example, there is the skin of the "Dog-Fish," the "Skate Skin," and the tongue of another fish called the "Aropaima Gigas." It is doubtful if many will get their own tongue to pronounce the name of this particular fish tongue, but be that as it may, here is how they used these materials. They wrapped the skins around a stick or flat piece of wood, and while the product was very poor, it served their purpose at that time.

In the Stone Age a new type of rasp was introduced. A flat wooden slab was studded with small pieces of flint, and later an improvement was made to this style by chipping the flint, making an irregular surface. It was not until the Iron Age that the metallic file made its appearance. The Romans are known to have used such files, but as far as can be gathered, files were unknown to the ancient Greeks or Egyptians. History shows that the oldest files of which there is record, were discovered at Chatlet in Champagne during some excavations. These were shaped flat, half round, and square, and as far as can be learned, were cut by hand.

With the increase in the requirements of civilization the uses of the file became amplified. Different types were devised for special purposes. Organ makers in the seventeenth century used a sort of float file with bent tang and point curved upwards. Tin pewterers used a piece of iron 2½ ft. long by 1 in. wide and nearly 1 in. thick, with teeth on both sides about 3/16 in. apart.

In 1795 we find that an English machinist decided that files were too easily worn out, so he patented an "everlasting file," the teeth of which were movable. They could be taken out, placed in a holder and re-sharpened on a grindstone. In all the above cases files were cut by hand, with hammer and chisel, and the illustration with the article shows two of the hammers used during the hand-cutting period.

From the Stone Age to the present time has witnessed so many changes of importance, that it is best to take all this development for granted. Should readers be anxious to read of the modern method of making files they can refer to the Oct. 30th, 1919 issue. Considering only the many styles of files in use to-day let us touch briefly on the terms applied to the different types. When a person speaks about the "Back" of a file, he means the convex side of either a half-round, cabinet, pitsaw, or other file of similar cross-sectional shape. The term "Bellied" is used to describe a file having a fullness in the center, while the word "Blank" is used to describe files in any process of manufacture before being cut.

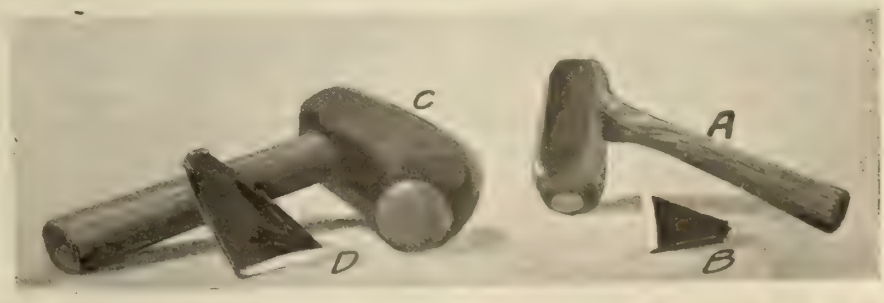
The term "Blunt" is applied to files which preserve their sectional shape throughout from point to tang, while the expression "Equaling" is used to describe a blunt file upon which is produced an exceedingly slight belly or curvature, extending from point to tang, the file apparently remaining blunt.

The coarser grades of single cut files are quite frequently called "floats," especially when cut for plumbers' use, or for soft metals or wood. Then there is the word "Hopped." This is a term known amongst file makers, and is used to represent a very coarse or open spacing of the teeth, (sometimes, exceeding ½ in.) mostly applied to the backs of half-rounds, and to the edges of quadrangular sections.

The term "Middle Cut" is used to designate the cut of a file when it is of a grade of coarseness between the rough and bastard. It is but little used in this country however. Then there is the "Over Cut," this term being used to describe the first series of teeth on a double cut file.

Re-Cut or Re-Cutting

The above expression means the working over of old or worn out files by the several processes of annealing, grinding out the old teeth, re-cutting, hardening, etc., and thus again preparing them for use. This operation is sometimes repeated two and even three times, but the economy of re-cutting at all is very much questioned, and in some plants, they refuse to use re-cut files of any



Showing two sizes of old style hammer and chisel. These were used when files were cut by hand and the heaviest hammer in illustration weighed ten pounds.

*We are indebted to the Nicholson File Co., Port Hope, for the use of their booklet, "File Filosophy," in the preparing of this article, also to the Ingersoll File Co., Ingersoll, for the illustration of old style hand-cutting tools.

kind whatever, claiming they do not stand up for any length of time.

"Safe edge," or "side," are two terms used to denote that a file has one or more of its edges or sides smooth or uncut, that it may be presented to the work without injury to that portion which does not require to be filed.

The term "Scraping," as applied in machine shops means that this process consists of removing an exceedingly small portion of the wearing surfaces of machinery by means of scrapers, in order to bring these surfaces to a precision and nicety of finish (as determined by the straight edge or surface plate) not attainable by the file or by any other means known to mechanics.

The word "Set" means to file off or blunt the sharp edges or corners of file blanks before and after the first or over cut is made, in order to prevent weakness of the teeth and consequent liability to break when put to use. "Dead Smooth" means a very finely cut file, and in Lancashire, England, they call this type of file "superfine," or super cut." The term "Taper" is used to denote the shape of the file is as distinct from "blunt," and custom has tacked this name on as a short way of designating the "Three Square Handsaw" file. When we speak of an "Up-Cut" we refer to series of teeth superimposed on the over cut series of teeth on a double cut file. So much for general terms; but how can such files be used to best advantage?

Hints and Suggestions

A novice watching a mechanic using a file, might be tempted to exclaim "What an easy task," but would such a remark be true? Very few mechanical operations are more difficult than that of filing well. In the case of the many styles of machine tools, the cutting medium is guided by some definite arrangement, but not so with the file. The human element enters into the matter, the hand being the guiding medium. When you meet a mechanic who can file well, you can safely say, that practice has made perfect, for in his earlier days the mechanic must have practised well. Anyone who has trouble with filing, should take these words to heart and decide to practise. True, it will mean perseverence and patience, but it will pay in the end as accuracy will be secured.

While a perfect file is necessary to secure the best results in filing, the workman's success depends very largely on his ability to select the proper shape and cut of file for the work he has to do, together with generalities that may be given with any idea of practical value to the beginner. The school of experience is where he must acquire the ability to become expert but from the description given later on in this article a general idea may be had that will assist in making the proper selection of the file to use.

A Severe Test in Filing

A severe test in filing would consist in producing a true flat surface upon narrow work, or say that whose width does not exceed one-eighth the length or stroke of the file. To the uninitiated this would seem to require that the file should have a perfectly true and straight surface, but were it practicable to make the file absolutely flat and true, it would then be necessary to move it in absolutely straight lines across the work; even were this operation possible, the pressure, if applied to each end of the file, as is the usual custom, would give it sufficient spring to cause a slight concavity to its cutting surface, and thus an inevitable rounding to the surface of the work must be produced.

Therefore, to produce a flat surface under this severe test, or even under more favorable circumstances, the file should have a convexity given to its surface.

Convexity in Files

Undoubtedly, few, even of the old filers, have given the subject of convexity as it bears upon broad surface filing the thought it is entitled to. It is known to many mechanics that a file which will bite and cling, with the accustomed-downward pressure, upon wrought iron or soft steel will require a greater pressure to prevent it from glazing or slipping over the work, when applied to broad cast iron surfaces. This is owing to the glassy nature and extremely granular formation of these surfaces; consequently the teeth should enter the surface deeper than in the more fibrous metals or they will soon glaze over and become dulled or shiny, thus giving to the file the appearance of being soft, while the contrary may be the fact. Many a well hardened file has been called soft because the operator has failed to give it a fair chance.

Considerable convexity is, therefore, needed in such cases; for while it gives greater control of the file from point to heel, it also presents fewer cutting points to the work with a given pressure downward than the less convex file—the bite being increased in proportion to the increase of the convexity. The ability, therefore, to increase it more or less, at the will of the operator, is of considerable importance.

In finishing many kinds of work, the absence of a suitable convexity limits the usefulness of thefile—as in the preparation of the valves of steam engines, tables of printing presses, stereotype plates, or other work requiring a true surface.

While an absolutely true surface is confessedly unattainable, it is evident that, as in the above cases, a degree of perfection is sometimes desirable beyond what the necessities of other work may require; and to be able to touch the exact spot indicated by the straight edge or surface plate with the file, is to utilize it in a manner which could not be done if the convexity did not exist.

Files Properly Handled

When the proper selection has been made, before using the file it should first of all be properly handled; i.e., a handle of the proper size with the proper size hole, drilled straight, should be fitted to the file, not, as is too often the case, by driving the handle halfway down the tang and thereby doubling the chances of breaking it, but by forcing it well up to the shoulder, thus enabling a suitable grip which is essential to a proper guiding and control of the file. It not infrequently happens that the tang hole is not drilled central or is badly out of line, or does not properly fit the tang of the file; in such cases the tang of an old or worn file of similar dimensions should be heated, taking care, of course, not to draw the temper, and the hole in the handleburned out to nearly the desired size and shape before driving it upon the tang.

Of the many file handles of special construction hitherto devised, there are none which have, as yet, combined that simplicity, utility, and economy necessary to take the place of an ordinary wooden handle conveniently formed and properly ferruled, provided it be firmly affixed and carefully used.

Devices for Holding Files

The file, when used in the ordinary manner, considerably exceeds the length of the work; but when such is not the case, as in filing large table surfaces and shaping out recesses of considerable length, or when, from other causes, the ordinary handle will not answer, it then becomes necessary to grasp the file by holders of special construction. These special devices (many of which are quite crude) are numerous, and vary to suit the particular shape of the file and the work to be performed.

Short pieces of files of special construction are sometimes clamped to the slide rest, to be used upon work revolving in the lathe, and are soldered or screwed to bent handles which require to be used in finishing in and around the bottoms of shallow cavities. The necessity of this last method can be avoided by using a stub file holder, this consisting of a specially constructed handle and which is marketed in the usual way. Wood workers quite frequently clamp one or more files to pieces of board, or fasten them by means of staples and wire pins, or by cutting in, in such a manner as will enable them to smooth out grooves, or true up the edges of their work, using the board or holder as a gauge. Bent rifflers are often used to reach irregular shaped cavities, this really being a file which curves upwards for about one third of its length.

Filing Large Table Surfaces

In filing large table surfaces, the tang is frequently bent upward to admit of the hands clearing the work when the file passes over the surface; sometimes a crank-shaped holder is employed, having one end fitted to receive the handle. These devices, while facilitating somewhat the handling of the file, do not give that perfect control which enables the operator to manipulate it at will,

nor do they aid in governing its convexity.

Improved surface file holders are marketed however which, meet these points, thus enabling a skilful operator to do much of the work with the file which has hitherto been done with the scraper.

Height of Work

For filing in a vise the work should be held as rigidly as possible and the vise jaws should be placed so as to be level with the elbow of the workman, which will be found to range from 40 to 44 inches from the floor—therefore 42 inches may be considered as an average height, best suited for all heights of workmen, when the vise is to be permanently fixed. This position enables the workman to get the full, free swing of his arms from the shoulder; the separate movement of the wrist and elbow should be done away with as much as possible.

If the work to be fitted is small and delicate, requiring simply a movement of the arms, or of one hand and arm alone, the vise should be higher, not only in order that the workman may more closely scrutinize the work but that he may be able to stand more erect.

If the work to be filed is heavy and massive, requiring great muscular effort, its surface should be below the elbow joint, as the operator stands further from his work with his feet separated from 10 to 30 inches, one in advance of the other, and his knees somewhat bent, thus lowering his stature; besides in this class of work, it is desirable to throw the weight of the body upon the file to make it penetrate, and thus, with a comparative fixedness of the arms, to depend largely upon the momentum of the body to shove the file.

Grasping The File

In using the larger files, intended to be operated by both hands, the handle should be grasped in such a manner that its end will fit into and bring up against the fleshy part of the palm below the joint of the little finger, with the thumb lying along the top of the handle in the direction of its length; the ends of the fingers pointing upwards or nearly in the direction of the operator's face.

The point of the file should be grasped by the thumb and first finger, the hand being so held as to bring the thumb, as its ball presses upon the top of the file, in a line with the handle when heavy strokes are required. When a light stroke is wanted, and the pressure demanded becomes less, the thumb and fingers may change their direction until the thumb lies at a right angle, or nearly so, with the length of the file; the positions changing more or less, as may be needed to increase the downward pressure.

In holding the file with one hand, as is often necessary in filing light work, pins, etc., the handle should be grasped as already described, with the exception that the hand should be turned a quarter turn bringing the forefinger on top and lying along the handle nearly in the direction of its length. In this position, the freest action of the hand and wrist may be had upon light work. Amateurs will find that following these directions, the movements of the file will be simplified and made somewhat easier than if grasped at random and without consideration.

Carrying the File

The most natural movement of the hands and arms in filing is to carry the file in circular lines, the several joints of the limbs being the centres of motion; this movement of a convex file apparently give a concavity to the work, but the real tendency, especially on narrow work, is the reverse, owing to the work acting as a fulcrum over which the file moves with more or less of a rocking motion, giving an actual convexity to its surface except when in the hands of a skilful operator. The real aim, therefore, should be to cause the file to depart only so much from a true right line as will be necessary to feel that each inch of its stroke is brought into exact contact with the desired portion of the work; and by thus changing the course of the stroke slightly, thereby preventing "grooving," a more even surface results and the work is completed sooner. The movements here referred to have reference to those in which both hands are used upon flat work, requiring nicety and trueness of finish, and the difficulties to be overcome in producing even a comparatively true surface with a file require much practice on the part of the operator.

In filing ovals and irregular forms, the movements, while not considered so difficult or trying, nevertheless require considerable experience and a good eye, so to blend the strokes of the file upon the round or curved surfaces as to give the best effect; the varied nature of the work upon this class of surfaces, though much might be said, prevents any detailed definition as to these movements of the file within the limit of this article.

In point of economy, the pressure on the file should be relieved during the back stroke; this will be apparent to anyone who will examine the formation of the points of the teeth, when it will be seen that the file can only cut during the ordinary or advancing stroke and that equal pressure during the back stroke must be very damaging to the points of the teeth.

We do not wish to make this article of undue length, yet there are many other important points which should be considered if good filing is to result. We believe readers will be vitally interested in the points discussed in the conclusion of this article which will appear in the next issue. Watch out for it, as it will speak on the lathe work, drawfiling, preparing work, when oil may be used on a file, etc.

NEW MINE RESCUE APPARATUS

Ever since the invention of the Miner's Safety Lamp by Humphry Davy, Great Britain has devoted keen attention to the subject of safety devices in mines. Experiments recently conducted by the British Scientific and Industrial Research Department have resulted in the design of two new types of rescue apparatus which are proving most successful. Both types of apparatus are what is known as "regenerative"; that is to say, the air expelled by the lungs is purified, supplied with oxygen, and returned to the lungs. Therefore, when a man wears this apparatus he is able to enter smoke or poisonous atmosphere without suffering ill effects. The apparatus and the lungs really form a closed circuit, and the lungs serve as a pump to circulate the air round that circuit. In one type of apparatus the oxygen is supplied from liquid air and in the other type it is obtained from a solution of compressed gas. Both pieces of apparatus are designed to enable the wearer to undertake continuous heavy physical exertion for at least two hours. As a matter of experience they can satisfy all the breathing needs of the wearer for three hours.

When it comes to area Canada is entitled to say something. It covers the vast stretch of 3,729,665 square miles, which is equal in area to the United States with Alaska, the Philippines and all other possessions. Its population, however, is as yet no larger than that of New York and Chicago cities.



The Selection and Training of Salesmen

This Branch of Business Management is of the Greatest Importance—Many Men Have Wisdom But Do Not Know How to Apply It—Prosperity Depends Upon Our Own Efforts

By F. E. MUTTON
President and General Manager International Business Machines Co.

ONE of the major problems facing Sales Managers to-day is building up an efficient sales force to secure orders. Sales organizations are being subjected to the acid test; some of them will fail to survive that test. We have passed through four or five years recently when men who were called Salesmen did not have to sell at all; they became very soft in their ideas of work, yet they made wonderful sales records. Now times have changed; order-takers are of no use now.

We have seventy-two salesmen in our Canadian organization, we reach from one ocean to the other, and have offices and service stations in all cities and large towns.

Get Down To Hard Work

It has occurred to me during the last six months to a year, carrying our share of worry as to business conditions, that there are many men who have got a lot of wisdom but do not know how to apply it. They do not realize the vital application of it, and that is the hardest kind of work. Especially salesmen who have had five years of easy going, it is hard to realize that they have got to get down to hard work or they will not stay in a sales organization very long.

Of course I recognize that a sales organization selling a specialty like Time Recorders or Scales is different from one selling a standard article, however, I believe the same fundamental principles apply, and that this matter of selecting and training salesmen is the most important factor facing executives of any concern to-day. It is the salesmen that keep the factory chimney smoking, and the amount of smoke depends on the efficiency of the sales-organization, absolutely.

The New Conditions

The quicker we all realize that prosperity depends on the action of our own self-starter the better. A good many people are just waiting for something to turn up, even sales managers. To my mind there is nothing "going to happen" until you make it. Instead of the men going out on the 9 o'clock train they will have to go on the 7 o'clock if they are to succeed, and instead of coming in Thursday night or Friday noon, they will come in Saturday morning—if they are lucky. Those are the new conditions that we are facing.

I want to convey this idea; it is not necessary to tell most men these things, it is necessary to "sell" them. In our organization we never tell a salesman to do something. We "sell" the proposition. That is the only way to get the proper co-operation and spirit. The art of selling is the art of buying. What do I mean?—well, the amount you sell depends on the amount of confidence you can buy, the respect you can buy from the prospective customer. I think that it is an important principle to have the sales force memorize.

Obtaining Sa'esmen

Now where are we going to get our salesmen? Our experience is that we



F. E. MUTTON.

get our best men through our present sales force. Those men know the policy of the company, they have confidence in the company, they know the calibre of men the company want, and they have seen in action the men that they are going to send in to apply for the position. That is something you cannot do as a general proposition. They know whether he plays pool in the hotel until 2 a.m. or poker until daylight. They know his characteristics through working with him. I emphasize that, because looking back over my experience during the last thirty years I find that the best salesmen it has been my good fortune to secure came through the salesmen we already had.

You will not buy an automobile unless you try it out, but there are many hundreds of salesmen employed by sales managers who have never seen them in action. A man comes to your office, naturally he is at his best, but that does not tell you what he will look like in Peterboro or Montreal or Vancouver. His nails are clean and his shoes are shined. We did the same ourselves years ago. The important thing is to see the man in action in his regular working form, day in and day out, get a line on his characteristics, how he stands up under the test of the three a.m. bus, and the one old kind of pie, and no cream.

The Other Fellow's Salesman

The next channel is from the salesmen that canvass you for orders; and that is a good channel. "Do you mean to tell me you woud deliberately employ one of my salesmen?" someone may ask; I certainly do. If you say that is not a fair proposition I do not get your point of view. If my salesmen can make more money with you they will go with you. Therefore I am never too busy to see a canvassing salesman. The bank manager can wait, but this man may be the one I need as the corner-stone to a certain portion of our sales force.

I believe the successful sales manager is the man who is never too busy to see a canvassing salesman. If I am in a conference which would make it necessary to keep him too long, I go out and see him for a moment and apologize and make an appointment.

I spent twenty years with the National Cash Register Co. Mr. Paterson the President of that company, is known as a wonderful leader. We were in a convention of the sixteen sales managers of the North American Continent. Mr. Paterson came in and remarked: "These are the Sales Managers, yes; now just what do you gentlemen do for the high salaries you get?"

Well, it was kind of sudden. One chap stood up and said, "I keep my eye on the territory, I see that the offices are kept nice and clean."

"And you?"

"I check up the accounts and payments and consignments—"

Well, I was thinking fast, it was coming close to me, I said to myself, "these boys are not thinking right," so when he came to me I said, "I employ and train salesmen. I was with the N. C. R. for twenty years."

Looking Them Over

I would have lost the opportunity to secure excellent men if I had been too busy to see salesmen. Often a man has come in and although I did not need him at all, he made an impression. I talked to him fifteen or twenty minutes, asked if he would mind coming in again day after to-morrow—next week,—I wanted to get another slant on him. They never act exactly the same twice in succession. I asked him — "Now just tell me how much money you make and how much you would like to make. It may be that you are fitted for this business. I

am going to find out in the next fifteen minutes if you are."

From the Retail Store

Another channel is the retail store. We have secured some excellent men who were retail store clerks. There is a field where you will find ambition; also, it is a field where men are not over-paid. An illustration; we had difficulty in getting our devices in retail stores. Our time-recording division salesmen had been trained to interview manufacturers and factory men, but they fell down on the stores. I discovered that they did not know the language of the retail merchant, they had never been in that atmosphere. I looked about and found a young man who was head clerk in one of the large hardware stores in Hamilton, snappy, well-dressed, knew his job or he would not have been head clerk. I brought him to Toronto and employed him. We had to teach him the time-clock business as it related to the retail store; I said to him, "Now you will have to go into the factory and put on a pair of blue jeans and work from 7 till 5.30 for two weeks, for which you will not get any pay."

"All right," he said, proving his mettle.

I was only testing him really, but that was his mechanical training. The first month that young man was out in the Hamilton territory he sold eighteen machines to eighteen stores. That was good work. He knew the atmosphere and the language.

The weakest source is advertising for salesmen. I do not believe it is good business or sound policy to hire a man who is out of a job. That, perhaps, sounds severe, but there is generally some reason why he is out of a job, and it is difficult to get at the true reason. If you are going to put up a "Safety First" sign get a salesman who is in a position.

"The Bible"

Now, I want to put before you in this graphic way, these principles:

Get them clean —Mentally —Physically —Morally —Spiritually

That to me is "The Bible" in hiring Salesmen. There is no one of those things that you can afford to overlook. And you can test them all out in your interviewing.

Mentally.—The salesman who will consume time telling those stories that we sometimes hear is not clean mentally. The results show physically and morally.

Spiritually.—This is very important. Sometimes we meet a man who does not believe in such things as churches. I am not preaching a sermon, but I know the value of that element, we all do.

Then I would like to add Keep Them Clean as to the environment they live in.

Organization

In my opinion the following elements come under the head of organization in a sales force.

Employing Men
Training Men
Supervising Men
Promoting Men
Firing Men

If we are capable of the first four, we will not have to worry about the last.

As to qualifications, here they are:—

Health
Character
Deportment
Reputation in Own Neighborhood
Guarantee Bond
Manner
Ambition
Confidence in Himself

I have a chart on my desk and that is always ticked off 100 per cent. before a man is taken into our organization. Health is most important. If a man has not got 100 per cent, health he is anchored. A lot of talks have been made on Salesmanship; to me Salesmanship is the combination of a lot of qualities. Health is the foundation.

Our company spends a good many dollars a year in taking care of the health of our organization. We talk to them of what to wear, what to eat, etc. A lot is wasted, but some gets home and it does a lot of good. I venture to say when you meet one of our salesmen you find he is "in the pink." If he is not, he will not go out, they are trained not to.

Foundation of Everything

When a salesman approaches a prospect, one of the most important elements in getting that man's order is the salesman's health. Selling is largely a matter of domination. You need all the health and energy at your command to dominate some people; if you are only feeling about 70 or 80 per cent. fit, the buyer will do the dominating. Health is the foundation of everything. Take personality, the salesman's greatest asset. You cannot see personality, you just sense it. It is a thing you cannot define, and the greatest element of personality is health His eyes are bright and his step springy and he thinks just a little faster than his prospect; he cannot do it unless he has 100 per cent. health.

Supervision

Then supervision. I think lack of supervision is one of the weak links in our work. Every man needs it. Let me illustrate. The chain is—

Salesmen
Sales Agents
District Managers
Sales Managers
General Managers
President

Does it stop there? No, it goes on—

Executive Committee
Directors
Shareholders

I would like to make this subject clear.

Who supervises Salesmen? The Sales Agents.

Who supervises the Sales Agents? The District Managers.

Who supervises the District Managers? The Sales Manager.

Who supervises the Sales Managers? The General Manager.

Who supervises the General Manager? The President.

Who supervises the President? The Executive Committee.

Who supervises the Executive Committee? The Directors.

Then last, but not least, who supervises the Directors? The Shareholders.

Enthusiasm Injections

One of the reasons salesmen fall down is because they are not supervised closely enough. I do not mean bossed. We do not know the meaning of "Boss" in our organisation.

Supervision means, for one thing, that you get out with the salesmen occasionally, especially the men in the Provincial territory, who are meeting to-day probably the greatest resistance in the history of trade in this country. They are only human, they get lonesome, they have gone a week perhaps without an order. The greatest asset for a salesman to have is a big stout heart, not knowing the meaning of "Quit." Well, that man needs supervision it might be termed, or Assistance, a new injection of Enthusiasm, which he can only get from an executive higher up.

I have recently returned from a trip to the Coast. I am running the manufacturing end as well as the selling end, but there is nothing else so important to my mind as going out and visiting these men, spending a day or two or three with them, getting that heart-to-heart touch that they appreciate so much—I know it because I have been there and received that treatment.

Necessity For Training

As to training. How many firms do not seem to realize its necessity? I have had men come to me who seem to have been given a price list and an order book, and left to grab any further knowledge they could out of the atmosphere. Those salesmen are going to run up against other men in parallel lines who have been trained, and we have got to see to it that our men are equipped to meet these trained men. If in your own judgment the new salesman is the right material for your organization, then it is worth spending time and money to give him the proper ammunition.

Peddling Troubles

It is important to train salesmen to know that it is no earthly use telling their troubles to fellow salesmen.

To salesmen I say, if you do not agree with the policy of the house, don't go to Bill Jones about it, he cannot cure it; go to the General Manager, and if he does not satisfy you, go to the President.

Get your men to have enough confidence in you and the house to know that they can do that. Many good sales organizations are wrecked by "gossip" breeding disloyalty, so have them feel that if they think they have any complaint they can come to you, and either they will "sell" you that they are right or you will "sell" them that they are wrong.

"People are only suspicious of things they do not understand." It is of primary importance in training salesmen that they should know and thoroughly understand the policy of the house. Then it will have their support.

Constructive Help

One of the chief duties of the Sales Manager is to give his men constructive help in their work. If a sales manager cannot help his salesmen make sales, what is he for? I have three sales managers in my business, one for each division. Each of them when he visits an agency helps the man there to make sales. If he could not he would not be the sales manager. I do not mean for him to go out and canvass the stores, I mean he is everlastingly gathering material and thinking, so that he has something to take out with him and say "Put this down in your note book."

A Talk On Cards

I have a little talk on cards for our salesmen. I am a great believer in teaching through the eye. Some of these cards are:

Success is Simple. You can talk five minutes on that to a Convention.

Service. Action of one on behalf of another in the interest of both.

Add Yourself Up. Don't overlook the weak spot—we all have a lot of them.

Think In Big Figures. Teach the salesman who is selling two thousand to think of ten thousand.

We Are Only As Big As We Think. Let him look at that a minute.

Increase Health and Knowledge. The salesman can never afford to stop doing that.

Men Make the Business. You can take the biggest concern in Canada and burn down the whole institution, and they could collect insurance and build up again, but if you took my seventy-two salesmen I would have some job to get things going again. Trained men are of more value than machinery and plant. Let them know how much you value them.

Teach Salesmen Not To Guess, to know what they are talking about.

Cut Out Gossip, Fault-Finding and Destructive Criticism. What is wanted is Constructive Criticism.

A Man Is Known By The Company He Keeps, And A Company Is Known By The Men It Keeps.

The Open Mind is The Growing Mind.

Men Should Not Be Employed At Any Task Which a Machine Can Perform.

Self Analysis. Teach the Salesman to analyze himself, the most helpful thing he can do.

Better To Aim At Perfection and Miss Than Aim at Imperfection and Hit It.

Organize The Brains of Your Organization.

Don't Make The Same Mistake Twice! But If You Never Make Any Mistakes You Are No Good.

Co-operation.

Concentration on the work you are doing.

Study, Learn and Teach.

Think.

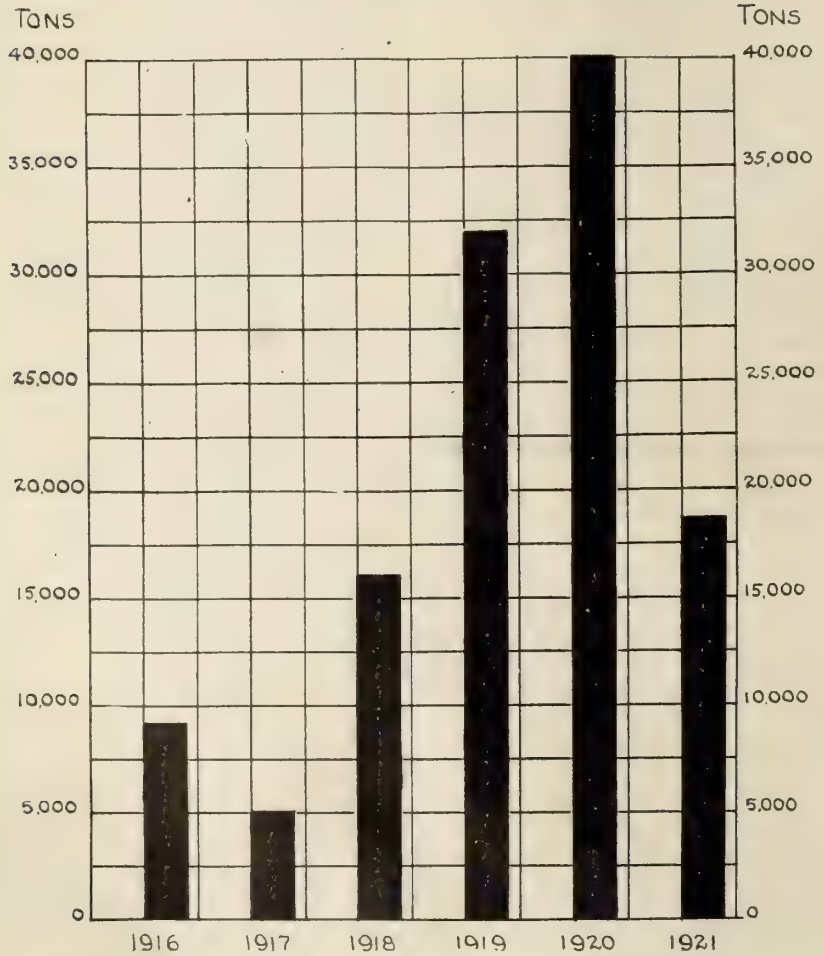
Tell Your Griefs to the Man Who Can Help You.

Through The Eye

The purpose of these cards that I use at Conventions, and further that I distribute around our factory and office is to educate the Organization through the eye, and at Conventions you will find the salesmen copying them down in their note book, in other words, they are gathering ammunition that is going to help them at some time.

The Sales Manager who can select the proper men and train them properly will never have to look for a lucrative position. The position is looking for him.

EXPORTS OF PULP FROM CANADA TO JAPAN.



CONDITIONS IMPROVED

Mr. F. W. Field, British Government Trade Commissioner in Toronto, has just finished an extensive trip to most of the industrial centres of Ontario for the purpose of securing first hand knowledge of the industrial situation and its outlook. He interviewed one hundred and fifty manufacturers, heads of departmental stores, principals of wholesale houses and others. He finds that business throughout the Province is comparatively quiet but he is gratified to learn that it is slowly improving. His opinion, based upon what he learned, is that the worst of the trade depression is over. Within a year, he states, the country should be enjoying a more normal time.

SOME SMASH

There is a story going the rounds about a Scotsman, who, anxious as usual to "make a little on the side," hit upon the idea of collecting old tin cans and pieces of scrap iron. Having accumulated a good collection he sent them to a local junk store.

Somehow or other, however, they went astray and were delivered to the wrong place. Imagine his suprise when he received the following letter from a garage:

"Dear Sir,—Your motor car to hand. We have never seen a worse smash, but we will do our best to put it together again. We send you herewith an estimate for the cost of repair and approximate date of delivery."

Standard Specification for Wire Rope

Requirements for Grades of Wire Rope for Mining—Dredging and Similar Purposes—Points Emphasized Are Regarded As Essential to Protect Both Purchaser and Manufacturer

By C. A. S. E.

VERY CREDITABLE work has been done by the Canadian Engineering Standards Association, in establishing standard specifications on various classes of goods. They have now issued a standard for wire rope for mine hoisting and hauling purposes; dredging and steam shovel work, and feeling sure readers will be interested in the details, we publish the points contained in the new specifications.

It was at first considered that separate specifications should be prepared for rope for mining, and for rope for dredging, etc., but on examination, the governing conditions for both kinds of work were found to be so far in agreement, that the specifications were combined. The classification of material adopted, recognizing three grades of steel, is in accordance with the practice now used in Canada. At the desire of the manufacturers' representatives on the Committee, the customary term "Crucible Cast Steel" has been retained as the description of a particular grade of material, although the Committee realizes that its employment is not in accordance with metallurgical usage.

Rope made under the new specification will be known as C. E. S. A. standard hauling rope as the case may be.

At the time of placing the order the purchaser will furnish to the vendor all necessary information regarding the conditions under which the rope is to be used, and the kind of service for which it is to be employed, together with other particulars, as enumerated in Appendix I. In tendering, the vendor will furnish the purchaser with information regarding the construction of the rope which he proposes to supply, as set forth in Appendix II, and shall, at the same time, furnish a written guarantee regarding the ultimate tensile strength of the finished rope.

The term "vendor" throughout this specification shall mean the seller of the wire rope, whether he be the manufacturer of the rope or not.

Grades Of Material

The following shall be the recognized grades for material for wire for C. E. S. A. standard ropes; Crucible Cast Steel; Plough Steel; Special Plough Steel.

The term "Crucible Cast Steel," as here used, is intended to imply an acid or basis open-hearth or bessemer steel of medium carbon content.

The terms "Plough Steel" and "Special Plough Steel" as here used, are intended to imply a high grade acid open-hearth steel somewhat higher in tensile strength than the Crucible Cast Steel, and of higher carbon content, say, 0.50 and upwards. Three grades of material, as here classified, shall be such that the wire made from them will have the following ranges of tensile strength:

Crucible Cast Steel, 160,000 to 210,000 lbs. per sq. inch.

Plough Steel, 200,000 to 230,000 lbs. per sq. inch.

Special Plough Steel, 200,000 to 270,000 lbs. per sq. inch.

Methods of manufacture of the wire itself, of the strands, and of the completed rope, shall be such as to ensure that the finished product will conform to all the requirements hereinafter specified. The wire shall be drawn from mild homogeneous steel, shall be uniformly heat-treated, and, if galvanized rope is required, shall be effectively galvanized as specified below under "Galvanizing."

The rope shall be laid up evenly and uniformly throughout as regards size, and shall show evidence of proper and uniform tension on the strands during manufacture. The number of wires and strands, and the angle and lay of wires and strands shall be as approved by the purchaser. If the construction of the rope is such as to call for filler wires, these, if of different material to the other wires of strands, shall not be considered as contributing to the strength of the rope. Joints in wires composing the strands shall be distributed as widely apart as possible, and in no case shall more than one such joint occur in a length of 50 feet of strand. The use of tucked joints is not recommended.

Lengthening of a strand after manufacture to make it suitable for use in laying up a rope longer than originally intended will not be permitted. The central core of the rope, unless of wire, and the cores of the several strands, if used, shall be of Manilla or New Zealand hemp. Jute cores will not be accepted. The cores shall be carefully laid up, shall effectively support the strands or wires, and shall be thoroughly impregnated during the manufacture of the rope with a preservative mixture which will have no injurious effect on the wires or the material of the cores.

Lubrication of Rope

Both the individual strands, and the rope, while being laid up shall be thoroughly impregnated with a suitable lubricating compound which shall have no injurious effect on the wires or the material of the cores, shall not gum, and shall be of the proper consistency to be retained in the interstices of the strand or rope. When the rope is purchased by weight, the purchaser shall be satisfied that no excess preservative or lubricant composition has been used. If galvanized rope is required, the galvanizing shall consist of a continuous coating of pure zinc of uniform thickness, which shall adhere to the wire and shall present a smooth surface.



Dredging calls for the use of reliable wire rope.

Physical Properties and Tests for Wire

The ultimate tensile strength of the wire shall comply with the following minimum requirements:

Crucible Cast Steel, lbs. per sq. inch 160,000.

Plough Steel lbs. per sq. inch 200,000.

Special Plough Steel, lbs. per sq. inch 220,000.

and shall in no case be less than the values stated by the vendor in his tender for the sizes to be used.

For the purpose of computing the ultimate tensile strength of wire for galvanized rope, the effective cross section of the wire shall be taken as 90 per cent. of the gross area of cross section including that of the zinc coating. The tensile strength of the wire shall be determined by means of a testing machine approved by the purchaser. Samples for the tensile tests of wire shall be not less than fifteen inches long and free from bends and kinks.

The wire shall be cylindrical and smooth, and its diameter (after galvanizing, if galvanized wire is called for) shall be uniform within the following limits:

	Tolerance Above Nom. Dia.	Below Nom. Dia.
Nominal Diameter		
.064 in. and larger	+ .005 in.	Nil
Below .064 in.	+ .003 in.	Nil

The diameter of the wire shall be determined by gauging with a micrometer at at least three places on each coil. The size of wire shall in all cases be expressed in decimals of an inch, using not more than three places of decimals, that is, in mils. Wire which measures below the nominal diameter will not be accepted.

A sample from each coil of the wire (after galvanizing, if galvanized wire is called for) shall be tested in torsion and shall withstand without breaking or showing any signs of splitting or other defect in the wire itself, a number of complete turns not less than the number given by the following table:

Kind of Wire	Turns per length of 100 diameters
Galvanized	15
Ungalvanized	25

In the case of wire for galvanized rope, this torsion test shall not be construed as in any sense a test of the galvanizing. The torsion tests shall be made as follows: The piece of wire shall be gripped by two vises, one of which shall be stationary, while the other shall be free to move longitudinally, and shall be rotated steadily at a speed not exceeding one revolution per second. The full number of twists shall be distinctly visible between the vises.

Samples for torsion tests shall be straight and not less than ten inches long. All tests, as specified above, shall be made upon fair samples, which may be selected by the purchaser's inspector or authorized representative from any portion of any coil of wire.

APPENDIX I.

Information to be furnished by the purchaser to the vendor.

1. Purpose for which rope is required.
2. Length of rope required.
3. Size (diameter or circumference), desired.
4. Grade of material desired { Crucible Cast Steel. / Plough Steel / Special Plough Steel
5. Lay (Regular or Lang's) desired.
6. Whether right or left lay.
7. Whether galvanized or not.
8. Maximum running speed.
9. Maximum working load.
10. Diameter of smallest sheave over which rope will run.
11. Form and dimensions of groove in sheaves.
12. Nature and arrangement of lining material in groove (if any).
13. Whether subject to reversed bending in operation; if so, sketch showing arrangement and diameters of sheaves is to be given.
14. If to be wound on drum, minimum diameter of same, and number of layers of rope.
15. Whether to be delivered on reels or in coils.
16. Whether all tests will be made at Manufacturer's works before shipment.

When samples of wire are taken from the coils before the rope is manufactured, such samples shall be taken from not more than 10 per cent. of the total number of coils, and tensile and torsion tests shall be made thereon as specified above under "Ultimate Tensile Strength of Wire" and "Torsion Tests of Wire."

Samples From Finished Rope

When finished rope is offered for sale by the vendor and it is therefore impossible to carry out the tests specified above on the wire before it is laid up into strand, the inspector may select the necessary samples of wire from the finished rope, cut from such portions of any length of rope as may be agreed upon between the vendor and the purchaser, and one set of tests as specified above shall then be carried out upon the wire taken from each length.

If, upon testing a sample of wire from any coil of wire or length of rope, that sample is found not to fulfil one or both of tests specified above, similar tests upon two additional samples from the same coil or length, samples fulfill the test or tests, the lot of wire or rope which they represent shall be accepted. If either of the additional samples fail, further tests may be at the discretion of the inspector, on samples from other coils or lengths of the same lot, and the purchaser may accept such coils at his discretion.

Physical Properties and Tests For Rope

The diameter of the rope when delivered, as measured over the extreme outside wires, shall in no case be less than the nominal size, and shall not exceed same by more than 3-32 of an inch in the case of rope one inch diameter and larger, or by more than 1-16 inch in ropes of diameter smaller than one inch.

The ultimate tensile strength of finished rope shall in no case be less than that guaranteed by the vendor.

Check tests of the tensile strength of samples of the finished rope may be made by the purchaser at his own expense, and if so made, shall be carried out on specimens prepared in accordance with the method set forth in Appendix III. Failure in these tests to meet the vendor's guarantee shall be cause for rejection. The vendor shall if required furnish free of cost a copy of any document in his possession showing the results of any tests made for him or for any other person on the rope, or on the material for the rope, sold or offered for sale to the purchaser.

He shall also, if required at the time of purchase, furnish free of cost a certificate that the rope or the material for the rope has been tested, and that such tests comply in all respects with the requirements of this specification. The furnishing of such copies of documents, or the giving of such certificate, shall not preclude the purchaser from rejecting any rope which does not comply with this specification.

Standard Constructions

The following are recognized as standard constructions for C.E.S.A. Standard Wire Rope:

Hoisting	Haulage
6 x 19	6 x 7
6 x 19 Seale type	6 x 12
6 x 37	6 x 19 Seale type

The wire shall be free from scales, flaws, inequalities, splints, and all injurious defects, and shall be of smooth uniform finish. The completed rope shall be free from injurious defects, evenly laid, and free from kinks, loose wires, open strands, or other irregularities, and shall remain in this condition when unwound from the reel or coil, or bent around a standard thimble, provided that proper precautions are taken, and the ends are properly secured.

All rope shall be furnished on reels unless otherwise specified by the purchaser, and shall be suitably protected to avoid damage in shipment. A metal tag shall be securely attached to each reel or coil and stamped with the maker's name, diameter of rope, grade of material, weight of rope, length of rope, and C. E. S. A. distinguishing mark.

APPENDIX II.

Information to be furnished with his tender by the vendor to the purchaser.

1. Grade of material of wires, and of filling wires (if any).
2. Size of rope.
3. Number of strands.
4. Number of wires in strand.
5. Nominal size of wires and filling wires (if any).
6. Nature of material of core.
7. Nominal weight in pounds per foot of rope.
8. Ultimate tensile strength of wire (to be stated for each size of wire used).
9. Guaranteed ultimate tensile strength of completed rope.
10. Location and particulars of testing machine available for tensile tests of wire.
11. Gross weight of rope as packed for shipment.

Inspection and Rejection

The inspector, representing the purchaser, shall have free entry at all times while work on the contract of the purchaser is being performed, to all parts of the manufacturer's works which concern the manufacture of the rope ordered. The manufacturer shall afford the inspector, free of cost, all reasonable facilities to satisfy him that the wire and the rope is being furnished in accordance with this specification. All tests and inspection shall be made at the place of manufacture of the rope, and prior to shipment, unless otherwise specified by the purchaser, and shall be so conducted as not to interfere unnecessarily with the operation of the manufacturer's works.

The manufacturer shall provide at his works, free of cost, all apparatus and labor for making the required tests under the supervision of the purchaser or his inspector. This requirement shall not apply to the tests specified above under "Tensile tests on fiinished rope." Rope which does not conform to all requirements of this specification will be rejected.

APPENDIX III

THE TEST pieces for tensile tests on completed rope must be free from initial bends and preferably not less than eighty inches in length between sockets. In preparing the test specimens for socketing, at least two seizings or servings of soft iron wire, each about one and one-half inches long, are placed tightly upon the rope at a distance apart equal to the intended length of the test specimen between sockets. Two similar additional seizings are placed beyond the first two and at a distance from the first equal to the length of the socket, this length being from five to nine inches in a range of diameter of rope of say one-half inch and one and one-half inches.

It is most important that proper seizings shall be placed at each side of any point at which the rope is to be cut. If possible two, or, better, three, seizings should be employed at each side of a cut. Annealed iron wire should be used, the suitable sizes being from .054 diameter for rope one-half inch diameter up to .080 for rope one inch diameter and .105 for rope two inches diameter.

After the specimen is served as described, it is cut from the coil of rope, and each end is slipped into a cast steel or forged steel socket, the outer dimensions of which suit the holders of the testing machine to be employed. The inner surface of the socket is conical, with taper of about one in four on the diameter. The ends of specimen are next to be broomed out and secured in the sockets, as follows:

Core of Rope Removed

After the sockets are placed on the specimen, it is clamped in a vise, the end serving wire removed, and the strands and wires carefully opened or frayed out as far as the second serving. The core of the rope is removed for a distance equal to the length of the socket. Individual wires are next thoroughly cleaned with waste and the free use of gasoline, and are then carefully wiped to ensure their freedom from any trace of oil which may occasion slipping of wires in the zinc filling. If the rope contains much lubricant, it may be desirable first to wash the frayed-out portion in caustic soda solution, but this is not necessary when the lubricant is carefully removed and the wire thoroughly cleaned with gasoline. A portion of the wires may be bent back on themselves at the ends for an inch or two in order to ensure a good bond in the zinc.

If difficulty is found in obtaining proper adhesion of the zinc filling to the wires, the wires, after cleaning with gasoline and wiping, may be dipped in dilute hydrochloric acid and wiped dry with a clean rag.

The specimen is next to be held vertical and truly axial with the socket, and adjusted so that the frayed out wires lie as evenly distributed as possible within the cone-shaped cavity of the socket. A small ring of fire clay may be used at the base of the socket t vent seepage of molten metal along the rope. Commercial spelter may be used for filling the socket. It should be heated to a temperature just sufficient to give a good degree of fluidity, but must not be too hot, otherwise the wires in contact with the molten zinc have their strength impaired by the heat. This difficulty occurs more especially on small diameter specimens (one-quarter to one-half inch diameter), on account of the annealing effect on the small wires. The melted zinc should be ladled as rapidly as possible in order to ensure a uniformly cast filling for the socket.

In applying a load to the test specimen, the rate of application must be very slow during the earlier portion of the loading, thus permitting the strands and wires to bed properly upon one another.

DON'T FORCE A BELT TO RUN ON THE PULLEYS

"Many millwrights make the mistake of thinking that it is perfectly proper to force a belt to stay on its pulley by any means whatever." "They seem to think, continues a writer in "Belts," "that as long as the belt 'runs' it is all right, and is doing as much as should be expected of it. For instance, one millwright "took a piece of old three-inch rubber belt, pulled off one ply, wrapped it twice around the centre of a wooden pulley and nailed it solidly to the pulley," and then he goes on and says, "The belt immediately took its place in the centre of the pulley and stayed there."

It is true that nailing a ridge of any kind of belting on a wooden pulley to increase the crown will cause the belt to move over and run on the intensified crown, even though the alignment of the pulleys may be poor. However, such a condition is hard on the belt, as a little thought would show that if the belt has much work to do it cannot endure.

Let us say that the width of the belt is 6 inches, and that the width of the ridge nailed on the pulley is only 3 inches. 6 inches minus 3 inches equals 3 inches, which means that about 3 inches of the belt (1½ inches on each side of the centre) is not in contact with the driving pulley or driven pulley at all or is in poor contact. A very intense pressure between the belt and the pulley occurs over the 3 inches of width of the ridge. In other words, 3 inches of width of belt is compelled to do what 6 inches was intended to do.

Furthermore, with the rough face of the ridge rubbing against the equally rough face of the belt, and with the pull per square inch and the pressure per square inch doubled, it is evident that the wear on the 3-inch ridge is going to be greater than it would be on a smooth iron or smooth wooden pulley. It is quite possible that the slip is greater with the 3-inch strip than without the strip. At least the creep is as great one way as the other. From every angle, therefore, it is obvious that nailing a ridge around pulleys to increase the crown is poor engineering.

It is far better to carefully align the pulleys and shafting so that the belt will run exactly as was intended by the designers of the pulleys. By using the low crown, the entire belt surface comes in contact with the pulley, both the load and the wear are evenly distributed. In fact, pulley coverings should not be used at all. It has been proved time and again that the natural smooth face of a metal, wooden or other pulley is far superior to any roughened face. Rough faces are too hard on the belt.

The Sirocco fan, invented by Sir Samuel C. Davidson to dry tea, has since been applied for the ventilation of ships, also for forcing draught in the stokeholds. Subways and theatres also make use of it. The Sirocco fan is so made as to have a ring of blades all moving at the same velocity, thus avoiding the difficulty of the common propeller fan which has different points along the blades moving at different speeds. The part which moves is cylindrical. It takes the air at the centre and passes it through curved slats at a high degree of efficiency.

Several of Hamilton's key industries are gradually becoming busier with the result that the acuteness of the unemployment situation has been eased during the past months. During the past three weeks the International Harvester Co. has employed about another 300 of its workmen. More will be taken back as improved conditions warrant. The Canadian Westinghouse Co., has also brought in all of its employees to produce some special work.

Seven Year Review of the Furniture Industry

Manufacturers Decided to Improve Status of Industry in 1915—A Thorough Survey Was Made in 1918—A Publicity Campaign Was Started in 1920 And in Many Ways Quality of Products Has Improved

By W. CAWKELL
Secretary of Furniture Manufacturers' Association.

BEFORE REVIEWING the activities and widening scope of the Furniture Industry during recent years, I think it would be well to give the following statistical information:

	No. of Plants.	Capital.	No. Employed.	Wages.	Selling value of products.
1915	175	$18,067,929.00	7626	$3,892,994.00	$ 9,765,339.00
1919	270	24,400,099.00	9080	7,873,158.00	25,166,305.00

The imports of furniture were, 1915, $761,804.00; and for 1920, $1,825,794.00. The exports were, 1915, $307,944,00; and for 1920, $846,853.00.

The principal imports came from the United States, and the bulk of the exports were to Australia, New Zealand and Africa.

In the Autumn of 1915, furniture manufacturers met and discussed ways and means whereby they could improve the status of the industry. They decided to re-organize the Furniture Manufacturers' Association, and a strong committee was formed, who engaged a permanent secretary. Fortunately, there were within the industry, men of courage and foresight with the necessary ability to carry the organization safely through the initial stages; and eventually the association has been placed in a position where it commands the loyal co-operation of its members, the result being a robust and progressive service.

In 1918, a thorough survey was made, covering fifty of the larger Ontario furniture manufacturing concerns. These firms besides answering a questionnaire, also submitted balance sheets and trading accounts. The most striking features brought out by the compilation of these returns were (1) the large investment involved, and (2) the small return on the capital invested, which after re-adjusting the depreciation charges, showed that the profit for the year ending 1917 was only 2.6 per cent. on the capital employed, and 3.1 per cent. on the total sales. Mainly as a result of these facts, the Ontario furniture manufacturers decided to install a cost accounting department in connection with the association. This was made effective in January, 1919, and cost accounting systems have been installed in many factories, and other plants are gradually preparing for the installation; but all the furniture factories throughout the country have been made more efficient as a direct result of this work.

Another important development was the formation in 1916 of a reporting service to investigate the credit standing of any retail dealer in Canada. This reporting, or credit section had a small beginning but has now grown into a very important branch of the Association's services. This service has undoubtedly kept down losses in the furniture industry very materially, notwithstanding that the failures in all lines in Canada this year are nearly three times as numerous as they have been in previous years.

Another recent development is the labor statistical department, which keeps records of all matters in regard to labor, such as the cost of living, etc.

It is to be noted that the manufacturing of furniture is carried on largely in Ontario towns and small cities where it is the important factor in the industrial life of the community, and it is stated that a greater proportion of the artisans employed in these towns own their own homes than in other manufacturing centres, with the resulting greater happiness, prosperity and contentment.

During the Autumn of 1920, the Canadian furniture manufacturers instituted a publicity campaign, the slogan being "Better Furnished Homes Mean Greater Happiness." Under the style of the homefurnishings bureau, a newspaper advertising campaign was started, covering the whole of Canada. Full page advertisements appeared in forty-four dailies, seventy-four weeklies, and eleven farm journals, about $40,000.00 being spent in that way. It was regarded by the retail dealers as the most forward step that had ever been taken by the furniture manufacturing industry in Canada.

The work of this home furnishings bureau was continued in 1921, and another series of newspaper advertisements was inserted in the daily papers during the Autumn months. In addition to this, some of the furniture manufacturers are now advertising their particular products in newspapers and magazines, and it appears as though the manufacturing industry has definitely entered into the field of publicity advertising.

These efforts if continued will most certainly enlarge the home market for furniture. During recent years, the Canadian furniture manufacturers have greatly improved their machinery and their factory efficiency with the result that that today Canadian furniture will rank with the most artistically designed and most carefully finished furniture to be obtained anywhere.

In the higher grades of furniture, during the past seven years, there has been an increasing demand for period styles. Departing from the Colonial style, the industry has developed modern adaptations of the classic Adam, Hepplewhite, Sheraton, the Jacobean, William and Mary, Chippendale, Queen Anne, Louis XV and XVI, and some Renaissance of the Italian and Spanish schools. Walnut has been the predominating cabinet wood.

THE TEN COMMANDMENTS

"By The Boss"

RULE I. Don't lie, it wastes my time and yours. I am sure to catch you in the end, and that's the wrong end.

RULE II. Watch your work, not the clock. A long day's work makes a long day short, and a short day's work makes my face long.

RULE III. Give me more than I expect. I can afford to increase your pay if you increase my profit.

RULE IV. You owe so much to yourself that you can't afford to owe anybody else. Keep out of debt or keep out of my factory.

RULE V. Dishonesty is never an accident. Good men can see temptation when they meet it.

RULE VI. Mind your own business and in time you'll have a business of your own to mind.

RULE VII. Don't do anything which hurts your self-respect. The employee who is willing to steal for me is willing to steal from me.

RULE VIII. It's none of my business what you do at night, but if dissipation affects what you do the next day and you do half as much as I demand, you'll last half as long as you hoped.

RULE IX. Don't tell me what I'd like to hear, but what I ought to hear. I don't want a valet to my vanity, but I need one for my money.

RULE X. Don't kick if I kick. If you're worth while correcting you're worth while keeping. I don't waste time cutting specks out of rotten apples.

All bank notes issued in Canada must be secured, dollar for dollar, by gold or Dominion notes.



WHAT OUR READERS THINK AND DO



NOVEL TOOL HOLDER

By J. C. Crichton

The tool holder shown has been found to be very useful in saw mills and factories where band wheels, saw arbors, pulleys, etc., have to be turned. It really enlarges the capacity of a lathe, because you can back your saddle to its extreme, fix the tool on the post, thus allowing work of large diameter to swing successfully.

In operation, the saddle remains stationary, the tool moving instead of the saddle. We can get a travel of 1½ in. with this style of tool which is found to be ample for our purpose.

ANSWER TO THREAD CUTTING DISCUSSION

By J. Davies

In Mr. Smith's article in the December 8th issue, he says he does not understand my viewpoint. It is this, that I cannot see any reason for using a system which in some cases gives a result with a slight error, when it can be worked out correctly just as easily. Mr. Smith starts out to compare the two systems, works out an example by the system he advocates, and admits a slight error in the result. Then he commences to work the example by the other method, obtains the ratios, and then for some unaccountable reason stops at this point, and asks the question, "Where do we go from here?" instead of cancelling it down exactly as he did in his own method.

From here you simply cancel or find factors and get a correct result as follows:

$$\frac{981}{500} = \frac{109 \times 9}{50 \times 10} = \frac{109 \times 90}{50 \times 100}$$

In reference to the improbable pitch and lead screw, these were only given to show the universal application of the system propounded.

Now let us suppose we have a lead screw six threads per inch which is quite common, and it is required to cut a thread ⅜ pitch, which is also quite common. A comparison of the two methods would be as follows:—

$$\frac{375}{166} \text{ Find factors} = \frac{75 \times 5}{83 \times 2} = \frac{75 \times 50}{83 \times 20}$$

This gives a slight error in lead and requires an 83 gear which is not usually found in a set of lathe gears.

$$\frac{3}{8} \times \frac{6}{1} = \frac{18}{8} = \frac{60 \times 30}{40 \times 20}$$

This gives a correct result and a set of very common wheels.

The metric example given by Mr. Smith could be worked out as follows, and to me is preferable to the rule given by "The Machinery Handbook." It is required to cut a pitch of 3 millimeters with a lead screw six threads to the inch.

25.4 mill = 1 inch

$$1 \text{ mill} = \frac{1}{25.4} \text{ inches or } \frac{5}{127}$$

Use this as a constant and proceed as before,

$$\text{Pitch to be cut} = \frac{5}{127} \times 3 = \frac{15}{127}$$

$$\text{Ratio} = \frac{15}{127} \times \frac{6}{1} \quad \text{Gears required} = \frac{90}{127}$$

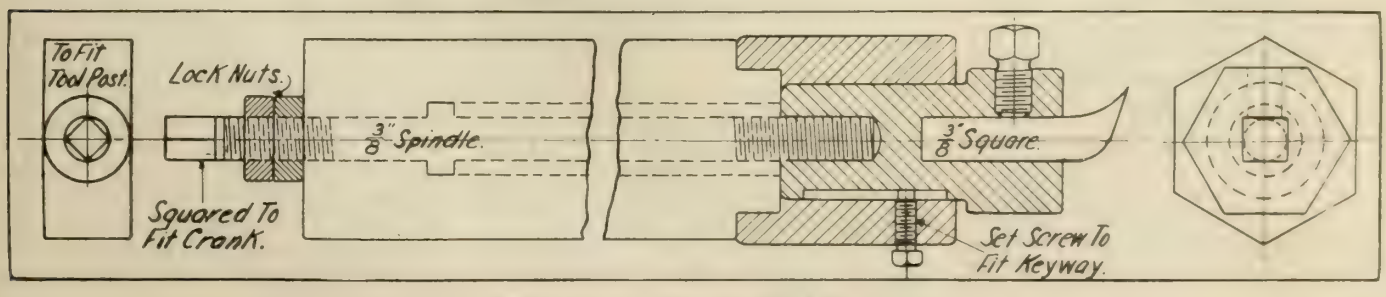
Mr. Smith says he is quite satisfied with his own system. I am also satisfied. Thus readers can choose for themselves, and we will all be satisfied.

ECONOMY IN THE BOILER-HOUSE

Below we reproduce a diagram for the guidance of boiler-house staffs, issued by the Fuel Economy Committee of the Federation of British Industries, 39 St. James's-street, London, S.W.I. The diagram can be obtained printed on metal plates 20 in. by 30 in. for hanging in the boiler-house.

1. Avoid wastage of cinders in the ashes by cleaning the fires carefully and by using suitable firebars.
2. Avoid production of black smoke and incompletely burnt gases by regularly and frequently firing coal in small quantities. Keep a proper depth of fire.
3. Regulate the draught by the damper to reduce the excess air. Try to obtain 12 per cent CO_2 in the chimney gases.
4. Keep the grate properly covered with a level fire. Use the rake when necessary for this purpose.
5. Examine the boiler setting carefully for air leakage, particularly furnace doors, cracks in the side walls, joints between the boiler shell and brickwork, and the damper slides.
6. Keep the boiler surfaces free from soot and flue dust.
7. Keep the internal boiler surfaces free from scale.
8. Do not force the boilers unnecessarily.
9. Examine the seating blocks and partition walls carefully. Repair if necessary to avoid by-passing.
10. Lag the exposed surfaces of boilers and steampipes efficiently.
11. Avoid excessive blow-down.
12. Keep the boiler filled to the working level by a continuous and steady feed.
13. Avoid leakages of steam from boiler fittings and valves.

Few people when thinking of industrial development have any idea what enormous water power is available in Canada. The recorded power available throughout the Dominion, under conditions of ordinary minimum flow and at 80 per cent efficiency is 18,255,000 horse power.



Sectional view showing the tool holder used.

Marking Country of Origin on Imported Goods

Goods Entered for Immediate Exportation or in Transit Through Canada Are Not Required to be Marked—Articles Not Susceptible of Permanent Marking May be Stamped or Labelled

FORTUNATELY, the Government substantially modified the marking act before it came into force on December 31st 1919. Several of the changes made are of considerable importance, so we reproduce this material feeling sure it will interest our readers. For convenience we shall give each item its paper section number. First comes section No.1. This new law, which applies to "all goods imported into Canada" naturally includes goods originating in the United Kingdom, British Colonies and British Possessions.

Country of Origin

2—The country of origin of a manufactured article may be the country in which the article has been finished by a substantial amount of labor amounting to not less than one-fourth the cost of production of such article in condition imported.

3—Goods entered for immediate exportation or in transit through Canada are not required to be marked.

4—When imported goods are found to be not legally marked, the appraiser will note the fact on the invoice and the additional duty shall be levied accordingly.

5—The appraiser will report all articles (and packages as hereinafter provided for) not properly marked to the collector who will notify the importer to re-deliver the unexamined packages or to arrange to mark the same and their contents under customs supervision.

6—The importer may be permitted to mark examined packages and their contents in customs warehouse, or arrange for the marking of same under customs supervision on the premises of importer.

7—Whether the marking found on goods in condition imported is as nearly indelible and permanent as the nature of the goods will permit is a question of fact to be determined in each instance by the collector, subject to the decision of the Commissioner of Customs and Excise.

8—If the importer fails to mark goods when called upon to do so by the collector, the collector may require the the same to be exported, and in default thereof, the goods shall be treated as unclaimed dating from time of importation, and if sold, must be sold on condition that they be marked by the purchaser under customs supervision.

A Substitute

9—Goods not susceptible of permanent marking may be stamped or labelled for purposes of delivery. It will be found that while certain kinds of goods as for example, chinaware and porcelain are capable of being permanently and indelibly marked in the process of manufacture, it is commercially impracticable to so mark them afterwards. Goods of this class, if not so indelibly marked in condition imported, will be subject to the additional duty as provided, but may be released upon being marked by the importer in a manner as nearly permanent or indelibly as the nature of the article will permit, as for example, by gummed labels or rubber stamp.

10—Where articles themselves incapable of being marked without injury are imported in bands, wrappers, or containers, or on cores or spools, such bands, wrappers, containers, cores or spools shall be marked so as to indicate the country of origin, unless such articles are of a class or kind not made or produced in Canada, in which case no marking is required.

Imported Containers

11—Imported containers, labels or wrappers intended to be filled with or used upon domestic products are to be marked as required by the Act, but in order to avoid the possibility of origin other than Canadian being imputed to domestc products sold in such imported containers labels or wrappers because of the marking of the latter, the words "Container," "Label" or "Wrapper," together with the indication of the country of origin as required by the regulations, shall be used. It will not constitute a non-compliance with the Act, however, so as to involve the levy of the additional duty, if the word "Container," "Label" or "Wrapper' as provided in the preceding paragraph be not used in the marking of the goods as imported, but before release from customs, this additional marking will require to be done. Provided that containers imported to be filled with Canadian produce and exported may be admitted without being marked with the country of origin, conditional on the importer certifying on the face of the entry for consumption that such containers are for use in the preparation of goods for exportation.

Section No. 12 has been cancelled.

13—The name of a manufacturer or his trade mark accompanied by the name of the country or a place in a Province, State or other division of a country where the goods have been manufactured or produced will be accepted as sufficient indication of the country of origin.

14—Fabric gloves are in the opinion of the department capable of being marked without injury either by stamping or by means of gummed labels on the inside of the wrist, where the brand or trade mark usually appears.

15—Hosiery may be so marked upon the foot where the brand or trade mark usually appears.

16—(a) Cloth and material in the web or roll shall be marked with an indication of the country of origin on the piece ticket, label or band, or on one end of each web or roll. (b) Carpets shall be marked with an indication of the country of origin by means of a protruding ticket attached to the edge of each roll at the centre. (c) Linuleums and oilcloths shall be marked with an indication of the country of origin on one end of each roll, either by stamping, stencilling or adhesive label.

Watch Dials and Movements

17—(a) With respect to watch dials and watch movements imported attached as one article, it will be deemed to be sufficient compliance with the regulations if the required indication of the country of origin appears on the movement only. (b) With respect to watches imported complete, it will be deemed to be sufficient compliance with the regulations if the movement and the case are each separately marked with the required indication of the country of origin.

The portion (c) of section 17 has also been cancelled. (d) Watches and watch movements bona fide ordered prior to October 1, 1921, may be admitted marked as formerly, without regard to this law or the regulations thereunder, provided they are imported previous to July 1, 1922.

18—The following goods will not be required to be marked with the indication of country of origin, viz:—

Goods in a crude, raw, or rough state, or goods which are not intended for sale to the consumer in the condition imported, but which are merely for use in the manufacture, construction or repair o articles in Canada. This not to apply, however, to goods elsewhere specifically provided for in these regulations. Provided that on every entry at Customs of goods as described in this Section a statement shall be placed by the importer certifying to facts sufficient to classify the importation within the provisions of this section. Section 19 has also been cancelled.

20—Goods bona fide ordered prior to the 1st October, 1921, shall not be subject to the additional duty of 10 per centum advelorem to be levied on the value for duty purposes, provided such goods are imported into Canada prior to the 1st July, 1922, but such goods shall not be released from customs possession until they have been marked, stamped, branded or labelled with an indication of the country of origin as required by the provisions of the Act, under customs supervision at the expense of the importer.



DEVELOPMENTS IN SHOP EQUIPMENT



POLISHING MACHINE

The St. Louis Machine Tool Co., St. Louis, Mo., have placed their new "Western No. 10" polishing machine on the market. The machine has a wide face pulley and long bearings for the spindle which is made from 0.40 carbon steel. The bearings have large oil reservoirs equipped with convenient methods for filling and draining. The oil in the reservoir is fed to the bearings by chains. The bases of the bearings are cast integral with the column and base. Extra point arbors are provided, either right or left hand when desired. The length of the arbor is 48 inches. Distance between wheels is 38 inches, and the centre of the arbor is 34 inches above the floor.

UTILITY FILING ATTACHMENT

A filing attachment designed to be employed with any type of drilling machine has been developed, by the Utility Tool and Mfg., Co., St. Louis, Mo. The device is suitable for either heavy duty or small work and will accommodate any shape of file and any length up to 16 inches. The table of the drilling machine may be moved to any position and the filing machine can be readily adjusted to any degree from 1 to 90. All gears are made of steel hardened and ground. In case of overstrain a small cold rolled pin in the shank becomes sheared which stops the operation of the device. This pin is easily replaced.

SELF TAPPING SCREW

A novel design of screw, which requires no tapping, is now being manufactured by the Parker Supply Co., Inc., of New York City. It will cut its own thread into die or sand-cast parts of grey iron and softer metals, without the thread on the screw being injured. The screw has a V thread of fairly coarse pitch and a cylindrical pilot which steadies the thread, while it seats itself in the metal. In using this screw, a hole is first drilled in the piece which, ordinarily, would be tapped, a few thousandths of an inch larger than the pilot, and the piece to be assembled drilled sufficiently large to provide clearance for the threads of the screw. The pilot is inserted in the hole and the screw given a few turns which drives the screw in place. The entire screw is hardened and heat treated so that the thread cuts into the metal similarly to the way of the tap.

DIE STOCK

A die-stock known as their No. 8 has recently been placed on the market by the Martin Machine Co., Inc., of Turner Falls, Mass. This stock can take round dies ranging from ⅝ inches to 2¼ inches in diameter. The loose handle of the stock may be quickly adjusted to line up with a spot hole in the side of a die by means of a sliding block, which is then held firmly in place by tightening two thumb screws. Final adjustment is made by screwing the die stock handle through the sliding block until it grips the dies snugly. The point of the die-stock that engages the spot hole of the die is made of hardened tool steel to withstand wear. The advantage of this tool is the possibility of using one stock for dies of various diameters. It is intended for use by machinists, garage men and plumbers.

INCLINABLE PRESSES

Two recent additions to the line of inclinable presses built by the Loshbough-Jordan Tool & Machine Co., of Elkhart, Ind., are known to the trade as their No. 5-Special and their No. O. The No. 5-Special is exactly the same as their No. 5 except that the die space is 12 inches whereas on the regular machine it is only 7 inches.

The No. O press is similar in design to the standard presses of the inclinable type built by this concern, but it is of smaller dimensions. The opening in the bed is 3 by 5 inches; opening through back 5½ inches; depth of throat 3½ inches; adjustment of stroke 4½ inches; standard stroke 1 inch. The pressure exerted by the slide is between 5 and 7 tons. One half horse power is required. The weight is 300 lbs. and with floor stand 400 lbs.

ELECTRIC GRINDING MACHINE

A two horse power electric grinding machine has recently been placed on the market by the Louisville Electric Manufacturing Co., Louisville, Ky. It has improved ventilation with an air intake so located that clean air is drawn through the motor. The machine will operate continuously without exceeding temperature limits and for intermittent duty will operate with air intake closed. Ball bearings are provided in dust proof housings. The safety hoods are of steel and have hinged side walls to enable wheels to be replaced. The rests are fully adjustable. The motor-starting switch is enclosed in the column. The water pot is attached to the column. Direct or alternating current can be used to drive the motor. The centre line of the grinding arm is 38 inches above the floor. The wheels used are 12 inches diameter, 2 in. face by 1 in. hole. The approximate weight of the machine is 400 lbs.

AUTOMATIC AIR COMPRESSOR

A full automatic air compressor has been placed on the market by the Hobart Bros. Co., of Troy, Ohio. After being once installed, the makers claim that it will keep air in the tank at a constant pressure with no attention whatever. The compressor unit is electrically driven from an ordinary lighting circuit, and is mounted on top of the supply tank. The compressor is of the rotary type directly connected to the motor. Ball bearings insure quiet running. A magnetic pressure release is used which enables the motor to start without load, and is thus economical in its consumption of electricity.

PORTABLE ELECTRIC WELDING BELT-DRIVEN AIR COMPRESSORS

The Ingersoll-Rand Company, New York, has announced a new line of belt-driven air compressors known as the "Imperial" Type XCB. This line of compressors is provided with Ingersoll-Rand plate valves for both the air intake and discharge, and a five step clearance control for the output of the compressor. The plate valves are kept in alignment throughout their operation without wearing guides. The clearance control, so successful on larger, electric-driven, types of compressors has been used. This control provides a method of securing efficient operation at partial loads, as it automatically loads or unloads the compressor in five successive steps as governed by the reduction or addition of clearance space in the air cylinders which has a direct relation to the amount of air taken in and compressed. The compressor will operate at full three quarter, one half, one quarter, and no load. At any one step the reduction of input required is in proportion to the reduction in the output capacity.

The compressors can be furnished in a single stage style for low pressures and in the two stage design for higher pressures. On the two stage machine

clearance space in the proper proportion is added simultaneously for both the high and low pressure cylinders, thus giving a constant rate of compression. A special feautre in the control is the provision of a stop which will prevent the compressor being operated at an overload. The piston displacement for the 100 pound discharge pressure ranges from 610 to 1505 cubic feet of free air per minute. A short driving belt with a floating idler can be furnished for driving the compressor. This method of drive saves floor space and gives a larger arc of contact for the belt.

SEMI-AUTOMATIC ARC-WELDING TOOL

A semi automatic arc-welding tool has just been placed on the market by the General Electric Co., of Shenectady, N. Y. It is designed to be of use in conjunction with the full automatic arc-welding head which was brought out some time ago by this firm. The new device enables the operator to direct the arc as required by irregular conditions in the work to be welded. The tool is held by the operator and acts as a guide to the electrode wire. The handle of the tool resembles that of an automatic pistol. This handle controls the switch for operating the control on the panel of the automatic welder, to stop and start the electrode wire movements.

The tool has attached to it a 10-foot length of flexible steel tubing which is fitted with an adapter on the other end for attachment to the automatic welding head. The electrode wire passes from the feed rolls into the flexible tubing and thence to the arc through a guide nozzle in the welding tool. With the new device the automatic welder functions as usual, tending to hold the arc length constant, but the operator directs the arc as required by the particular job in hand.

The real field of operation for this tool is work in which the seams to be welded are of irregular contour, or large work where the travel mechanism and clamping operations of the full automatic welder would be complicated. In many instances seams are not accurately prepared, so that there are gaps in some places and tight fits in others. It is rather difficult to compensate for these conditions by varying the speed, or by manipulation of the electrode in the full automatic welder, but with the semi-automatic arrangement these conditions can be taken care of.

GRINDING SPINDLES

A line of grinding spindles has recently been designed and placed on the market by the Coates Machine Tool Co. Inc., of New York City. These grinding spindles are known by the trade name of "Fortuna". This line of grinding spindles consists of three spindles, the first being intended for internal grinding, second for both face and internal grinding and the third for vertical internal and face grinding. The spindles may be driven either from a pulley or by a motor. A clamp block is provided on which is mounted the motor or pulley as well as the spindle itself. This clamping block may be attached to the slide of a machine and the feeding of the grinding wheel across the work may be accomplished in much the same manner as other tools are fed. This particular line of clamp block provided with these spindles is most applicable to a lathe. "Norma" ball bearings are provided in all cases in the spindles. One advantage of the clamping block is that it permits a quick reversing of the counter shaft, or the motor, which will permit of work being revolved to the left as readily as to the right. The construction of the attachments permits grinding wheels to be run at a maximum speed.

UNIVERSAL JOINT

A universal joint, said to be quite apart from the conventional designs, has recently been designed and is now being marketed by the Borgeson Manufacturing Co., Torrington, Conn. The yoked ends are milled from solid cold-rolled steel bars. The parts subject to motion and wear are of mild steel carbonized and hardened. The design is of the "ball" type, but the ball is a cube, with corners rounded and of the "split" design, the two halves being held together with a bolt. The nut on this bolt is secured by a cotter pin. Taper pins, upon which the ball swivels, are driven into the wings of the sockets, or yoke pieces, and are staked in place. The pins are provided with shoulders to insure against the possibility or working loose. After continued use, if wear occurs, it can be eliminated by removing the ball, then withdrawing the bolt, and on a disk grinder slightly touching up the two parts. On account of the tapered bearing of the pins it will be found that after this operation the joints will be tight when re-assembled.

BALL-BEARING BUFFING MACHINE

The J. G. Blount Co., Everett, Mass., has just brought out a line of buffing machines which are marketed in three sizes. The design of these machines is very similar to the regular line of machines manufactured by this concern except that the new machines are equipped with S K F ball bearings. The bearings are all mounted in dust proof housings. The spindles are of high carbon steel carefully ground to size, and well balanced. A taper point is fitted to the right hand end of the spindles to accommodate small wheels. The contact surfaces throughout the machines are all machined insuring rigidity. The machines can be supplied with the head only for mounting on a bench or they can be equipped with a pedestal. Two types of countershaft are available, the shelf oiling type or the Hyatt Roller bearing type.

INDICATING CALIPER

The F. W. Horstman Co., of Irvington, N. J. have recently placed on the market an extension-beam indicating caliper, which is a modification of the indicating caliper placed on the market several years ago by this firm. The beam is ½ inch in diameter and can be supplied in any length desired. To the beam is attached two arms by means of split clamps. One of these arms houses an indicator and the other arm houses an adjustment screw. The rear surfaces on the arms are machined flat so that the instrument may be used while lying on a flat surface in a horizontal plane. The principal use of the device is for ascertaining the exact amount that work varies from a desired standard. It is set by placing a piece of the desired length between the plunger of the indicator and the adjusting screw. The adjusting screw is then adjusted until the pointer of the indicator registers zero. Then by applying the instrument to various examples of the work variations in the length of the pieces from that of the gauge or master piece can be observed by noting the amount that the indicator pointer moves from the zero mark. Internal distances above a certain minimum limit can be measured in much the same way as just explained. All that is necessary is to reverse the arms on the beam. Two classes of work for which the instrument is especially valuable are the gaging across the face of large diameter work in a lathe, or across wide pieces being machined on a planer.

VISES AND BAR CLAMPS

The Rae Machine Tool Works, Hamilton, Ont., have marketed a new line of vises and clamp bars. This covers wood-workers' vises—amateur and household type, machinist vises with stationary and swivel base, oval slide vises, and self locking pipe vises. Then they have several sizes of bar clamps, and they claim that only the best material goes into their product. The parts of the pipe vises and bar clamps are made of malleable iron, and in the latter case all parts are interchangeable.

PORTABLE ELECTRIC GRINDING MACHINE

A portable electric grinding machine intended for use on any type of machine tool or in a vise for the accurate grinding of hardened parts has been developed by Arva Stroud of New York City. The machine is furnished in two models which are driven by ½ and 1-horsepower motors, respectively. The motors are of the universal commutator type operating on alternating or direct current. Grinding wheels 5 inches in diameter are supplied. The net weight of the complete machine is about 22 pounds.

CANADIAN MACHINERY
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Keep Up On The Highlands

CUSTOM, bearded and patriarchal, has for generations flattered itself with customs old and mellow. Easter, for instance, never comes without dumping a lap full of wonderful millinery creations down on the heads of ladies. Thanksgiving regales us with the lordly turkey, with tender viands and cranberry sauce. Christmas brings forth jolly Santa Claus, who for centuries has been dispensing the same infatuating laughter and generosity.

So, too, the New Year, hopeful and optimistic as a morning in April, invites everyone to make a resolution,—any one of a thousand and three will do so long as it is sufficiently brittle to be broken when expediency demands! If any one feels so inspired that he wants to start January with a pocket stuffed, they will all be accounted to the resolutioner for good and marked up to his credit on the score board of time. But for most ordinary types of bipeds one good intention, molded into a fair, round, innocent shape, like a rosy-hued apple, is about all that experience shows is wise to undertake. Even this one should be selected and nurtured with affectionate care or before a month has passed it will have been disfigured and abandoned.

The ability to make resolutions is not of a high character. Any babbling tongue can order up a few words, saddled and bridled, like a trooper his horse, ready to journey forth with the same lofty spirit as a knight in quest of the Holy Grail but few persons have the strength of mind or the sincerity of motive to pursue a worthy determination to its day of achievement. It is easy to start out on the upland road, girded and mantled with white robes, face elevated and eyes forward, typifying the courageous and noble, but in too many ninety-nines out of every hundred the weary feet soon descend to lower levels. The resolution baggage taken on January 1st is thrown off bit by bit, till when February 1st comes, the highway is strewn with broken pledges.

To the readers of Canadian Machinery we give a word of cheer. Let the New Year be introduced with joviality and glee, let him drink out of the cup of mirth, let him plume his feathers before the mirror of optimism, but when the day is gone and the halls are silent again, let the inspiration of the Great Day leave behind it a permanent record—that of one resolution MADE and KEPT. The mistakes, errors and experiences of yesterday should be steps up to a better tomorrow.

In the coming months metal workers may well cast the flaws aside and work with purposes that ring as clear as high grade steel. But whatever the resolution may be with which one starts out, whether moral, mental or commercial, let it be maintained throughout the future, as a friend of youth is often held through life.

Success In Salesmanship

ON ANOTHER page of this issue appears an article on "The Selection and Training of Salesmen." This is a very important subject, and manufacturers and executives should read this material carefully as it contains many suggestions of value. We are now in a period when salesmen have an opportunity to prove whether they are order takers or order getters. Success in salesmanship depends on many things. A good appearance; an optimistic outlook; a convincing manner; all these are necessary, but such factors alone cannot make success. They merely help.

One of the primary essentials of a successful salesman is a thorough knowledge of the goods he is selling. Many a prospect has been lost through lack of confidence. This condition is created by the salesman himself when he displays an ignorance of the manufacturing process of his line. Before a traveller goes on the road he should spend some time in the factory, become acquainted with the process of manufacture, quality of raw materials, and any other points which will help his selling talk.

After he secures his shop experience, he must develop the faculty of saying the right thing at the right time; he should be able to sense instinctively the degree of response he is obtaining, and above all he must be patient

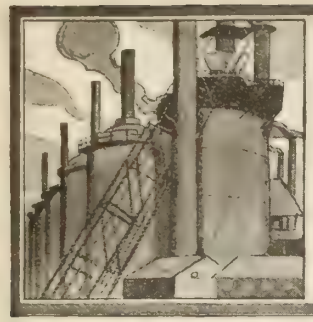
There is also the point where silence is golden. It is not always the glib talker that makes the greatest impression. A man of few words, yet who speaks those few with authority, can create more confidence than a salesman who talks voluminously, but vacantly.

Unfortunately some travellers have not grasped the true meaning of the expression "Good appearance."

They may be neat, but their idea of good dress is loud checks, brilliant ties, spats, etc. Such a salesman often wonders why he doesn't land the business, but if he could only read the minds of his prospective customers, he would soon tone down his clothes which fairly hurt the optic gaze.

Last, but most important of all, comes "Health." A salesman who takes care of himself while on the road has 50 per cent. of his battle won. He can get up in the morning clear of eye and mind, and has the advantage over his competitors who feel that a nice quiet (?) game of poker is the end and beginning of a perfect day.

Manufacturers have come to the point where they must get orders. If their present staff cannot land the business it is only reasonable to expect that they will secure help that will produce results. The year 1922 is a brand NEW year, and it will be what we make it. The three I's will carry you far; Initiative; Industry; Intrepidity. Use them, they are valuable helps.



MARKET DEVELOPMENTS



All Markets Reflect the Holiday Season

Pittsburgh Reports a Quiet Finished Steel and Pig Iron Market—Coke is Selling at Low Prices—Montreal Feels Confident About the Future—Toronto Activities Are Very Light

THE HOLIDAY season is making itself felt on all markets. Pittsburgh says that both finished steel and pig iron lines are very quiet. There has been no change in prices since December 22nd, when wire products took a drop. However, even this reduction did not represent corresponding declines on the open market, as the cause of the reduction was really the cutting of nominal prices by the independents. Since the corporation announced its new prices, the markets have been steady, no fresh price cutting having occurred.

Speaking on the future of steel prices, Pittsburgh says that the iron and steel producing trade has passed into a period of close competition. This is expected to continue for several years, so that we can look for a "buyer's," rather than a "seller's" market.

Prices have been made on furnace coke during the past two weeks that were not considered possible six weeks ago. Some contracts for this material have been made at $3.10, and even lower prices than this are spoken of.

Montreal reports a very quiet market in all lines. In spite of the lull, optimism prevails, and good things are looked for in 1922. Present building plans are rosy. Canadian railways have not yet placed their orders, and other local firms are expecting business in the near future.

Toronto comes forward this week feeling better, although not much business is actually being closed. The betterment is in feeling only, but travellers bring back the cheering report that all through the country things are picking up. They say that manufacturers have decided to forget the old year and get out and obtain results in the new. The small tool market has picked up a little and feels confident about the future.

VARIOUS LINES ARE VERY QUIET EXPECT BUYERS' MARKET FOR SOME TIME

PITTSBURGH, January 2.—The finished steel markets have been altogether inactive in the past week, thus being true to all the precedents. The influence is not so much the holidays, as the annual inventory.

As is to be expected in a quiet market, there have been no price developments. The last important changes in prices were in connection with the reductions the Steel Corporation made, December 15 on tubular goods, and December 22 on wire products. These reductions did not represent corresponding declines in the open market, as the market had declined more or less by way of independents cutting the nominal prices. Since the corporation put out its new prices the markets on these lines have been very steady, the independents not having started any fresh price cutting. Quite possibly they will not do any cutting in the near future, as the new prices are very low, relative to cost of production.

Finished Steel Market

The finished steel market having stood still long enough to be counted, following may be regarded as regular market prices: Bars, shapes and plates, 1.50c.; hoops, bands and hot rolled strips, 2.00c.; plain wire, 2.25c.; galvanized wire, 2.75c.; wire nails, $2.50; standard steel pipe, 71 per cent. basing discount; blue annealed sheets, 2.25c.; black sheets, 3.00c.; galvanized sheets, 4.00c.; tin plate, $4.75.

Varying degrees of firmness are exhibited by the different markets. Bars, shapes and plates sometimes bring a little over 1.50c., particularly in carloads, while on a distinctly large lot 1.50c. might be shaded. Strips would probably be shaded on a large lot, but the test does not come as orders are in very small lots. Wire products are very firm, and this seems to be the case with pipe. The blue annealed sheet quotation of 2.25c. is probably firm with the jobbing mills, while the heavier gauges would be sold by plate mills at a lower price. Black and galvanized sheets are phenomenally rigid at 3.00c. and 4.00c. respectively. Tin plate is quite steady, but of course some large buyers can secure slight concessions, this having been the usual thing in the tin plate market.

Future of Prices

As to the future of steel prices, it is very easy to argue that prices will have to be higher, and therefore very many do so. Present prices are at around the cost of production, and some say they are below the cost of production. One is not observant, however, if he does not see that the whole iron and steel producing trade has passed into a period, probably of several years' duration, in which there will be close competition and not enough demand to take care of all the productive capacity. This does not mean that demand will not be fairly large or that the country will not be busy, the point being simply that the producing capacity has grown disproportionately. For the country to give work to the entire iron and steel producing capacity it would have to curtail many of its other activities and take to consuming iron and steel instead, or would have to find many new ways in which to use iron and steel.

That is, demand can be large from the viewpoint of buyers and still be small from the viewpoint of sellers, therefore there will probably be a "buyers' market" for several years, and it will not be easy to get the price of any commodity up, once it has gone down. Quite possibly there will be a number of paper advances, by the mills filling up for a few months at strenuously competitive prices and then advancing their asking prices until the orders are worked off. That is a very old practice, and even in the past few months it has been seen in some commodities, particularly sheets. Somewhat the same thing was

attempted in hoops two or three months ago, sales being made at around 2.00c., the mills afterwards all advancing to 2.25c., but in a short time they began selling at 2.00c. again.

Coke Deve'opments

A little suggestion as to the general situation is furnished by recent doings in the coke market. Prices have been made on furnace coke in the past fortnight, for the first quarter or first half of 1922, that were not considered a possibility six weeks ago. At that time spot furheld then that this was a temporary Connellsville ovens, with no takers except for occasional odd lots for use outside blast furnace industry. It was held then that this was a temporary weakness and that of course coke would bring close to $3.50 for first quarter. The basic idea then was that while there was strenuous competition at the time the competition would not be so keen after the holidays.

The outcome has been different. While it is claimed that some first quarter contracts were made recently at $3.25, $3.40 and 3:50, it is now known that a contract has been made at $3.10, and even that is not all. A Youngstown steel interest, which has a by-product coking plant with a capacity slightly under the requirements of all its blast furnaces when running full, has been supplying three outside furnaces with coke, as its own requirements were light. A few weeks ago it looked as if this interest would refuse to continue the supply after January 1, but lately it opened negotiations again, evidently concluding its own requirements would be relatively light. One of the contracts went back to Connellsville coke and now it is learned that a new furnace has been taken on, not simply for the first quarter, but through the first half, and it is reported on what seems to be excellent authority that the price in this case was only $2.90, Connellsville basis.

Such developments seem to suggest that when men get down to actual trading very close prices have to be made, and when that is the case in coke there is no reason to suppose it will not be the case in pig iron and in steel products generally. In the past six years the seller has had the upper hand. In the next few years the buyer will have the upper hand. Why not?

The Pittsburgh-valley pig iron market has continued very quiet. It seems that in the past two or three weeks eastern Pennsylvania furnaces have been making a drive for business, at the expense of prices, because they did not want to blow out or to pile iron, and a fair sized tonnage has been sold, at prices the consumers could not resist. Somewhat the same thing has occurred in southern iron, but in that case it seems there were stocks of iron to be sold. Nothing of the sort has been attempted in the local market, and nothing is likely to be. The western Pennsylvania and valley furnaces are in the habit of sitting tight and waiting for inquiries to develop before they compete.

Bessemer remains quotable at $20, valley, and foundry at $19.50. Basic iron is now fairly quotable at $18.25, valley. The market price for some time was $19, and recently a steel works interest made one sale at $18.25. The merchant furnaces have accepted this as a governing sale and now quote $18.25 as their price. There have been no sales of any grade of importance in the past week.

POINTS IN WEEK'S MARKETING NOTES

Prices of steel in a semi-finished condition such as sheets, plates, bars, rails, and structural shapes, remain unchanged on the Montreal market. Quotations are low, and the stocks in the warehouses of the various jobbers are also low.

Canadian Railways have still to come into the market for their 1922 requirements. This business is looked for in the near future, and present building plans in the Montreal district makes it appear as if there will be a good demand for structural steel when spring opens up.

The standardization idea is being adopted by Canadian Railways. This will mean better purchases than if a varying and conglomerate range of equipment is carried. The pig iron market in Montreal is very quiet.

The Toronto small tool market shows a more optimistic spirit. Dealers feel that good things are in store, and that 1922 will see many improvements in their own particular market. The machine tool business is very quiet, but even here we find a note of optimism.

The metal market locally is quiet but steady. Dealers expect a gradual improvement from now on, and as stocks in scrap are said to be quite low in the foundries, business will pick up considerably when plants extend their activities.

The Pittsburgh-Valley pig iron market remains very quiet. Some furnaces have been making a drive for business, at the expense of prices, but locally, Pittsburgh reports no such move, with little likelihood of it occurring.

The finished steel markets have been quiet in the Pittsburgh district, no changes in price developing. The iron and steel producing trade will encounter keen competition for some time to come. It is quite likely that this will be a buyers' market for several years, thus it will be no easy matter to increase prices once they have been lowered.

MORE OPTIMISTIC SPIRIT ON MARKET

TORONTO, January 2.—Now that old Father Time has swung his scythe on another year, dealers, and those interested in market conditions locally, have decided to forget there was such a period as 1921. In one way it is just as well to forget the year just closed, for it was by no means a good one for the iron and steel industry. With the start of the New Year, everyone seems to be taking a more optimistic view. Not that they expect an immediate or sensational change for the better, but simply that they feel the worst is over. From now on a steady improvement can be looked for in all lines, although the steel market will not likely show any upward trend until the end of February or the beginning of March. In fact a slight drop in production can be looked for this month as various of the mills have given their workers a holiday over the New Year.

Conditions During the Week

The closing week in December fulfilled our recent prophecy, viz, that steel dealers would experience a much better month in December than in November. One dealer claims that his sales during December were far ahead of his expectations. In fact he never remembers a December in his experience which showed such good results. This business was all the more welcome, because it was unexpected. Low stocks seem to be the only answer for the unlooked for demand, and if this is the correct answer, and it seems the only feasible one, augurs well for business in the spring when things open up.

As far as prices are concerned there are no changes. Quotations remain firm, and as the reductions which occurred in boiler tubes last week are now history, we need not refer to this phase in the market.

Small Tools

A very decided tone of optimism exists on the small tool market. Dealers, in travelling over the country, have found manufacturers very cheerful. "Every one I spoke to last week had a cheering story to tell," commented one dealer to Canadian Machinery. Manufacturers generally feel that February will see a change, according to this dealer, and that business from then on is going to be very satisfactory.

Lumbermen report better conditions, this in turn meaning business for the small tool dealer handling wood working lines.

Machine Tool Market

Unfortunately we cannot report any improvement in the machine tool market. Dealers frankly admit that they do not expect any demand for some time to come. They are hoping when things open up in the spring that manufacturers will scrap some of their obsolete but runnable machinery, replacing this equipment with production ma-

chines. Competition is bound to be keen for some time to come, so that plant owners will have to be on their toes to produce at lowest cost. This is the comforting thought which keeps hope alive in machine tool dealers' breasts. In the meantime every nook and cranny is being scoured carefully for possible business, dealers refusing to let the grass grow under their feet.

Scrap Metal Market

"No change, but a better outlook," is the way one dealer summed up the metal situation this week. He went on to say he expected a steady but gradual improvement from now on. As soon as foundries open up watch the scrap market stiffen. Stocks are very low in plant yards, and once let foundry owners, get a whiff of possible business, then watch the orders start to roll in. Taken all in all, the week can be said to be the period when optimism took a new hold on life and that 1922 received an encouraging start so far as the Iron and Steel market is concerned.

RAILWAYS ARE COMING TO STANDARDS GOOD BUSINESS LOOKED FOR SHORTLY

MONTREAL, January 4th:—Illustrating the old proverb that "Hope springs eternal in the human breast," the entry into the year 1922 brings forth that optimistic spirit in a fuller measure, than is usual in normal years. The strenuous times that have been experienced during the last year are matters of the past. Experiences gained will be used to good advantage in the coming year. The metal working industries are acknowledged to be among the basic or key industries, yet, in the general improvement of trade, that we so confidently look forward to, it is hardly expected that these industries will be the prime mover in such an improvement. The expansion and development of our iron and steel business from the mining of the ore to the finished article, during the war years extended to a point far beyond that which is justified by our peace time needs. For that reason, men were attracted from other lines of endeavor to this branch of labor. Thus, the great abundance of manufacturing plants are only operating on very short time causing a great deal of unemployment. Generally quiet conditions create only a comparatively small demand for material, from our railways and our large industrial centres. During the year 1921 vast sums representing idle machinery, stocks, and superfluous equipment and supplies, were written off. Staffs were reduced to a minimum, dead wood was eliminated, re-organization to a greater or less degree was completed, and coincident with these changes some say that the bottom has been reached in the way of prices. With the old burdens cast aside, and with the mist which surrounded the future, to a great extent, removed, manufacturers are ready to start 1922 with courage, and with hope, that will be backed with an organized and well directed effort that will not countenance failure.

Prices in Steel

Prices of steel in a semi-finished condition such as sheets, plates bars, rails and structural shapes remain unchanged. The quotations are very low indeed. When the base price of steel drops below three cents it is always a good time to buy. Stocks in the warehouses of the jobber, as well as in the shops, are very low in all lines. Shortly, certain general plans for 1922 will develop, for these matters will demand attention in the coming year. Then too each year brings forth its quota of regular jobs. This, together with many new business ventures, will present a volume of business which represents a definite consumption of steel products. Thus, between the present time and the first of April there will be orders for stock and for contracts from jobbers and manufacturers. The rail mills and steel plants have had a reasonably good year all things being considered. In fact, the Algoma Steel Company's mills at the Canadian Sault have been operating at a greater percentage of their capacity, throughout the year, than has any other steel plant in Canada or the United States.

The Canadian Railways have not come into the market as yet for their requirements for the year. Plans for building are being made on a large scale locally, and throughout the province. This will call for a large volume of structural steel. The demand for sheets and plates has been reasonably large all through the closing months and from the manufacturing schedules now being announced the demand will continue. The Parker Motor Car Co., with head offices in this city claim to have closed contracts for thirty-five hundred cars. They plan to assemble these machines in their own factory locally. Several large hydro-electric power developments are contemplated. If the contract for the turbines and other equipment required for the Winnipeg development is placed in Canada, there is an indication that the work will be placed with a local firm, the Dominion Engineering Works, Ltd. In the Maritime Provinces several other developments are receiving close consideration.

The Canadian Railways are developing the idea of standardization as far as possible. It is stated that trucks will be reduced to a minimum number as will all other major assembled units. The smaller articles have been standardized for some time past. The Canadian Pacific claim they will soon have their types of locomotives reduced to about six—namely, light and heavy passenger; light and heavy freight, and light and heavy switching. Of course, this is a theoretical idea and can never be really attained due to constantly increasing improvements and developments in locomotive design. With a railway well standardized, it makes for greater purchases, however, while with a varying and conglomerate range of equipment it would be impossible to carry stores on a scale that would be necessary, as the investment would be too great. The result would be that the stores would not receive proper attention; inventories would be hard to make, and the stores department would become an unsatisfactory unit. On the other hand with a well regulated and standardized system, large and profitable orders would be received at regular intervals by jobbers and manufacturers. There is no doubt but that the steel situation will gradually improve and with the advent of spring will have attained very satisfactory dimensions.

Pig Iron Market

The pig iron market is very quiet this week. Some time ago it was evident that most foundries had a sufficient supply of pig in their yards for the modest requirements for the balance of the year. In fact most foundries are not operating this week, even their office staffs being somewhat disorganized. To further add to the general dullness it was decided some two weeks ago not to change any prices or quotations until after the New Year. Thus there was no possible advantage to be gained by manufacturers in placing orders for pig iron before the early part of January, unless same was required for use before that time. Therefore, for the last week there has hardly been any tonnage moving. There is some speculation in connection with the price to be quoted for January delivery. The producers claim the price is firm and is quite likely to be advanced as business increases. On the other hand the shops seem to be of the opinion that a further drop can be expected.

Machine tool sales have again been conspicuous by their absence this week. This condition, of course, is only to be expected at this season of the year. Bulletins from the manufacturers of tools describe some really very efficient machines with many real labor saving devices. Prices generally are coming down and there is every probability of a gradual improvement.

Small Tools and Supplies

Small tools and supplies have had a quiet week, but with the opening of the shops next week business will undoubtedly improve. Prices are pretty fairly firm all along the line, and prospects for the New Year are good.

The non-ferrous metals have been quiet, in sympathy with the rest of the metal working trading. The rise in value of the Canadian dollar in New York will, of course, have a reaction in the translation of New York quotations, having a tendency to slightly lower quotations, which is entirely foreign to the factors which usually influence these

(Continued on page 48)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 50
Tank plates, Pittsburgh mill price	1 50
Structural shaues, Pitssburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 7 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 75	$17 50
Electric copper	17 50	17 50
Castings, copper	17 25	18 00
Tin	38 50	38 50
Spelter	7 25	7 50
Lead	6 50	6 75
Antimony	6 75	8 25
Aluminum	27 00	30 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 90	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT
Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.08	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C
Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.59	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 20%.
Standard couplings, 4-in. and under, 20%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices
Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and less	55
Coch and lag screws	55
Stove bolts	72½
Wrought washers	—25
Elevator bolts	40
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	25
Machine screws, fl. and rd. hd., brass	25
Machine screws, o. and fil. hd., brass	25
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	$1.25
Nuts, hex., tapped off net list	75c.
Copper rivets and burrs, list less.	27½
Burrs only,	20
Iron rivets and burrs	37½ and 5
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	67½
Wood screws, flat, bright	67½
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55½
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47½

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$4 25
Cut nails, base	4 85
Miscellaneous wire nails	50%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	17 00
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	0 87
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	57
Class B	22	32
Class C	14	22

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 75
Sheets, blue ann., No. 10	4 00	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B. W. G.	7 75	.....
Flerur-de-Lis, 28 B.W.G.	7 25	.....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	...
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz.	6 85	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60 0/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 25
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 75
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	4 00

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.17	Atlas	.19
Peerless	.22	X Empire	.14
XX Grand	.16	Ideal	.18
Superior	.21½	X Press	.13
X L C R	.15		

Colored

Lion	.12½	Popular	.10
Standard	.11	Keen	.9
No. 1	.14	Fancy	.14

Wool Packing

Arrow	.30	Anvil	.20
Axle	.25		

Washed Wipers

Select White	20
Dark colored	.13
Mixed colored	.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



The city council of Montreal, Quebec, plan waterworks improvement for the coming year to the extent of $700,000.

A mill-work contract for a car cleaning shop costing $50,000 in the Glen Yards for the C. P. R. in Montreal, Quebec, has been granted.

Contracts for the erection of a high school in North Toronto, Ontario, costing $160,000 have been granted.

Additional contracts for a school costing $100,000 for Verdun, Quebec, have been granted.

A steel contract has been awarded to erect a factory for the Universal Cement Casket Co., Dunnville, Ont.

Plumbing and heating contracts for additions to hospital costing $107,986 for the Royal Jubilee hospital, Victoria, B. C., have been awarded.

The general contracts for the erection of a Technical school costing $450,000 for Windsor and Walkerville School Board at Windsor, Ont., have been awarded.

Additional contracts for alterations to the office building costing $150,000 for the Toronto Hydro Electric and Toronto Transportation Commission have been awarded.

Contracts for re-inforced concrete for addition to factory costing $75,000 for George Weston Ltd., 134 Peter Street, Toronto, have been granted.

Contracts for addition to the office building costing $35,000 for Merchants Fire Insurance Co., 86 Adelaide St., W., Toronto, have been awarded.

Electrical contracts for a market building costing $150,000 at Windsor, Ontario, have been awarded.

Mr. J. D. Johnston, architect, Kentville, N. S., is preparing plans for a telephone exchange for the Maritime Telegraph and Telephone Co., Hollis St., Halifax, N. S.

Canadian trade statistics show an increase in total exports to Italy of $22,900,000 for the past twelve months, exports having risen from $24,300,000 August-September, 1920, to $47,200,000 August-September, 1921.

Speaking on business conditions in the Argentine, Trade Commissioner B. S. Webb says that import and export trade has been in a state of partial paralysis during the past few months, but there is every reason to believe that the worst is now passed and that commercial conditions from now on will steadily improve.

The T. G. Rice Wire Mfg. Co., 134 King St. W., Toronto, has recently been incorporated under the name of Rice Wire and Metal Goods, Ltd.

The Increase in production of coal in the Province of Alberta is equivalent to the addition of one new colliery of one thousand tons per day output, each year for the last eighteen years.

There have been more garages built in Toronto, Ontario, than houses in the year, 1921. According to figures received from the City Architect department, 3,078 garages have been built during the current year.

At the annual meeting of the Oak Tire & Rubber Company approval was given the plans for enlarging the present factory, which has been made necessary by the increased demand. It was stated at the meeting that every indication pointed to a banner year in 1922.

Wall Street interests are said to have their eyes on Northern Ontario. $25,000,000 ready money is waiting investment and will become available as soon as the financial interests are assured that the Ontario government will cooperate by placing water power for development purposes at the disposal of the financiers.

Contracts for the last two sections of road on the main highway between Fredericton and Woodstock, N. B., have been let to Concrete Builders, Ltd., Fredericton, and Guildford & Hammond of Dumfries. The two contracts are for about 13 miles of road, which will practically complete the Fredericton-Woodstock highway with the exception of a short section at Meductic which will be under the supervision of the highway department. This highway, when completed, will have cost about $500,000.

In the December 8th issue of Canadian Machinery we mentioned that the Wm. Hamilton Co., Peterborough, Ont., were building certain machines for the Canadian General Electric Co., which is establishing a plant at St. Catharines. This information was rather misleading for what they are actually supplying are the hydraulic turbines for the new power plant of the Canadian General Electric Co., at Nassau, Ont. This company has also told us they are supplying full equipment for the power plant of the new Red Arrow Tire Co. plant at Peterborough, Ont.

The attention of Canadian exporters is directed to the new service which is being maintained by the Canadian Pacific Steamships, Ltd., from St. John to Havana, Cuba. This service was inaugurated by the ss. Sicilian on December 5, and is to be a regular passenger and freight service between Canada and Cuba, with Boston as a port of call on each trip.

Major H. A. Chisholm, late Canadian Government Trade Commissioner in Havana, Cuba, sailed on the 24th December to open the new office of the Commercial Intelligence Service in Calcutta. It is expected that Major Chisholm will arrive at Calcutta a little before the end of January. Until offices have been engaged in Calcutta, correspondence should be addressed care of H. M. Trade Commissioner, P. O. Box 683, Calcutta.

The largest Hydro Electric Plant at Chippawa was officially opened on Wednesday, December 28th. About 2,000 municipal representatives were present, and water was released into the first installed turbine setting in motion the 55,000 H. P. generator. At the present time only one turbine will be used but when the actual plant is completed there will be nine turbines in all which will have approximately a capacity of 650,000 H. P.

A firm of rubber manufacturers is laying an experimental section or road with rubber blocks. This is to be tried as a substitute, in fact an improvement over the present wood paved streets of Melbourne. The rubber blocks used, have an ebonite base, reinforced with expanded metal, and are fixed on to a concrete foundation to which they are held by screws. It is considered that only the present low price of rubber warrants its use for road purposes, and that competition with hardwood blocks, which have proven very satisfactory, is unlikely to any large extent.

A new concern, Hadfields (Australia) Ltd., has been formed and registered with a capital of £500,000 to take over the works of the Australian Electrical Steel, Ltd. at Alexandria, and a plant, which is now in the course of erection, at Perth, Western Australia. The Australian Electrical Steel, which will be absorbed by the new company, was the pioneer in Australia in the manufacture of steel by the electrical process. It is stated that the new company expects to so expand the scope of its manufacture that all of the high-grade steel now imported from overseas will in future be made in Australia.

Mr. J. D. Best, Glencoe, Ontario is in the market for equipment for drilling oil wells.

Gropp Bros., Penetang, Ontario, are in the market for saw-mill machinery, boiler engine, belting, etc.

Mr. W. W. Avey, Norwich, Ontario, is in the market for engine, boiler and complete equipment for new planing mill.

The Taylor and Arnold Engineering Co., have been appointed to act as dealers for the Davis-Bournonville Co., in Ontario, Quebec, New Brunswick, Nova Scotia and Newfoundland.

The "Weekly Bulletin," the publication of the dept. of trade and commerce, will change the name of their booklet, to "Commercial Intelligence Journal," as they feel the new title will be more descriptive of their efforts.

The total value of buildings erected at Timmins, Ontario, this year is estimated at $100,000. Within the limits of the town of Timmins there were permits taken out for the erection of 216 buildings, the total value of which is estimated at $207,353.

The secretary of the Building Trade Union has stated that the unemployment situation at the present time is more hopeful than at this time last year. He says there is work in sight which, with government work, will reduce unemployment in the building trades industry to a minimum this winter.

Many friends will be sorry to learn of the death of Mr. John J. Cunningham, president and general manager of the Western Foundry Co., Wingham, Ont. He died in Toronto on Tuesday, December 27th. The deceased was well known in Western Ontario and had been prominent in the manufacture of stoves for a number of years.

James Whalen, president of the Port Arthur Shipbuilding Co., has announced that they have received a contract from the Matthews Steamship Co., Toronto, for the construction of a 550 foot lake freighter. The erection of this will take place in Toronto. Construction will give employment to 700 men well into next summer. A later report states that 400 additional men will be taken on the payroll to work on a contract for paper machinery required by the Provincial Paper mills, this work requiring two years to complete.

United States exports to Canada declined by $3,606,000 in November as compared with the previous month, according to an official summary of the month's trade issued by the Department of Commerce. Goods were sold the Dominion of Canada to the value of $41,-194,000, against $44,800,000 in the previous month. On the other hand Canada's sales to the United States showed an increase of nearly a million and a half dollars. The import figures show goods valued at $10,875,000 were received from Canada, against $9,469,000 in October.

Advertisements of machine tools should contain complete information as to extra parts, fixtures and equipment; prices should be included. It requires clear, forceful technical copy and illustration. A matter of phraseology should be carefully considered; use of superfluous and flowery terms should be avoided. Co-operation between the engineering and advertising departments is imperative if satisfactory results are to be obtained.

The latest tendency in the textile industry has been upward. For the final month of the year 1921, the reports on the whole show expansion and greater activity, cottons, silk and ribbons all having an upward tendency. Increases are also reported in the Maritime Provinces. In Ontario and Quebec there were local fluctuations, with a net increase in employment. At Toronto, employment has been held at the September level. On the whole the financial outlook seems brighter.

It is stated that British Columbia now produces 37 per cent. of the lumber used in Canada. During the last 14 years, this part of Canada has increased its output 100 per cent., and the province's share of the saw-mill business in the Douglas Fir region has grown from about 8 to around 11 per cent. In 1920 it is asserted that nearly $93,000,000 of commercial material was produced, and the hundred million mark will probably be exceeded this year. Last year's output amounted to approximately two billion feet of wood product. Employees in mills and logging camps numbered about 20,000 men.

The Engineering Experiment Station of the University of Illinois, has issued a bulletin, No. 124, entitled "An Investigation of the Fatigue of Metals." This is a progress report of the first part of the investigation, having for its object the determination whether or not there exists any clearly defined relation between static properties and ability to resist repeated stresses. It having been decided not to enter the field of non-ferrous metals at this time, a series of tests of materials well scattered over the field of ferrous metals was made, and in most cases two or more distinct heat treatments for each metal were studied. The results of the tests, and the conclusions to be drawn therefrom are given in the above mentioned bulletin, copies of which may be had without charge by addressing the Engineering Experimental Station, Urbana, Illinois.

German tanneries, says the United States Commerce Reports, are producing calf skins, patent leather, and kid leather up to 65 or 75 per cent. of their prewar output. The tanners are receiving adequate supplies of raw hides and skins to keep the industry occupied. France is supplying 70 per cent. of the calf skins and 90 per cent. of the kid leather. Denmark and Sweden are other sources of supply; England sends additional patent leather, Russia virtually nothing. Labor conditions in the leather industry are satisfactory, with almost no unemployment. Present wages per hour of 6.25 to 8 marks compare with 1913 rate of 45 to 65 pfennigs per hour.

Mr. E. L. McColl, Canadian Trade Commisioner in Rio de Janeiro, says that the British are giving $70,000 for a permanent building for Imperial exhibit, at the Brazil Centennial Exposition which is to be held at Rio de Janeiro from Sept. 7th to Nov. 15th, 1922 The permanent building will not have an industrial exhibit. A temporary annex is to be added for holding products, space in which will cost exhibitors from £2 to £3 per square foot, and in which there is plenty of space available. Canadian requirements in space are requested at the earliest convenience. Mr. McColl believes that Canada should have an exhibit of manufactured goods, as Canadian products resemble, with a few exceptions, those of the United States. Something, he suggests, should be shown in such products as agricultural machinery, lumbering machinery, logging and railroad construction machinery, and in textiles, canned goods, chemicals, machine tools, electrical equipment and rails. Canadian manufacturers who are interested are invited to communicate direct with the Trade Commissioner in Rio de Janeiro.

The "Weekly Bulletin" says that H. M. Senior Trade Commissioner in Canada and Newfoundland has forwarded specifications which he has received from the British Legation, Santiago, Chile, for requirements for the Chilean State Railways. These are for:—

(1) Twenty-three cars, boilers, electric machinery, lamps, etc., tin and lead in ingots, ordinary bars, iron and steel tubes, etc., etc., for which public tenders are called for the 4th February, 1922, by the Chilean State Railways, to be opened at 10 a.m. on that day at the "Departmento de Materiales y Almacenes," Alameda Station, Santiago.

(2) Fish-plates and chairs for rails, for which public tenders are called for 16th February next, to be opened at 10 a.m. on that date at the above-mentioned department. Canadian firms interested in these specifications (which are in Spanish) may obtain copies on application to the Director, Commercial Intelligence Service, Ottawa (quoting file No. 27526).

Hoping to find oil for several years past the Commonwealth Government of Australia has offered a reward of £50,-000 to the discoverer of a payable oilfield in Australia. In addition the New South Wales Government offers a reward of £10,000 for the production of the first 10,000 gallons of natural mineral oil within the state. The oil position at present is that scouts are out in almost the whole of the four quarters of Australia hunting for the faintest indications of its presence, and bores have been put down in places where favorable features have been located.

Right on the Lead



Running
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Nothing but Geometrics in the Buffalo shop where these two jobs are done

160 of the Large Pieces Turned and Threaded Each Day

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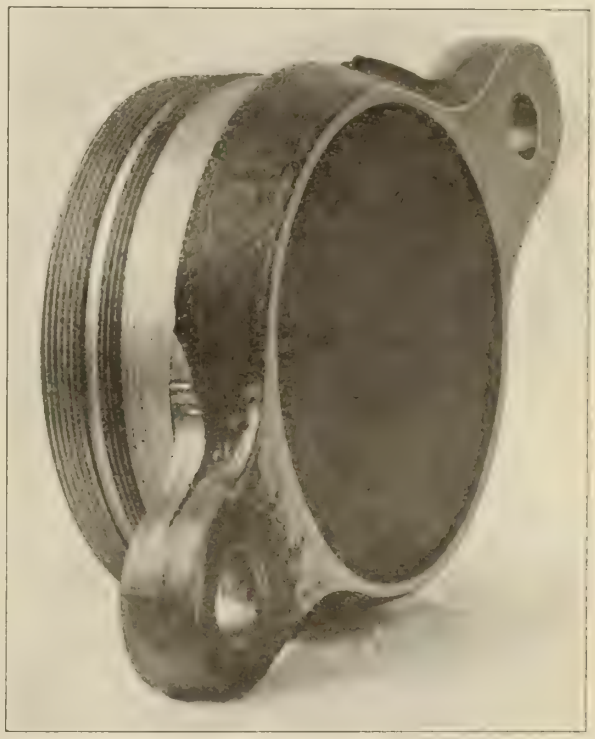
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All Other Die Heads and Taps Have Been Discarded There

Geometric Self-Opening Die Heads and Geometric Collapsing Taps are in use on the turrets of all makes of Screw Machines and Turret Lathes.

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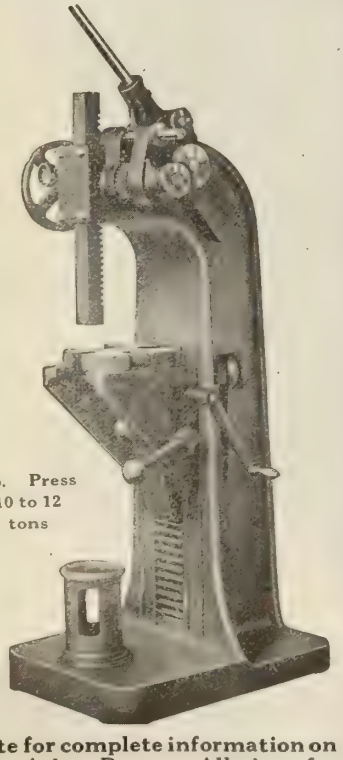
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selves. So far favorable results have not been achieved. Geologists are exceedingly cautious in their expressed opinions as to the possibilities of finding oil. It is quite possible that the desire to eliminate errors has made scientists somewhat chary of expressing too encouraging opinions. They have, however, gone so far as to say that complete and thorough surveys of certain parts of Australia, chiefly in the northwest portions, are eminently desirable, and that from a geological point of view the outlook is sufficiently hopeful to justify large expenditure in putting down many trial bores.

MONTREAL MARKETS

(Continued on page 42)

quotations. As trading has been light, no very concrete effects have been noticed. Just what changes will occur in quotations, trading, and general conditions surrounding the non-ferrous metals, early in the New Year, is a problem. The outlook, however, is for a gradual improvement starting the middle or latter part of January and continuing into the early summer. Shortages of stocks exist in many quarters and should an increased demand arise, it will be necessary to produce more ore and additional refining plants will start up, all of which have a tendency to upset any prophecies made in view of the present conditions and outlook.

The scrap metal markets are quite dull, but it is refreshing to see the spirit of optimism prevailing among the trade. Foundry activity is about the only real factor that will revive this department of the metal trade.

Of the 300 million acres fit for farming in Canada only one sixth is cultivated.

NEW USES FOR RUBBER

A very interesting competition was recently organized in Great Britain. Prizes were offered for suggestions for novel uses of indiarubber. About 10,000 suggestions were sent, and the first prize was awarded for the suggestion for using sponge rubber for general upholstering purposes, including the making of mattresses. Another prize suggestion was that rubber should be included in liquid form with paint or other composition for use in the preservation of wood and metals against the action of the sea. A third prize was given for the suggestion that rubber should be used for general decorative and preservative purposes. These and other suggestions are likely to create important new departments for British manufacturers.

NEW OIL GAS BURNER

A demonstration was recently given in London, England, of a new type of burner for use with oil. The oil is first converted into gas in a chamber filled with nickel gauze heated by the flame. The oil gas then passes through a regulating valve and issues as a jet which carries with it the air required for combustion. The mixture then passes into another chamber, where it is still further heated; and it issues from orifices arranged according to the services required. No carbon forms in the burner, and it does not require cleaning.

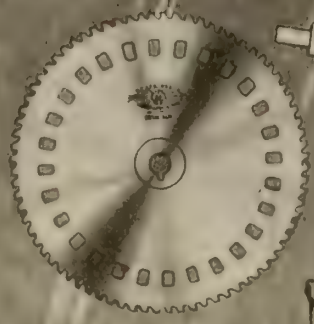
Railways in the United States have found that farmers along the rights of way are willing to haul old ties away for fuel and to perform some service in return, such as plowing fire guards, etc. This overcomes a problem which roads have had to face of late in as much as the increased cost of labor has made it too expensive for the companies to load and haul these ties to terminals for engine wood.

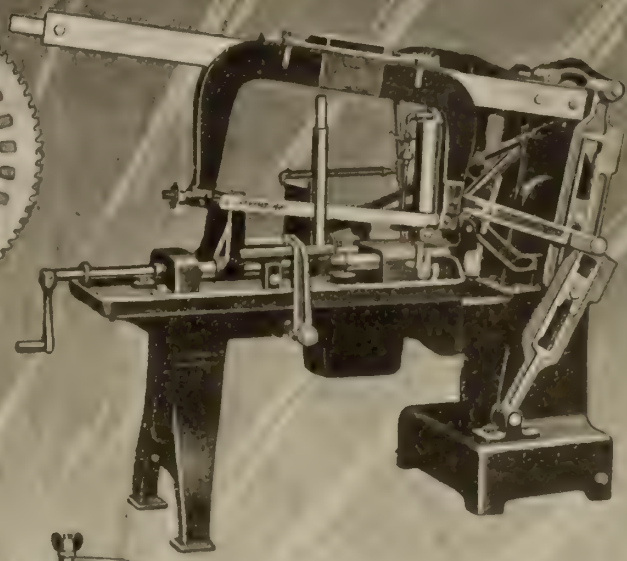
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O'er Land and Sea
North South East West

Atkins Sterling Quality Saws

are noted for their efficiency. Their use will increase your production.

Ask for new literature describing Atkins Kwik Kut Power Hack Saw and Metal Cutting Band Saw Machines, Circular Metal Cutting Saws, AAA Hack Saw Blades and Frames, etc.

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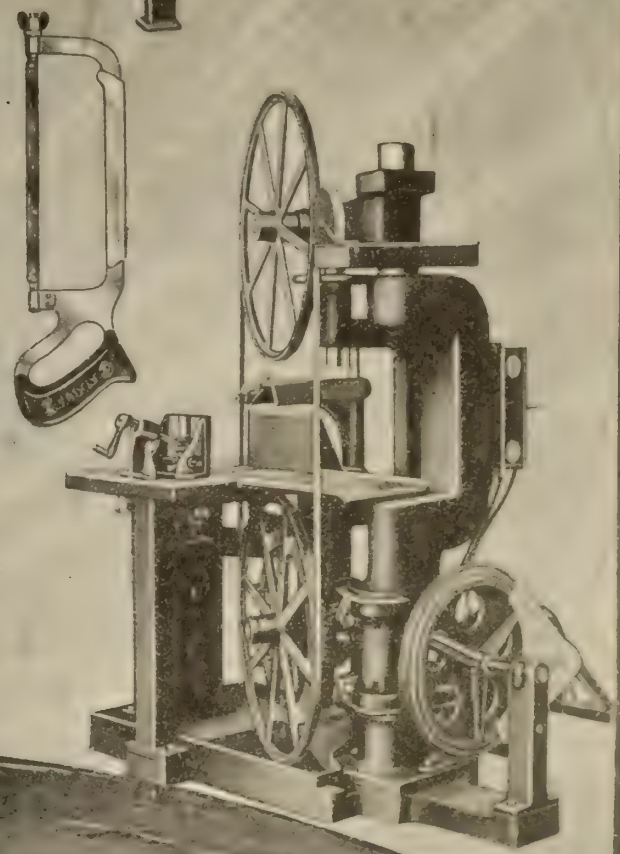
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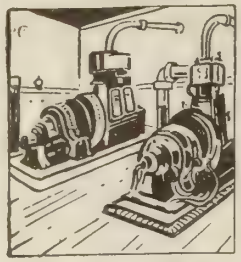
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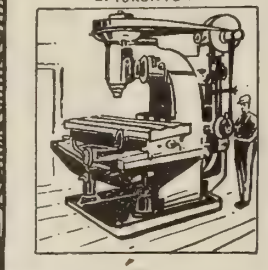
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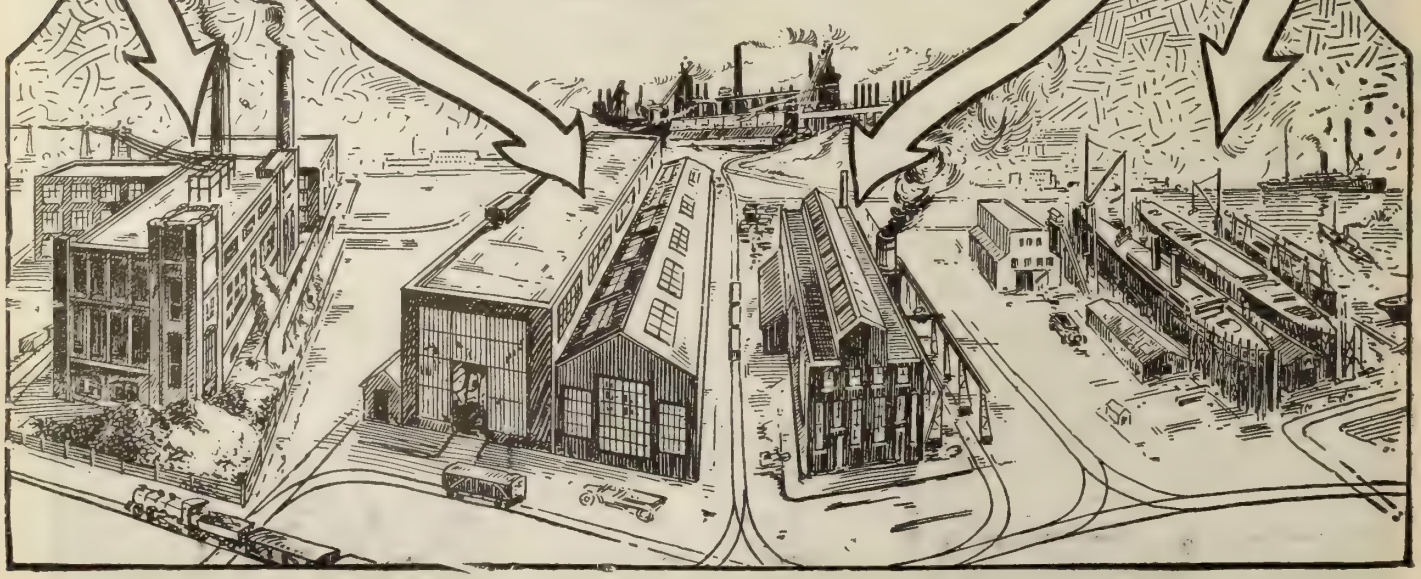
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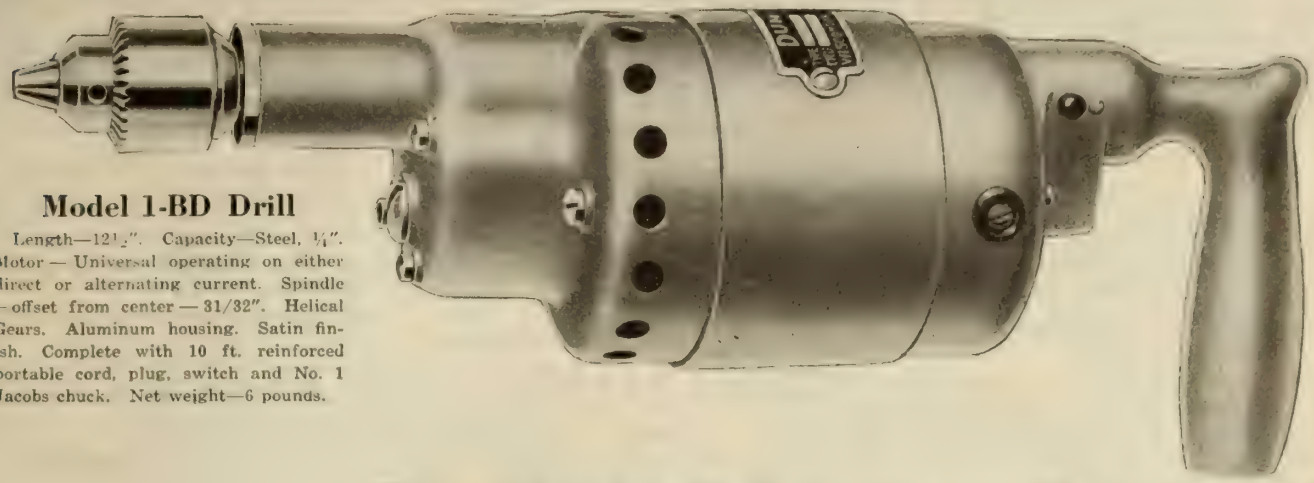
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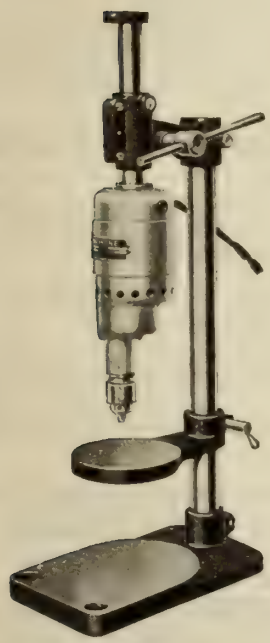




Model 1-BD Drill

Length—12½". Capacity—Steel, ¼". Motor — Universal operating on either direct or alternating current. Spindle — offset from center — 31/32". Helical Gears. Aluminum housing. Satin finish. Complete with 10 ft. reinforced portable cord, plug, switch and No. 1 Jacobs chuck. Net weight—6 pounds.

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DESIGNED by men who know the practical advantages of small, light tools that get to the spot where needed without waste of time, Dumore Drills save time, money and energy. Equipped with perfectly balanced motors, Dumore Drills are accurately built and have an almost unlimited range of usefulness. For speed and accuracy on fine and sensitive jobs Dumore Drills will supplement the work of your big machines—adding to the capacity of your shop and cutting down production costs on many classes of work.

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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

WE BUY ANYTHING IN BOILERS, TANKS, general shop, mill and factory machinery, electric motors, gas engines, air compressors, etc. The A. R. Williams Machinery Co., Limited, 64 Front Street west, Toronto. (cfm)

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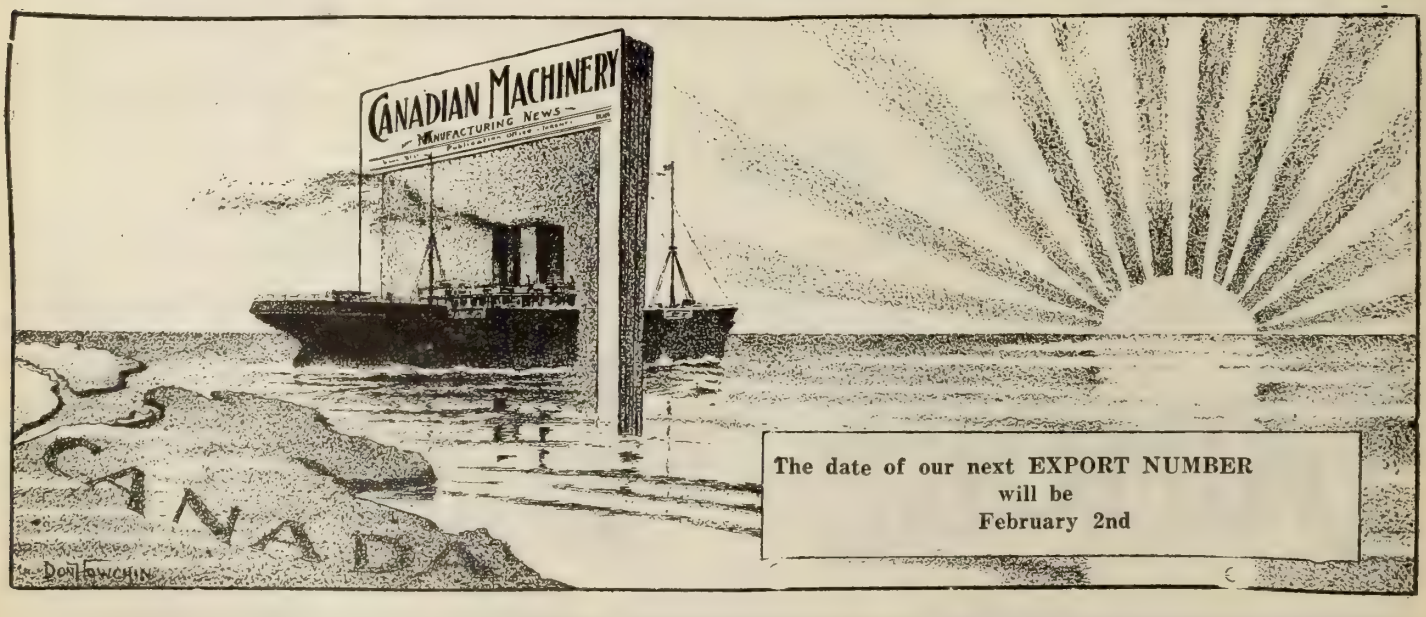
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Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
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Racine High Speed Hack Saw Blades,
3—Davis 24-in. Turret Lathes,
1—36x18 Putnam Engine Lathe,
1—18x8 Rae Engine Lathe,
1—16-in. Bardons & Oliver Turret Lathe,
1—18-in. Oliver Turret Lathe,
1—McKechnie-Bertram 20x12 Engine Lathe,
1—Racine No. 10 Hack Saw,
1—16x6 Lathe,
4—Woodward & Rogers Four Spindle Drills,
1—Canadian Allis-Chalmers 5 H.P. Motor,
1—Roots No. 1 Pressure Blower,
1—Perfect No. 3 Hack Saw,
1—12-in. Dividing Head for Ford-Smith Miller,
1—Plain Vise for Ford-Smith Miller,
1—Buffalo No. 3 Blower,
1—Champion 20-in. Drill,
1—Grant No. 80-B Riveter,
1—12-in. Three Jaw Universal Chuck,
1—Burke No. 1 Bench Drill,
1—Smart-Turner 4½x2¾x6-in. Pump.
1—Goldie-McCulloch Pump,
1 Greenerd No. 3½ Arbor Press, with Stand,
1—Landis 12x42 Plain Grinder,
1—Greenerd No. 3½ Arbor Press, without Stand,
1—Bellevue Double Oil Furnace,
1—Silver Three Spindle Gang Drill,
1—Silver 20-in. Drill,
1—Canadian Allis-Chalmers 5 H.P. Motor,
4 Speed Lathe Beds,
1—Air Compressor Stand,
1—No. 190 Brown-Boggs Press,
Chain Hoists,
Motors, varied H.P. and Current,
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1—30-in. Bending Roll,
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Lot of Friction Rolls, Log Chains, Shafting, etc.
1—36-in. Back Geared Drill Press,
1—American 14x6 Double Back Geared Lathe,
1—16-in. Ohio Shaper,
1—Acetylene Welding Outfit on Truck, Portable,
1—Cataract No. 3 Bench Lathe,
No. 20 Rich Drills of various sizes.

If you don't see what you need here—write us—
We Desire to Serve You in Every Way Possible

GARLOCK MACHINERY LTD.
163 Dufferin Street
Montreal TORONTO Winnipeg

Buying in Bulk

Grocers used to display their wares by placing them in bushel baskets on the sidewalk. In those days customers often paid for dirt when they were buying coffee.

Then came the day of standardized merchandise. Grocers gradually learned to sell their wares in sanitary packages trade-marked for definite quantity and quality.

Advertisers used to buy space in publications "in bulk." Like the old-time grocer's customers they frequently received as much refuse as "coffee."

The Audit Bureau of Circulations has done for advertising what standardized merchandise has done for the consumer. It has marked circulation with the stamp of accuracy.

In Canadian Machinery's circulation and advertiser buys a definite and known quantity. Its records are audited by the A. B. C.

MACHINERY FOR SALE

Lathes

1—26" x 12' Pond Lathe, S.B.G., C.R., P.C.F.
1—24" x 12' New Haven Lathe, D.B.G., S-Q.C.G., C.R.
1—24" x 12' Can. Mach. Lathe, S.B.G., C.R., P.C.F.
1—21" x 10' London Lathe, S.B.G., C.R., P.C.F.
4—20" x 8' C.M.C. Lathes, D.B.G., S-Q.C.G., C.R.
1—18" x 8' C.M.C. Lathes, D.B.G., Q.C.G., C.R.
1—21" x 10' Butler Lathe, D.B.G., Q.C.G., C.R.
1—16" x 6' McDougall Lathe, S.B.G., S-Q.C.G., C.R.
1—18" x 8' C.M.C. Lathes, D.B.G., Q.C.G., C.R.

Shapers

1—24" Rockford Shaper.
1—12" Port Hope Shaper.
1—16" Hendey Friction Geared Shaper.

Drills

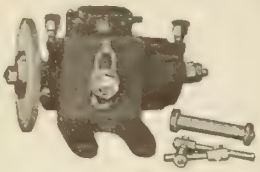
1—No. D-1 H.D. Colburn Drill.
2—No 24 H.D. Foote Burt Drills.
1—28" Barnes Drill, B.G., P.F.
1—22" Barnes Drill, B.G., P.F.
2—16" Back-geared Drill, lever feed only

Miscellaneous

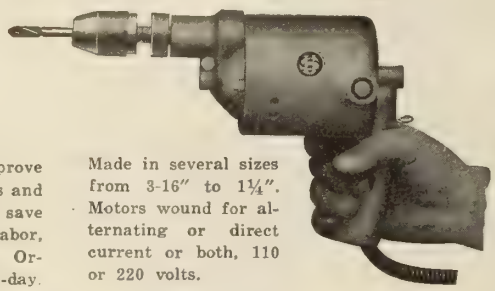
2—2" x 26" Pratt & Whitney Turrets.
1—No. 2 Gardner Disc Grinder.
1—8" Acme Bolt Cutter.
1—No. 54 Perkins Sprue Cu
1—No. 320 Brown-Boggs Press.
1—10"x24" Plain Landis Grinder, self-contained.
Union Triplex Hydraulic Pump, 1¼"x"4

YEATES MACHINERY
HALE STREET
LONDON, ONT.

U. S. ELECTRIC
Drills and Grinders
Can be Attached to any Lamp Socket



For drilling in metal these drills are the superior of every other kind of portable drill. Their operating cost is only half that of air drills. And they can be attached to any lamp socket.



A trial will prove that our drills and grinders will save you time, labor, and expense. Order a few to-day.

Made in several sizes from 3-16" to 1¼". Motors wound for alternating or direct current or both, 110 or 220 volts.

For Sale By
The Canadian Fairbanks-Morse Co., Limited
Montreal, St. John, N.B., Toronto, Winnipeg, Calgary, Vancouver

THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO

WRIGHT HOIST



Workmen Prefer It

The positive safety lock and non-fouling chain make the Wright High Speed Hoist absolutely safe and easy to operate.

Have you our Catalogue?

WRIGHT MANUFACTURING COMPANY
Lisbon, Ohio, U. S. A.

Canadian Distributors: The A. R. Williams Machinery Co.,
St. John - Halifax - Toronto - Winnipeg - Vancouver - Montreal

PATENT ATTORNEYS

PATENTS

Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
Booklet Free.

BLACK DIAMOND OVENS

"OVENS"

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co. Ltd.
Brantford, Canada

BLACK DIAMOND OVENS

THE

TRADE K–T MARK

FOUNDRY
GALT, ONT.

Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25 per cent.; a different method of molding them might double your production at no increase in molding cost. We can advise you and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns

send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

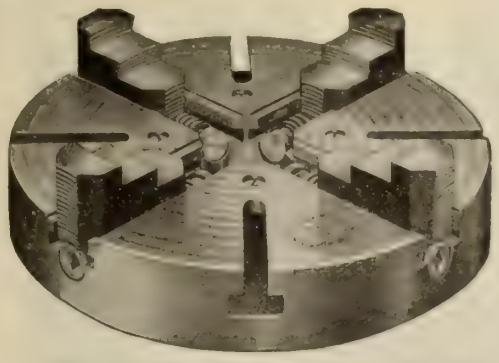
We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us. Ask us.

We have for our and your requirements, a large stock of assorted White Iron Stars, suitable for light agricultural to medium weight machinery castings, while they last, at 8 cents per lb. F. O. B. Galt.

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

Union Manufacturing Company

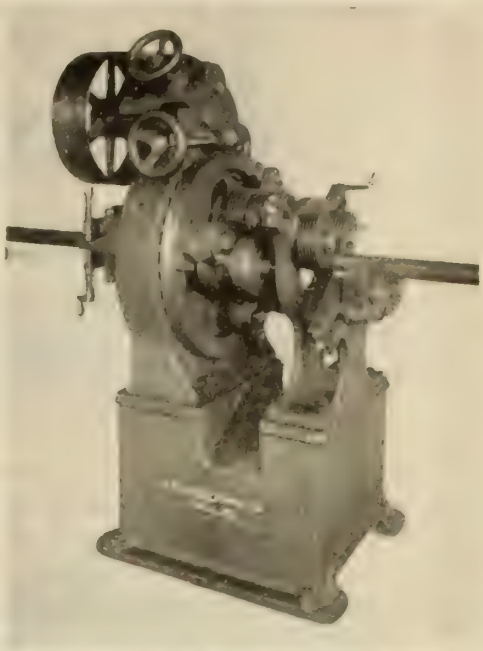
New Britain, Conn.

New York Office: 26 Cortlandt Street

Makers of a complete line of chucks

Underwood Rotary Flue Cleaning Machine

Built in Two Sizes



For removing scale or crust from boiler flues this strong, easily operated machine is unequalled. It requires very little power and will clean from eight to ten feet per minute completely removing all scale without injury to the flue.

Full particulars of this and other Underwood Machines upon request.

H. B. UNDERWOOD CORPORATION

1025 Hamilton St. Philadelphia, Pa., U.S.A.

Monel Metal Castings

For Anti-Corrosive and Superheat Service

Made in Canada by

CANADIAN DRIVER-HARRIS CO.

WALKERVILLE, ONT.

American Office and Works

Chicago-Detroit Harrison, N. J. England-France

MILWAUKEE MILLING MACHINES

ACCURATE RIGID DEPENDABLE

Manufactured in various types and sizes for all classes of milling.

KEARNEY & TRECKER CORPORATION

MILWAUKEE WIS., U.S.A.

STEEL TUBING

CLOSE Joints and Welded Steel Tubing for Bedsteads, Trolley Arms, Agricultural Implements, and all manufacturing purposes, reliable quality, uniform in size, 14 to 20 gauge, 3-8 inch to 2 inch outside diameter.

STANDARD TUBE COMPANY, LIMITED

WOODSTOCK, ONT.

AN IMPORTANT QUESTION

For the Advertiser to Answer

Is the Publication Soliciting Your Business a Member of the Canadian National Newspapers and Periodicals Association?

YOU would never engage a man on an important piece of work until you gained a thorough knowledge of his qualifications. It would not be wise. You first of all require a clear record of his character and ability, in addition to a statement of his aims and aspirations. When you are in possession of this information you have a real basis for judging his fitness to serve you.

It is just as important that you should know the character, ability and aspirations of the publication in which you desire to carry your business message.

You should know if the paper is circulating and has an influence among those men who are responsible for results—the men who buy, or influence the buying, of machinery, tools, power and any other equipment or merchandise which you may sell.

Facts are essential. When you are in possession of the facts you can make every dollar spent for advertising a judicious investment. To enable the advertiser to make such judicious investment is the purpose of Canadian National Newspapers and Periodicals Association. From this Association the advertiser may secure complete information concerning the character and aims of the leading Canadian publications. The facts are fully presented for your consideration—and they are presented RIGHT.

CANADIAN MACHINERY

is a member of the Canadian National Newspapers and Periodicals Association, along with the following publications which constitute the Association's Technical Newspapers Section:

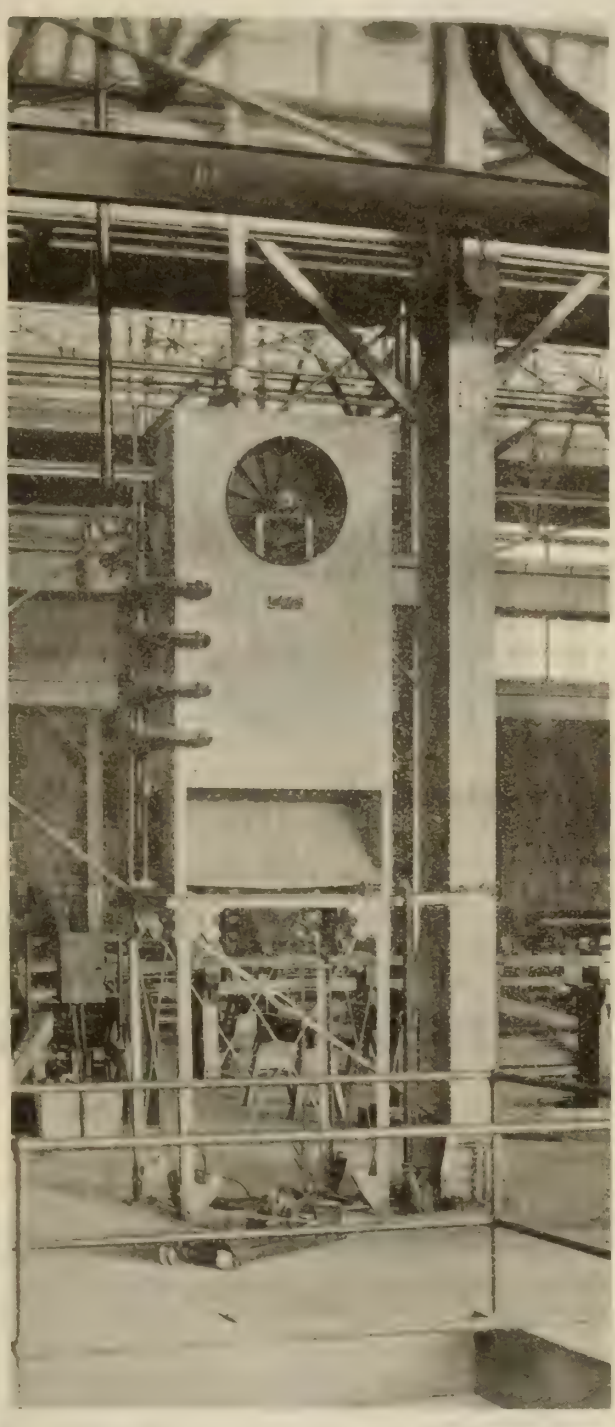
Canadian Engineer
Canadian Foundryman
Canadian Machinery
Canadian Manufacturer
Canadian Railway and Marine World
Construction
Contract Record and Engineering Review
Dominion Dental Journal
Electrical Dealer & Contractor
Electrical News
Marine Engineering of Canada
Municipal World
Power House
Sanitary Engineer

Canadian National Newspapers & Periodicals Association

70 Lombard St., Toronto

Sturtevant

PUTS AIR TO WORK



20 UNIT HEATERS

are providing plenty of heat for the LeSalle Steel Company, North Hammond, Indiana.

These units maintain the temperature at 65 degrees above zero in the coldest weather.

The illustration shows one of the heaters in the finished material room. You will notice that the apparatus is placed above the floor, out of the way, where it does not interfere with the shop operations.

Placing these unit heaters in shops of any size causes very little inconvenience and a small amount of time and expense.

Thre is no more economical method of heating your shop buildings.

The Winter is not too far along to install Sturtevant Unit Heaters. Write any of our offices or representatives today.

B. F. STURTEVANT COMPANY OF CANADA, LTD.

MONTREAL GALT TORONTO

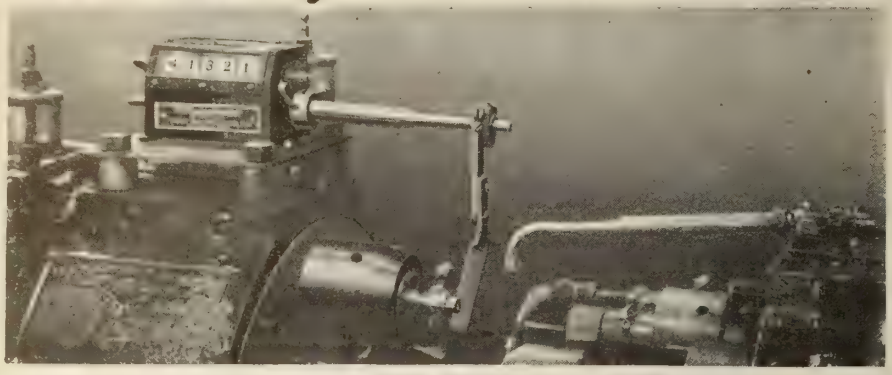
TERRITORIAL REPRESENTATIVES:

Empire Engineering Co.
Edmonton, Alberta.

Kipp-Kelly, Ltd.
Winnipeg, Man.

Fryer-Barker Co.
Vancouver, B.C.

Save Money on Screw Machines



Here's a way to effect a real saving on the work of your Automatic Screw Machines. Put this little detective on each machine and it will catch the loafers and the wasters.

Operators like it because it helps them to increase their production, and cuts out the nonproductive time formerly spent in counting by hand.

The Productimeter

Superintendents, production managers, and foremen like it because it enables them to plan work ahead, keep all machines always busy, and speed up production.

Executives like it because it cuts costs.

Try, One 30 Days Free

Durant Manufacturing Co.,
623 Buffum St., Milwaukee, Wis., U.S.A.

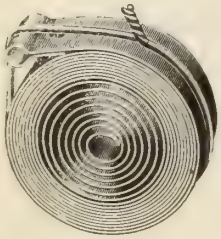
SPRINGS

THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON ONTARIO



Better Springs!

For over half a century the policy of our plant at Bristol, Conn., has been—"Better than the Average." and the Canadian plant will hold to the same principle. If you require Springs for uncommonly severe duties—or for better service on ordinary work, get our quotations. All sizes for all purposes.

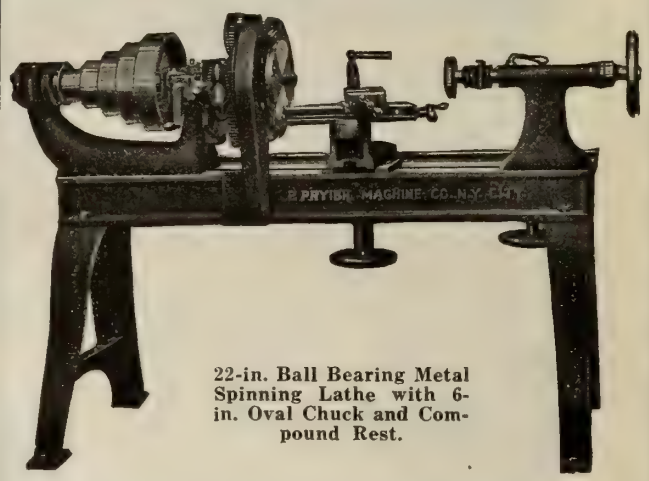




FIFTY YEARS OF QUALITY

The Wallace Barnes Co.
LIMITED

Main St. W. HAMILTON



22-in. Ball Bearing Metal Spinning Lathe with 6-in. Oval Chuck and Compound Rest.

Metal Spinning Lathes

Tools and Accessories

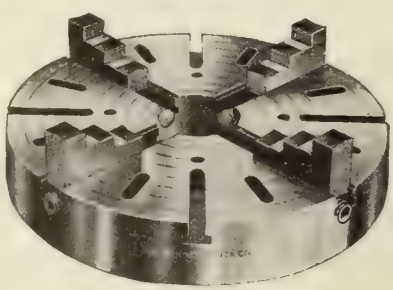
for Round and Oval work from 15 to 60 inch swing

P. Pryibil Machine Company
New York City

Established 1859

SKINNER CHUCKS

Trade Mark



SKINNER STEEL BODY INDEPENDENT CHUCK

POWERFUL - STURDY - DEPENDABLE - ACCURATE

In railroad shops, where exceptional gripping power is required, where heavy cuts are often necessary and large pieces are held, this type of chuck will render most satisfactory service.

Although the Skinner Steel Body Chuck has been in use for years, we have never known of one breaking in service. It is the heaviest, strongest Independent chuck made.

Body—Cast Steel. Jaws—Extra wide. Adjusting screws. Large diameter.

Illustrated literature and catalogue on request

THE SKINNER CHUCK COMPANY

NEW BRITAIN, CONN U S A

Established 1887

New York Office: 94 Reade Street. San Francisco Office: Rialto Building. Chicago Office: 552 W. Washington Blvd.

London Office: 139 Queen Victoria St. E. C. 4.

THE MORSE CHAIN CO.

are the

Largest Manufacturers in the world

of

High Speed Silent Chains

The superiority of **Morse Rocker Joint Silent Chain** has never been seriously questioned.

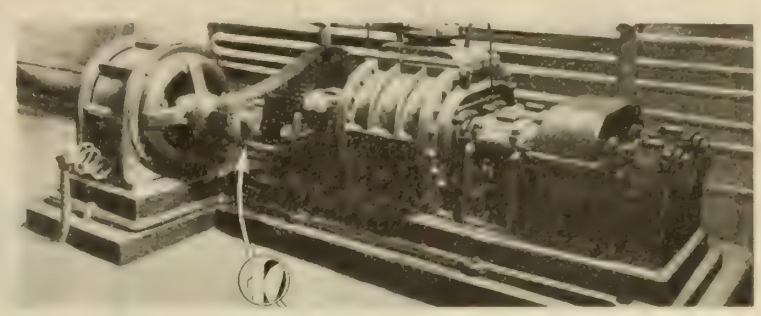
They speed up production, cut belt expense and overtime wages.

Catalogue Free.

Jones & Glassco (Reg'd)

Canadian Agents

Montreal - - Toronto



25 H.P. Morse Silent Chain to Positive Blower.

Hand Protection

Means Better Work



Mitten Style No. 681

Steel-Grip WORK MITTENS

and work gloves give complete hand **protection** plus hand **comfort.** The same reinforcement (small steel ribbons over strips of tough leather) that protects the hand also gives so much extra wear that these mittens and gloves last almost indefinitely. Sewed closed with steel thread, they are absolutely rip-proof. The steel reinforcement does not interfere with flexibility. Your workmen equipped with Steel-Grips will dig in with a will.

Write us to-day for suggestions on your hand protection problems. We can save you money on your work glove purchases.

Industrial Gloves Corporation

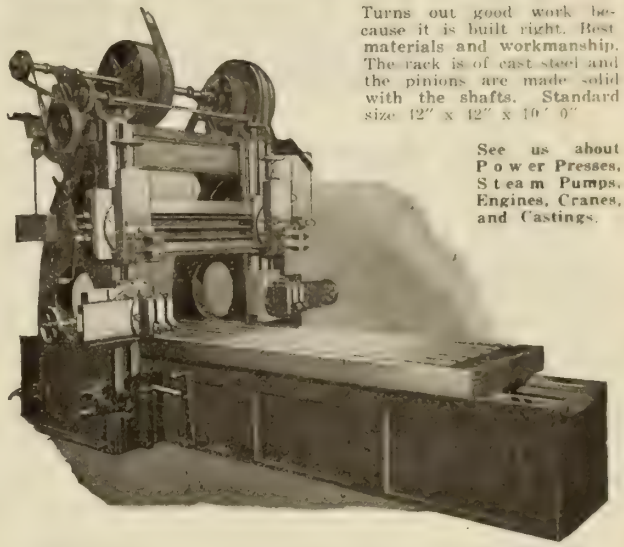
424 Wellington St., W., Toronto

HEPBURN

High Speed Planer

Turns out good work because it is built right. Best materials and workmanship. The rack is of cast steel and the pinions are made solid with the shafts. Standard size 12" x 12" x 10' 0"

See us about Power Presses, Steam Pumps, Engines, Cranes, and Castings.

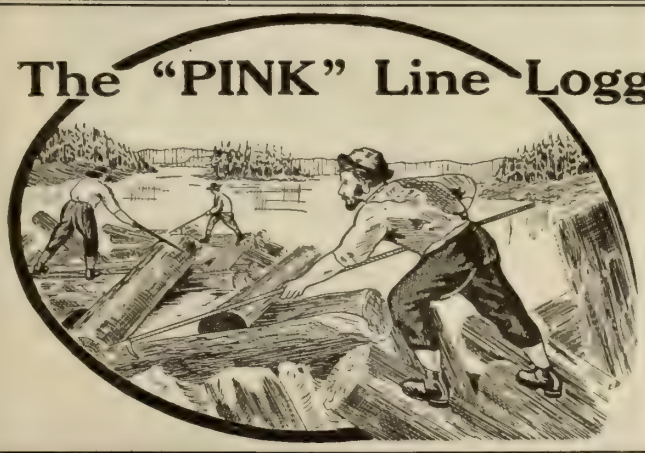


JOHN T. HEPBURN, Limited

Engineers and Iron Founders

18-60 Van Horne St., Toronto, Ont.

The "PINK" Line Logging Tools and Handles



MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

EXPORTERS TO EUROPE

We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited

PEMBROKE, ONT., CANADA

Examine your Files carefully each day for signs of wear.

The proper time to discard a file is when the teeth have become just a tiny bit "dull".

The slightest loss of keenness means reduced efficiency—and a trifling sum buys a new one.

Our famous five brands of files, specially hardened, stay keen and efficient for the longest possible time.

They are:

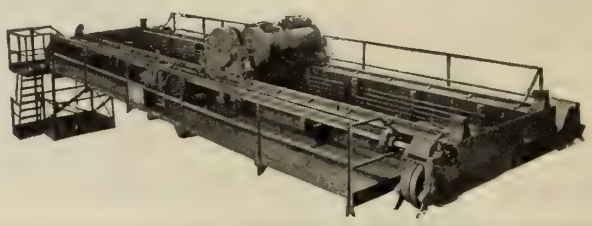
Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario

NORTHERN CRANES



Northern Mill Type Crane

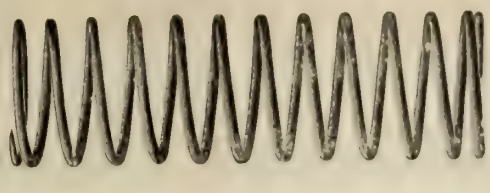
Northern Cranes are Made in Canada for the Canadian user.
Send for Cat. No. 28C for Cranes
and Catalog No. 43C for Electric Hoists.

Northern Crane Works Limited
Walkerville - - Ontario



SPEND!

"THOSE who will not profit by experience deserve to suffer. Experience has taught thousands of successful business men that a dollar hoarded when it should be expended on advertising is worse than a dollar thrown away. This is particularly true of the time when the inclination to **conserve** is strongest."



Manufacturers of

HIGH GRADE SPRINGS, CARBON OR VANADIUM STEEL, BRASS OR BRONZE.

Our excellent facilities for the production and heat treating of Springs insure accuracy and durability.

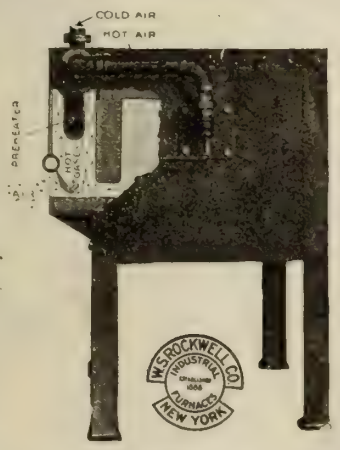
Write for catalogue, also free engineering service on your spring problems.

Raymond Mfg. Co., Ltd.

Corry, Pa., U. S. A.



IDLE MEN IN FORGE SHOPS



(Patented)
Section showing deflection of hot gases, with induced air toward the furnace for protection of the operator and the preheating of air for combustion.

When men are idle, expensive equipment and buildings are also idle.

In past summers, the unbearable heat that caused prolonged shutdowns in many forge shops was **often due to faulty forges or improper application and utilization of the heat.**

To relieve these conditions, progressive forge shops are installing Rockwell Economizer Forges.

These forges enable the men to **work steadily and in comparative comfort.** They also afford other advantages in the way of **decreased operating cost, better quality of product,** and **decreased floor space.**

Write for Bulletin 239-T, dealing with improved methods of heating and handling material, layout of equipment, and other factors influencing the cost of production.

W. S. ROCKWELL COMPANY

Furnace Engineers and Contractors

50 Church St. (Hudson Terminal Bldg.) New York

We Make Industrial Heating Furnaces for Every Requirement.
Coal—Oil—Gas—Electricity
"FURNACE AND FUEL TO SUIT CONDITIONS"

THERE is as much difference in the various makes of High Speed Steel as there is in men—

The practice and methods of manufacturers differ widely in every mill and anyone who is at all familiar with the manufacture of High Speed Steel thoroughly understands this

"Red Cut Superior"

The Nationally Known—First Quality

HIGH SPEED STEEL

is the best for all Machine Work

ARE YOUR TOOLS MADE OF "Red Cut"?

VANADIUM-ALLOYS STEEL COMPANY

Main Office and Works
Latrobe, Pa.

BRANCH OFFICES:

TORONTO	BUFFALO	CLEVELAND	CINCINNATI
MONTREAL	BOSTON	CHICAGO	DETROIT
NEW YORK		PHILADELPHIA	PITTSBURGH



HINTS TO BUYERS

NOVO-SUPERIOR

HIGH SPEED STEEL

Tool Steel for Every Purpose

Twist Drills, Music Wire, Steel Balls

Pilot Steel & Tool Co., Ltd.

332 St. James. - - - Montreal

Our New Factory Will be the Only Plant in Canada Specializing in

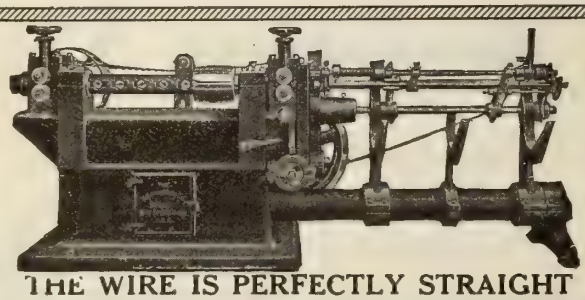
SEAMLESS TUBING

in

BRASS and COPPER

The Goldstein Manufacturing Co., Ltd.

12-18 BEVERLEY STREET, TORONTO, ONT.



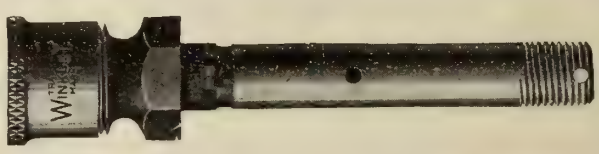
THE WIRE IS PERFECTLY STRAIGHT

and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?

The F. B. SHUSTER COMPANY, New Haven, Conn.

Formerly John Adt & Son. Established 1866.

Also makers of Riveting Machines, Sprue Cutters, Cotter Pin Machines, etc.





"D"

SPRING SHACKLE BOLTS

Complete Line of Oilers, Oil Cups, Brass Dowel Pins and Pressed Steel and Brass Grease Cups All Types

Write for catalogues and prices

THE CANADIAN WINKLEY CO.

Limited

WINDSOR - ONTARIO



Plain

FOR SERVICE ON

Jigs, Fixtures, Gauges

SPECIAL MACHINE TOOLS

SPECIAL MACHINERY

General Machine Work and Repairs

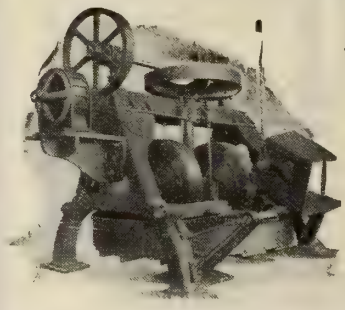
Write

The Crescent Machine Co.

LIMITED

20 Longueuil Lane Montreal, Que.

Canadian Steel Foundries Need Frost Improved Sand Mills



WINNING FEATURES

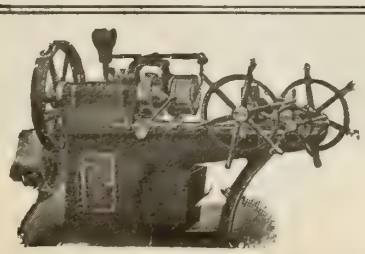
Heavy Mullers

Unloading Device

Motor or Belt Drive

The Frost Mfg. Co.

112 W. Adams St., Chicago



BOLT, NUT, FORGING AND WIRE NAIL MACHINERY

"National" Bolt Cutters, "Wedge Grip" Bolt and Rivet Headers, Forging Machines, Nut Machines, Roll Threaders and Wire Nail Machines are used by leading Railroads and Industrials.

THE NATIONAL MACHINERY CO. TIFFIN, OHIO, U.S.A.

CANADIAN AGENT

H. W. PETRIE, Ltd.

TORONTO, ONT.

MONTREAL, QUE.

VANCOUVER, B. C.

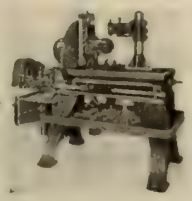
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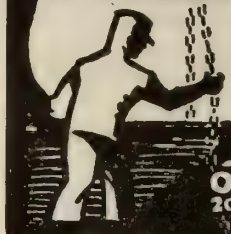
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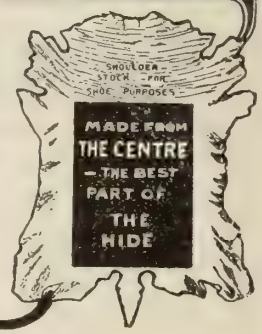
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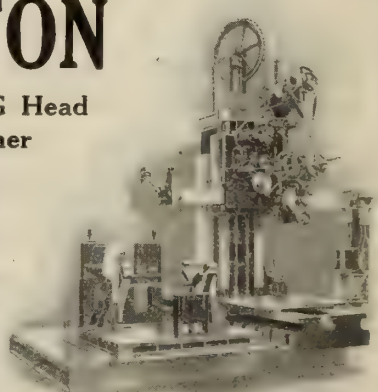
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Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn

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Atkins & Co., Inc., E. C., Indianapolis, I.
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McDougall Co., Ltd., R., Galt, Ont

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Pilot Steel & Tool Co., Montreal, Que
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.
Franklin Die-Casting Corp., Syracuse, N.Y.

Bearings, Journal
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Can. Link-Belt Co., Toronto, Ont.
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Morse Chain Co., Ithaca, N.Y.
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Atkins & Co., Inc. E. C., Indianapolis, I.
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Can. Fairbanks-Morse Co., Ltd., Montreal.
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McLaren Belting Co., J. C., Montreal, Que
Sumner & Co., New York City.

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Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal Q.
McLaren Belting Co., J. C., Montreal, Que
Smith Belting Co., Toronto, Ont.
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Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal Que
Quaker City Rubber Co., Philadelphia.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland
Brown, Boggs & Co., Ltd., Hamilton Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Dom. Foundries & Steel, Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont

Blowers
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd Montreal, Que
Skinner Bros. Mfg Co., Inc., St. Louis Mo.

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Goldie & McCulloch Co., Galt, Ont

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Beardmore & Co., Ltd., Wm., Montreal, Que.

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Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio

Bolts and Nuts
London Bolt & Hinge Works London, Ont
Fittings, Ltd., Oshawa, Ont
National Acme Co., Montreal, Que.
N. S. Steel Co., Ltd., New Glasgow, N.S.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont

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Armstrong-Whitworth of Canada, Ltd Montreal, Canada
Bertram & Son Co., Ltd., The John Dundas, Ont
Gisholt Machine Co., Madison, Wis

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Armstrong-Whitworth of Canada, Ltd Montreal, Canada
Bertram & Son Co., Ltd., The John Dundas, Ont
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McDougall Co., Ltd., R., Galt, Ont
Oliver Machinery Co., Grand Rapids, Mich
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Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis

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Pure Sanitary Drinking Fountain Co Haydenville, Mass

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Elk Firebrick Co. of Can., Ltd., Hamilton, Ont.

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Bilton Machine Co., Bridgeport, Conn

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British Smelting & Refining Co., Ltd Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont

Buffers
Pratt & Whitney Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati.

Bulldozers

Building Materials
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Bertram & Son Co., Ltd., The John Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont

Bushings
Fisher Motor Co., Ltd., Orillia, Ont

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery)
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont
Fittings, Ltd., Oshawa, Ont
Langley & Austin, Galt, Ont

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont
Can. Driver-Harris Co., Walkerville, Ont
Fittings, Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont

Castings, Marine
Can. Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont
Franklin Die-Casting Corp., Syracuse, N.Y.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que

Castings, Grey Iron
Fittings, Ltd., Oshawa, Ont

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Bilton Machine Co., Bridgeport, Conn
Brown, Boggs & Co., Ltd., Hamilton, Ont
Hanna & Co., M. A., Cleveland, Ohio
Hepburn Ltd., John T., Toronto, Ont
Katie Foundry Co., Galt, Ont
Kennedy & Sons, Wm., Owen Sound, Ont
McDougall Co., Ltd., R., Galt, Ont
Victoria Foundry Co., Ltd., Ottawa, Ont
Dominion Engineering Works, Limited, Montreal, Que

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Fittings, Ltd., Oshawa, Ont

Castings, Monel Metal
Can. Driver-Harris Co., Ltd., Walkerville, Ont.

Castings, Nichrome
Can. Driver-Harris Co., Walkerville, Ont.

BUYERS' DIRECTORY

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Hull Iron & Steel Foundries, Hull, Que
Katie Foundry Co., Galt, Ont.
Manitoba Steel Foundries, Ltd., Winnipeg Man
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock-Walker Mchy. Co., Toronto, Ont

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Prybil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William L. Procunier, Chicago, Ill

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass

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Oakley Chemical Co., New York, N.Y

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks' Watchman's Portable and Stationary
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Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
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Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Can. Mathews Gravity Carrier Co., Port Hope, Ont.
Jones & Glassco, Montreal, Que.

Cost Keeping Devices
Durant Mfg. Co., Milwaukee, Wis.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Counters, Engine
Durant Mfg. Co., Milwaukee, Wis

Counters, Revolution
Durant Mfg. Co., Milwaukee, Wis.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont
Durant Mfg. Co., Milwaukee, Wis.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont

Couplers, Car and Locomotive
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Dominion Foundries & Steel, Ltd., Hamilton, Ont

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn
Can. Link-Belt Co., Toronto, Ont

Cranes, Electric
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

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Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Atkins & Co., Inc., E. C., Indianapolis, I
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, Milling
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Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can

Cutting, Oxy-Hydrogen
Carter Welding Co Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont
Prest-O-Lite Co. of Can., Toronto, Ont

Cylinder Reaming Sets
Wetmore Reamer Co., Milwaukee, Wis.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can Steel Foundries, Montreal, Que. Ont.

Diamonds, Importers.
Can Desmond-Stephan Mfg Co, Hamilton, Ont.
Wheel Trueing Tool Co, Windsor, Ont

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham Eng
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros Tool Co., Chicago, Ill

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont

Drilling Machine Heads
United States Machine Tool Co., Cincinnati, Ohio

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn
Garlock-Walker Mchy. Co., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Drilling Machines, Heavy Duty
Barnes Drill Co., Rockford, Ill.
Armstrong-Whitworth of Canada Ltd Montreal Canada
Bertram & Son Co., Ltd., The John Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis

BUYERS' DIRECTORY

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Emery Wheel Dressing Tools

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph Ont.
Fittings, Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont
Strand & Co., N. A., Chicago, Ill.

Flux, Galvanizing
British Smelting & Refining Co., Ltd Montreal, Que.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Flour Mill Units.
Pollard Mfg. Co., Niagara Falls, Ont

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., W land, Ont.
Dominion Forge & Stamping Co., Lt Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Canada Foundries & Forgings Co., W land, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom Foundries & Steel, Hamilton, Ont
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S

Founders & Machinists
The Vulcan Co., Ltd., London, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.
The Vulcan Co., Ltd., London, Ont.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass
Volta Mfg. Co., Welland, Ont

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Lt Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont

Gas, Compressed
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Fellows Gear Shaper Co., Springfield, Vt
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Steel Products Co., Brantford, Ont
Ford-Smith Machine Co., Hamilton, Ont
Gardner & Son, Robt., Montreal, Que
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont
Jardine & Co., A. B., Hespeler, Ont
Jones & Glassco, Montreal, Que
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que
Dominion Engineering Works, Limited Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec

Gears, Worm
Dom Steel Products Co., Brantford, Ont
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont
The Alexander Milburn Co., Baltimore Md.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont

Goggles, Safety
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Blanchard Machine Co., Cambridge, Mass.
Brown & Sharpe Mfg Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Perfect Machine Co., Ltd., Galt, Ont.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit Mich
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, On

Grinding Machines, Drill
Bellevue Industrial Furnace Co Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

BUYERS' DIRECTORY

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock-Walker Mchy Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.
McKenzie Machinery Co.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Moatreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y

Hardening, Case-Hardening and Tempering
[illegible] Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont

Hobs
Armstrong-Whitworth of Canada, Ltd Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
[illegible] Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, On

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Flexible Steel
Quaker City Rubber Co., Philadelphia, Pa.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Hospital Equipment
Hartz Co., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
William Hamilton Tool Co., Peterborough, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited. Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Pars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, Q

Japanning and Varnishing Ovens
Electric Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Rockford Machine Tool Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Machinery Corp., Galt, Ont.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Porter-Cable Machine Co., Syracuse, N.Y.
Roelefson Machine & Tool Co., Toronto,
Rockford Lathe & Drill Co., Rockford, Ill.
Jas. I. Ryerson & Son, Chicago, Ill.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison. Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machy. Co., Grand Rapids, Mich

Lathes, Threading
Hendey Machine Co., Torrington, Conn
Warner & Swasey Co., Cleveland, Ohio.
Queen-Gray Co., Philadelphia, Pa. N.Y.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Machinery, Woodworking
Cowan Co., Ltd., Galt, Ont.

Machinists
Parker Co., Charles, Meriden, Conn.
McKenzie Mach. Co., Guelph, Ont.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Ill.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Durant Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
F. F. Barber Machinery Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
McKenzie Mach. Co., Guelph, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garvin Machine Co., New York, N.Y.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

BUYERS' DIRECTORY

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Fairbanks Morse Ltd., Montreal Q
Ford-Smith Machine Co., Hamilton, Ont
Kearney & Trecker Co., Milwaukee, Wis
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
The Alexander Milburn Co., Baltimore, Md.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Quaker City Rubber Co., Philadelphia, Pa.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Atlas Press Co., Kalamazoo, Mich.
Quaker City Rubber Co., Philadelphia, Pa

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Oliver Machinery Co., Grand Rapids, Mich

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont
Wraggis Pattern Works, Galt, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R I

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Canada Machinery Corp., Galt, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Pollard Mfg. Co., Niagara Falls, Ont
Oliver Machinery Co., Grand Rapids, Mich
Rockford Machine Tool Co., Rockford, Ill.
Williams Machinery Co., A. R., Toronto.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Archibald & Co., Chas. P., Montreal, Q
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R I
Ford-Smith Machine Co., Hamilton, Ont
Prybil Machine Co., New York, N Y

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa
Fisher Motor Co., Ltd., Orillia, Ont

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich
Can. Fairbanks-Morse Co., Ltd., Montreal
National Engineering Co., Sarnia, Ont
Petrie, Ltd., H. W., Toronto, Ont

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot
Brown, Boggs & Co., Ltd., Hamilton Ont
Ferry & Co., John C., Birmingham, Eng

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O
Ferrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Niagara Machine Tool Co., Buffalo, N Y
Hepburn Ltd., John T., Toronto, Ont
Rockford Machine Tool Co., Rockford, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal Que
William Hamilton Tool Co., Peterborough, Ont

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont

Punches, Power
Brown Boggs & Co., Ltd., Hamilton, Ont
Can Blower & Forge Co., Ltd., Kitchener
Excelsior Tool & Machine Co., East St. Louis, Ill.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford Smith Machine Co., Hamilton, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont
Can. Detroit Twist Drill Co., Walkerville, Ont
Wetmore Reamer Co., Milwaukee, Wis
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Reamers, Machine Expanding
Wetmore Reamer Co., Milwaukee, Wis

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont
Cleveland Twist Drill Co., Cleveland, O
Excelsior Tool & Machine Co., East St. Louis, Ill.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis

Regulators, Oxygen & Acetylene
The Alexander Milburn Co., Baltimore, Md.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont

Rheostats
Northern Electric Co., Montreal, Que

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
National Machinery Co., Tiffin, Ohio

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rebuster Co., F. B., New Haven, Conn
Stewart & Co., Duncan, Glasgow, Scot

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que

Roofing Asbestos, Corrugated and Gypsum
Robertson Co., H. H., Cleveland.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Disconnect Saw & Stamping Works, Buffalo, N.Y
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
McKenzie Machinery Co., Guelph, Ont
Oliver Machinery Co., Grand Rapids, Mich
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Prybil Machine Co., New York, N Y
Gisholt Machine Co., Madison, Wis

BUYERS' DIRECTORY

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
William Hamilton Tool Co., Peterborough, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Que.

Screens
Can. Wire & Iron Goods Co., Hamilton.
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Skylights
Robertson Co., H. H., Cleveland.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Rocklefson Machine & Tool Co., Toronto.
Rockford Machine Tool Co., Rockford, Ill.
Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Niagara Machine Tool Co., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.
Selson Engineering Co., New York, N.Y.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Excelsior Tool & Machine Co., East St.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Corrugated
Robertson Co., H. H., Cleveland.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can Steel Foundries, Montreal Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont

Siding, Corrugated and Plain
Robertson Co., H. H., Cleveland.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber
Excelsior Tool & Machine Co., East St.
Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio
Wetmore Reamer Co., Milwaukee, Wis.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping Machinery
Excelsior Tool & Machine Co., East St.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.
Can. Atlas Crucible Steel Co., Toronto,

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,
Can. Driver-Harris Co., Walkerville, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps.
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Garvin Machine Co., New York, N.Y.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield Vermont.
Landis Machine Co., Inc., Waynesboro, Pa.

Thread Gauges, Special
Wetmore Reamer Co., Milwaukee, Wis.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
Murchey Machine & Tool Co., Detroit Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

BUYERS' DIRECTORY

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que

Transformers
Northern Electric Co., Montreal, Que

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Steel Products Co., Brantford, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison Wis
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis
Warner & Swasey Co., Cleveland, Ohio.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis

Tyres.
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can Fairbanks Morse Ltd Montreal Q
Dominion Engineering Works, Limited, Montreal, Que
Quaker City Rubber Co., Philadelphia, Pa
Voorhees Rubber Mfg. Co., Jersey City, N.J.

Ventilators
Robertson Co., H. H., Cleveland.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn

Voltmeters
Bristol Co., Waterbury, Conn
Northern Electric Co., Montreal, Que

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Wallace, Hamilton.

Watchman's Clocks, Portable and Stationary
Chicago Watchman's Clock Co., Chicago, Ill

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto
The Alexander Milburn Co., Baltimore, Md
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal
Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal,
The Canadian Fairbanks-Morse Co., Montreal, Que
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont
H. W. Petrie Limited, Toronto, Ont
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy Co., Grand Rapids, Mich.
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto
The Alexander Milburn Co., Baltimore, Md.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
L'Air Liquide Society, Toronto, Ont
Liquide Air Company, Toronto
National Electro Products Co., Ltd.
Prest-O-Lite Company, Toronto.

Welding, Electric
McLaren Belting Co., J. C., Montreal Que
Steel Co. of Canada, Ltd., Hamilton, Ont
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto
National Electro Products Co., Ltd.
Prest-O-Lite Company, Toronto.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co. Ltd., Toronto
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont
Liquide Air Company, Toronto
National Electro Products Co., Ltd
Prest-O-Lite Company, Toronto.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wiping Cloths
The Lewis, Toronto, Ont.

Wire
Barrett Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont
Northern Electric Co., Montreal Que

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barrett Company, Wallace, Hamilton.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown Boggs & Co., Ltd., Hamilton Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Welding
L'Air Liquide Society, Toronto, Ont
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont

Wires, Special
Dennis Wire & Iron Works, London Ont
Greening Wire Co., B., Hamilton, Ont

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto Ont.

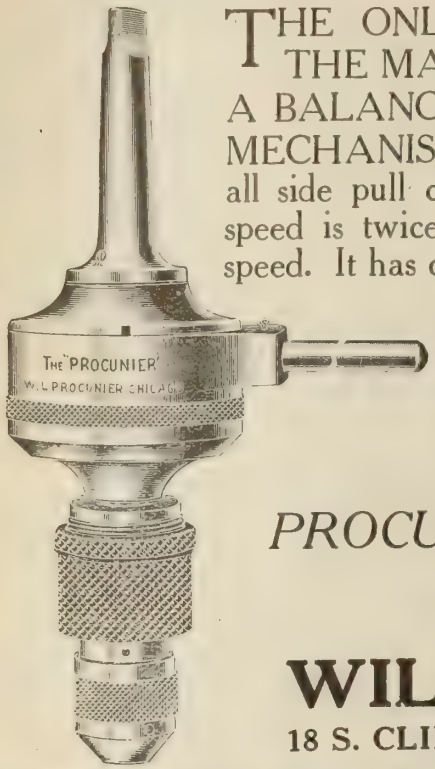
Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

Seven pages printed here each week for your convenience

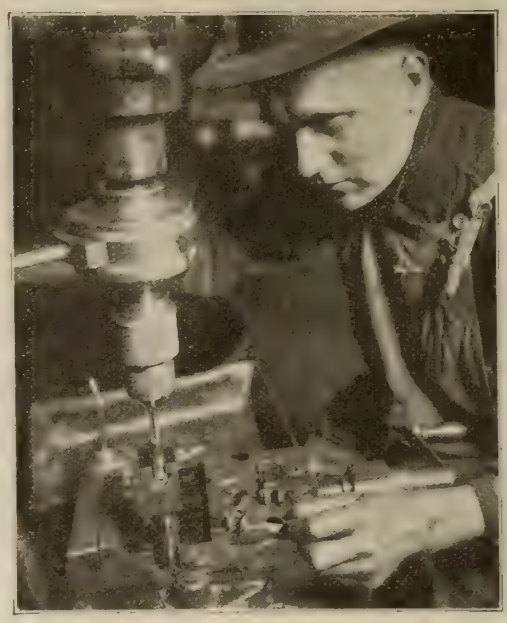
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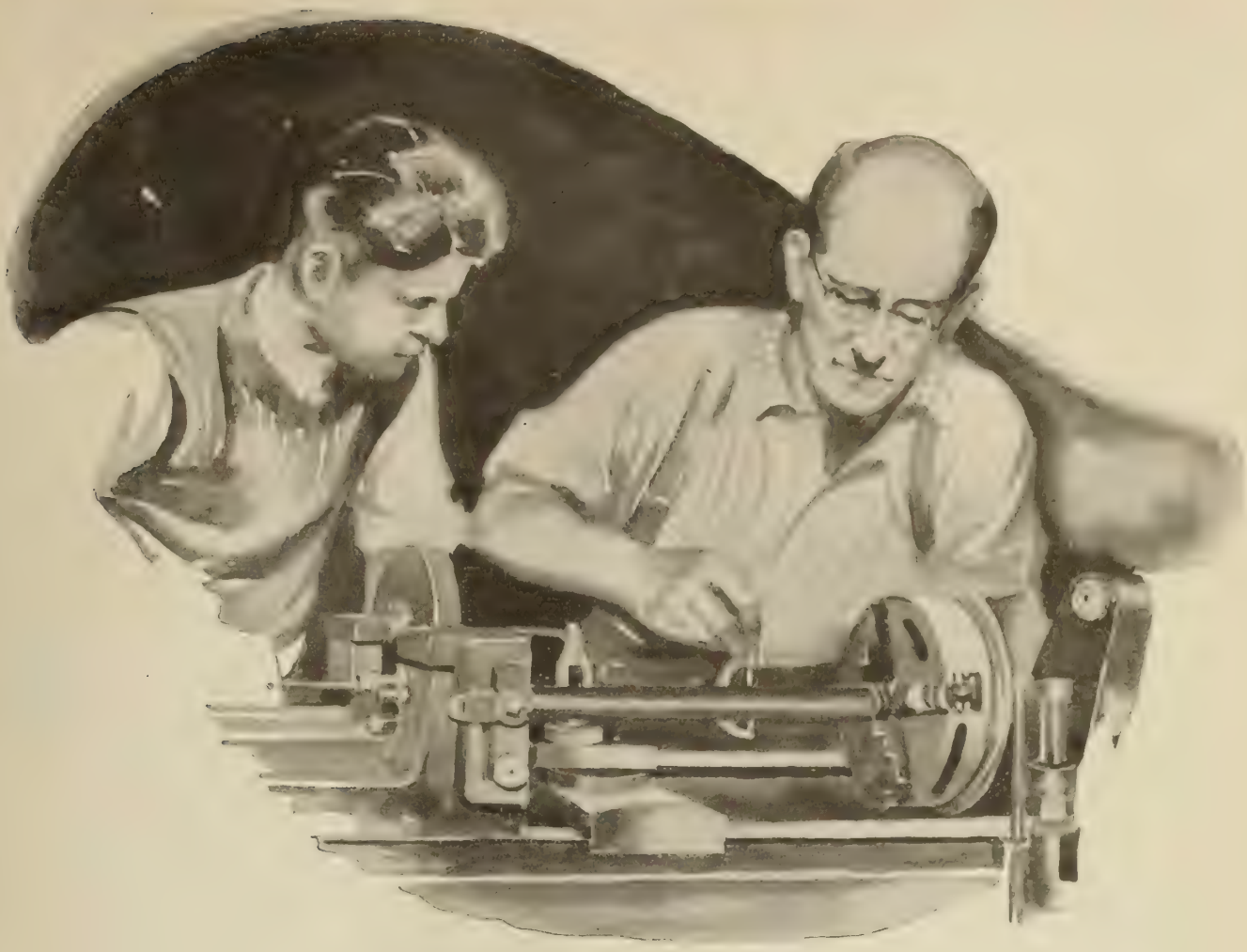
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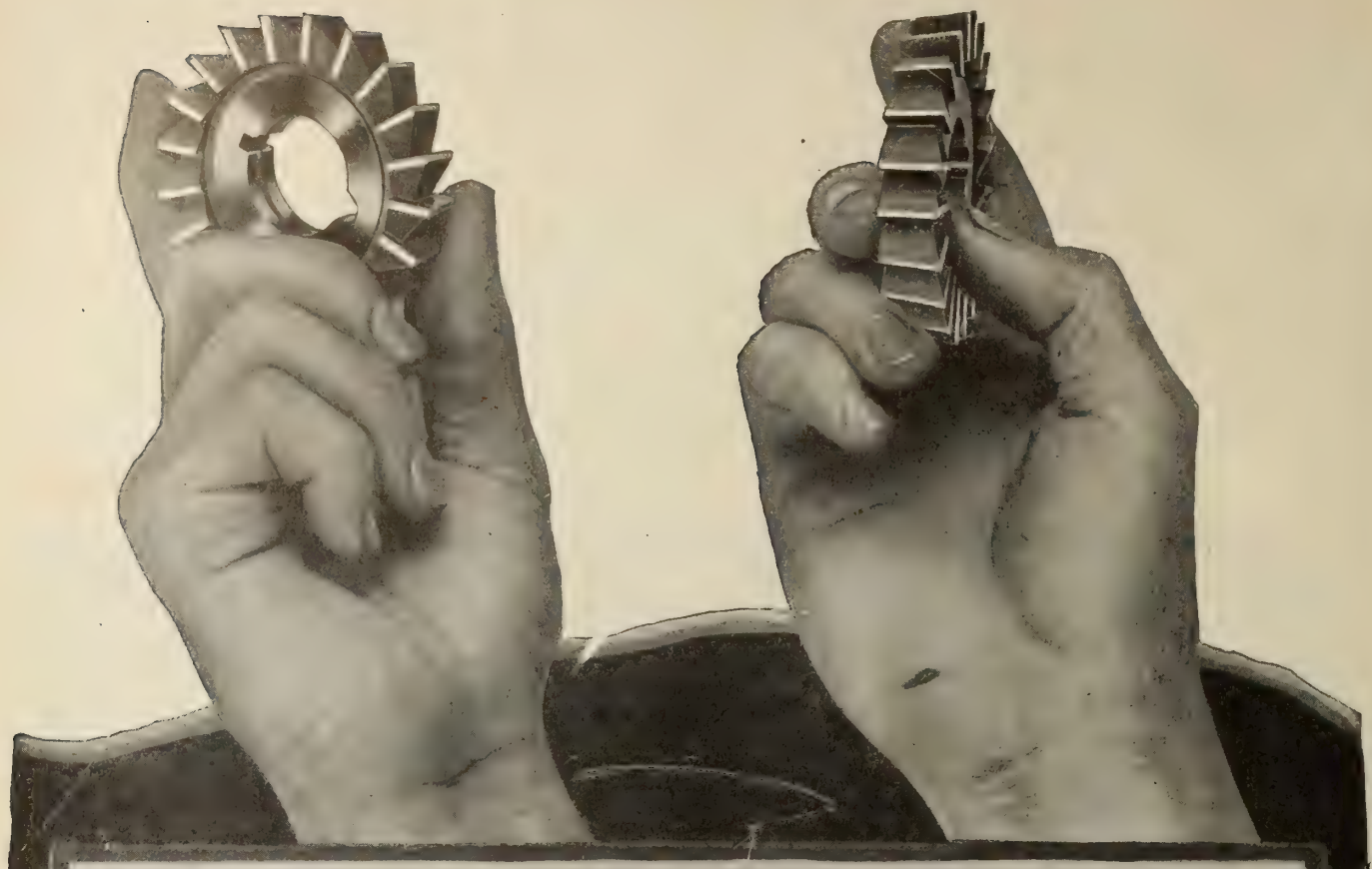
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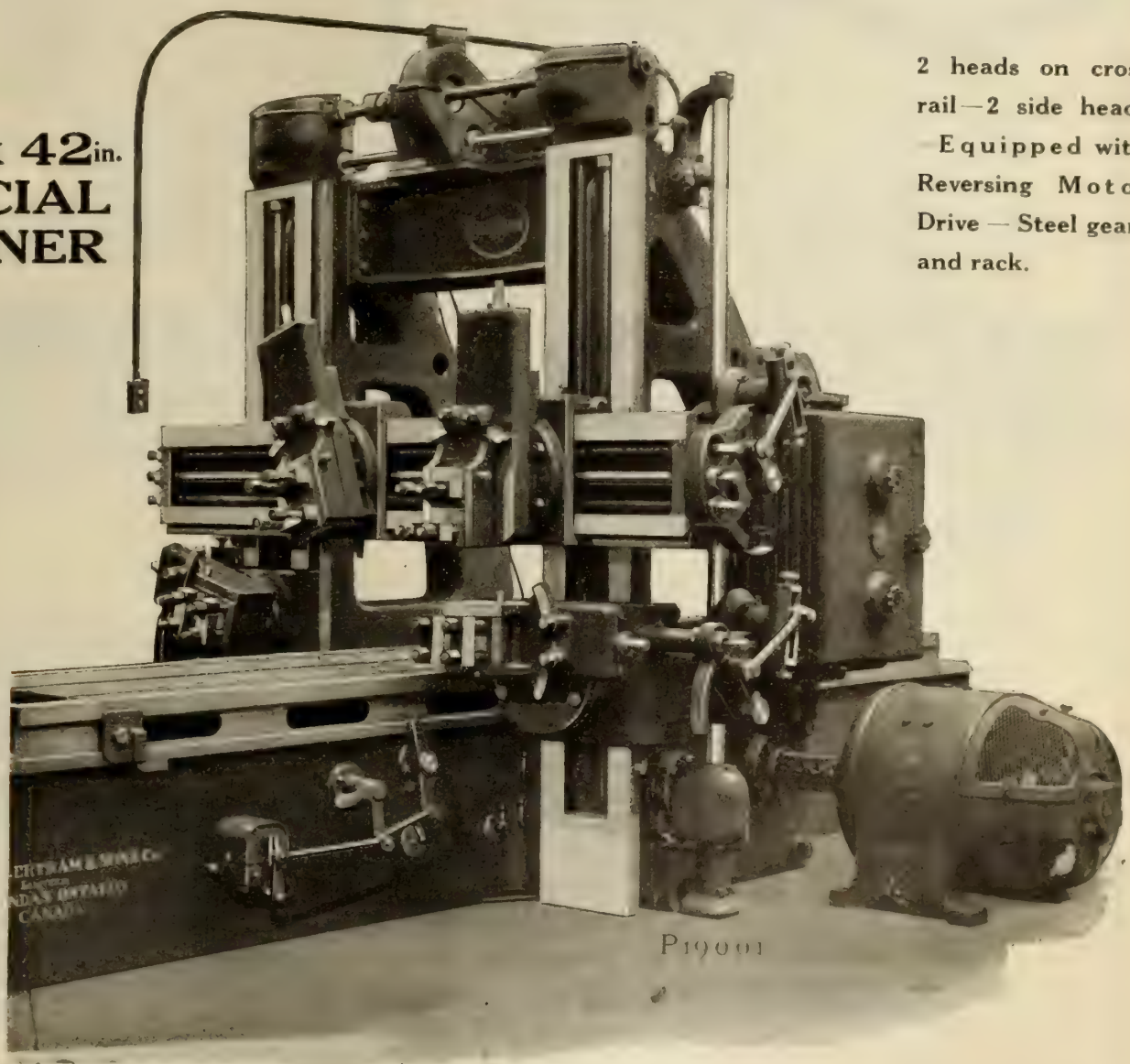
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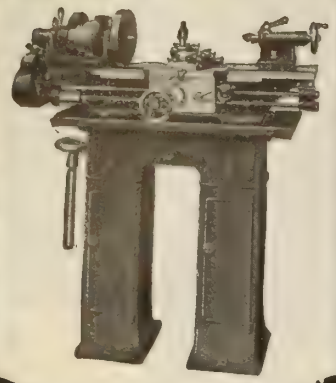
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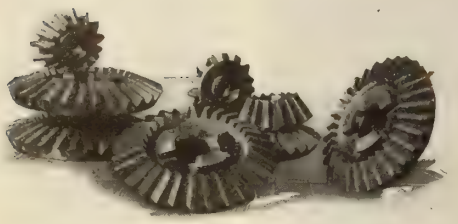
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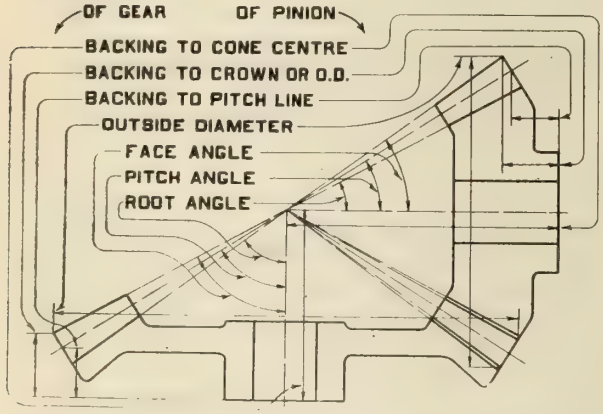
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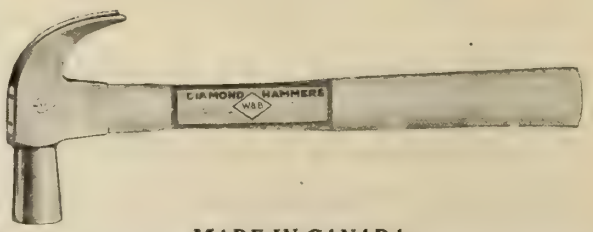
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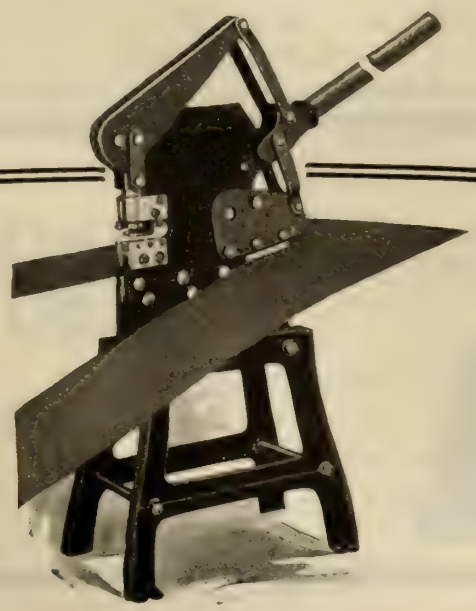
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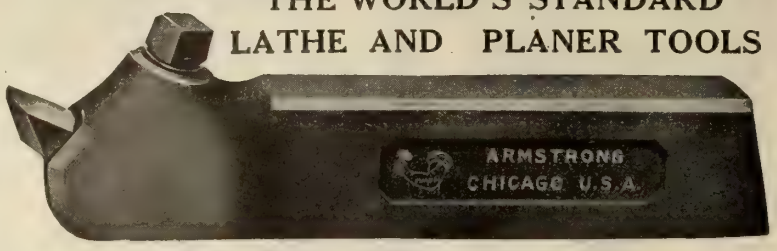
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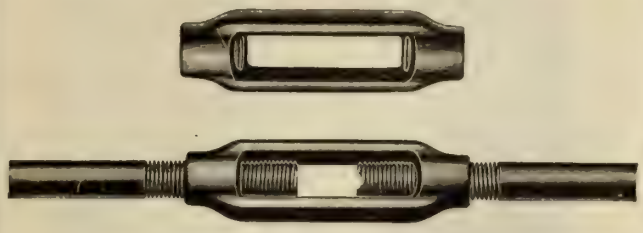
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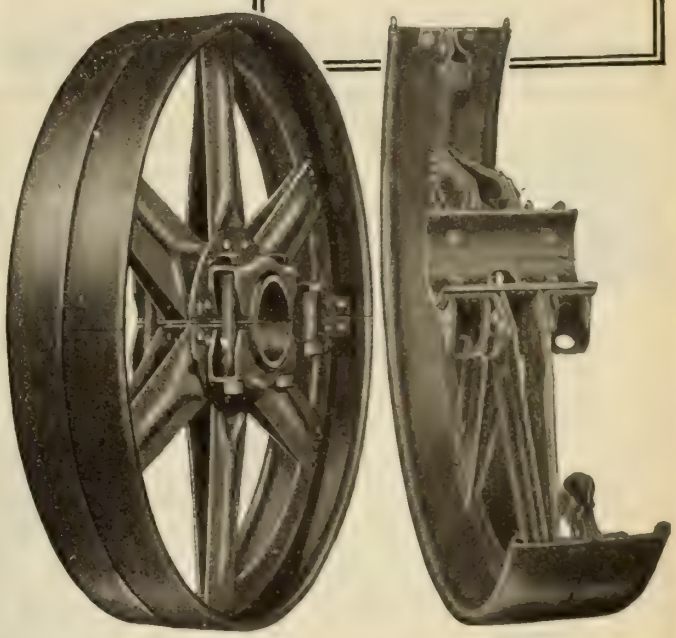
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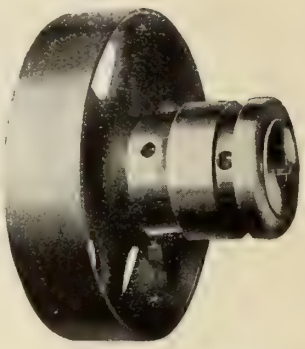
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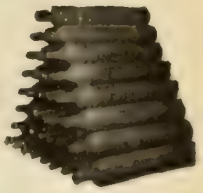
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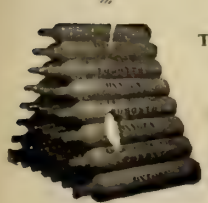
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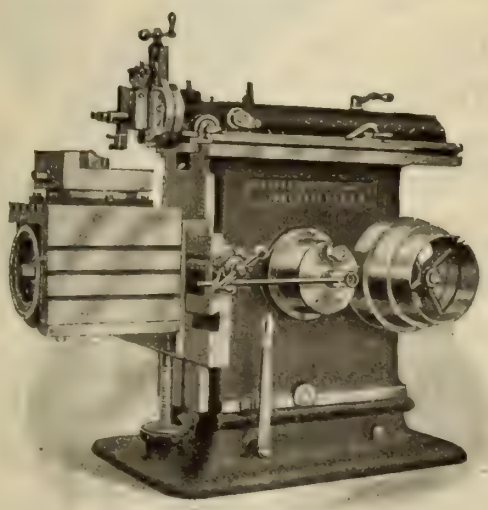
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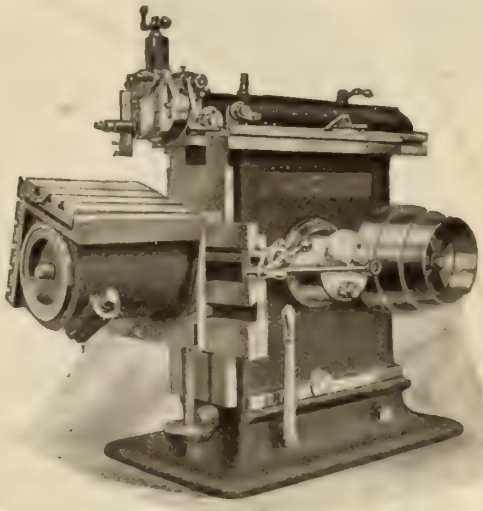
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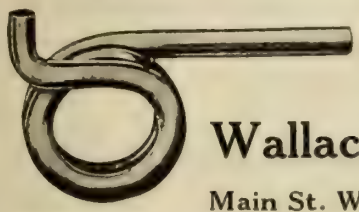
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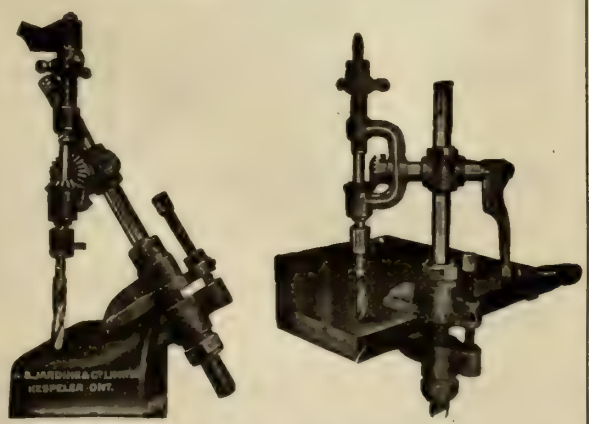
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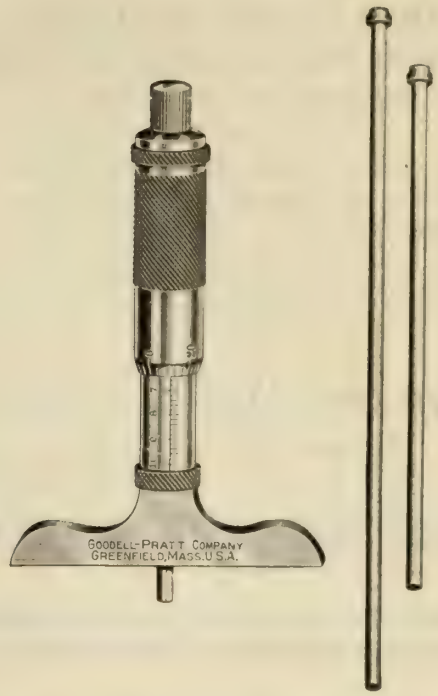
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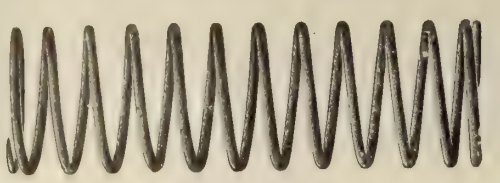
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VOL. XXVII No. 2 JANUARY 12th, 1922

Machining Locomotive Brasses on Boring Mill

Proper Fixtures Important If Maximum Production is to be Procured—Railroad Shops Find Many Uses For This Type of Machine Tool—Machining a Nine Inch Globe Valve

*By J. H. MOORE

IN THE September 15th, 1920, issue of Canadian Machinery, we published an article on Vertical Boring Mill work. As these machines have become very popular during the past few years, we feel that further examples of work performed on this type of machine would not be amiss.

In a short article of this nature we can only touch on a few scattered examples, but readers will no doubt be able to supplement the operations shown by experiences of their own. Unfortunately, a few mechanics still look upon the vertical boring mill as a production tool only. This is an erroneous idea, for while such tools are ideal for production purposes, they must not be overlooked as general purpose machines. In manufacturing plants, automobile factories, and so on, they would be used as production factors. Operations in such cases are laid out very carefully, and usually the work passes down a regular line of machines until completed. The operator takes his work off the mill, places it on a gravity conveyor, gives it a slight push, and on it goes to the next operation. Under such circumstances the machine can well be termed a production tool. But in the case of the general machine shop, or a plant where locomotives are built or repaired, the vertical boring mill is likewise useful. True, only a few pieces may be completed in a batch, the nature of work being changed several times a day, but this in itself merely proves the versatility of the tool. The writer at one time operated a mill which usually produced eight different styles of work inside the ten hours.

*We are indebted to the Bullard Machine Co., for the use of the illustrations in this article.

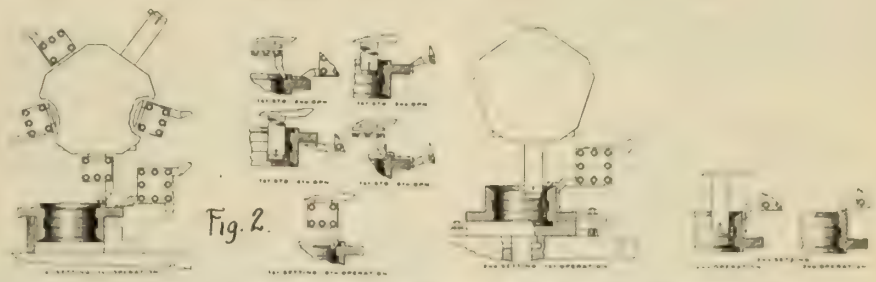


Fig. 2—Showing Set Ups For Machining Packing Glands.

To make the most of a boring mill, or in fact any machine tool, intelligent operation is essential. The operator should make it a point to become thoroughly conversant with the proper style of tool to use on the different operations. He should see that he is supplied with suitable jigs for holding the work quickly, and when the quantity does not warrant a special fixture, he should devise some simple method of holding the work. The foreman and operator can often get together to good effect, the discussion bringing out some further improvement. When the plant is large, the tool designer usually takes over this responsibility, but here again it will pay the designer to co-operate with the foreman whenever possible, as the shop point of view should not be ignored.

Some Railroad Work

We will first consider some parts which have been machined in railroad shops. Fig. 1 shows, in photographic form, a cylinder head being finished. These parts are subjected to considerable

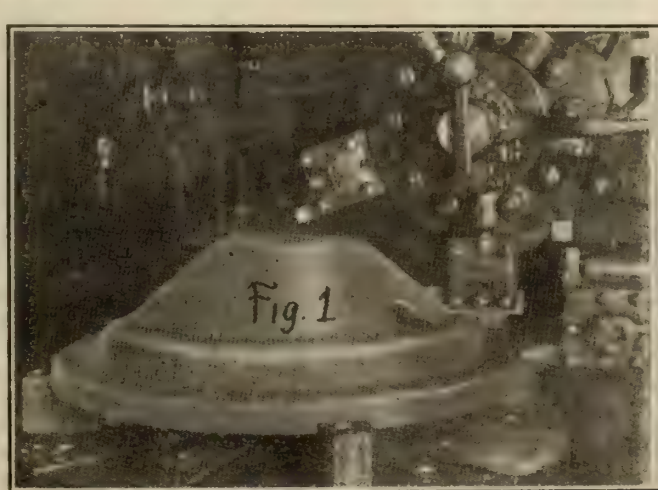


Fig. 1.—Machining a Cylinder Head.

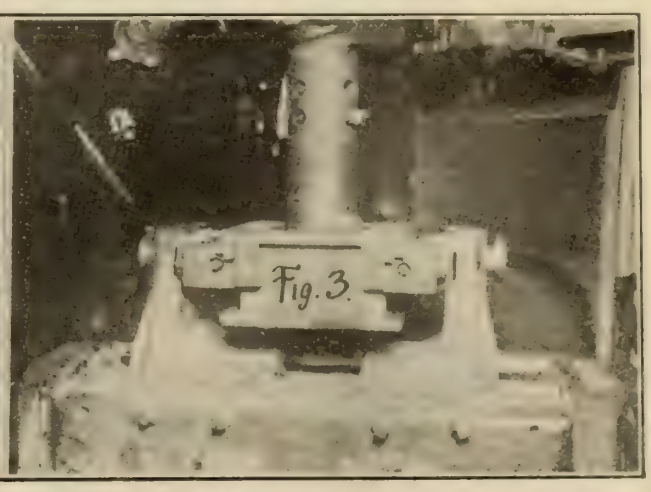


Fig. 3—Producing Locomotive Brasses.

wear, and are often required quickly to replace breakages, worn-out heads, etc. Note the simple yet efficient type of form tool used. The design varies considerably, so that the versatility of a boring mill is useful on such work.

A very good method of machining packing glands is shown at Fig. 2. It will be noted that in this case we have a combination of boring, turning and facing operations. Two settings are required, the first taking care of six operations or steps, the second completing the other three. The turrets clearly show the various tools required, and the arrows indicate the direction of movement. When the tooling is properly laid out, the two heads can work continuously without interference. This bears out our previous remark viz., that the study of the proper tools to use is most important.

Fig. 3 shows one method of machining locomotive brasses. Note the simple type of chuck used on this work. It holds the brasses, quickly, and releases just as rapidly. As the type of boring bar used is very simple we need comment no further.

Machining Sprocket

The use of the side head is well illustrated in the remaining sectional views. Take for example Fig. 4. Here we see a sprocket being machined all over, this part being made from octagonal boiler plate. The tool layout being so clear we will pass on to Fig. 5. In this case the work being produced is a steam engine piston. The surfaces finished are clearly shown and as will be noted the piston rod hole is tapered in the regular manner.

Fig. 6 depicts a flywheel being machined. Note the tool layout, also the arrows which show the direction of rotation and feed.

At Fig. 7 we see a gear blank being machined, while at Fig. 8 is shown another type of flywheel being produced. The tooling in the latter case is well worth studying. The machining time can always be cut considerably by careful tooling.

The remaining illustration, Fig. 9, shows a 9 in. globe valve being machined. Again we see the advantage of side head working in conjunction with the main head. The variety of parts which have been shown is very meagre when viewed in comparison with the possibilities of vertical boring mills, but the success of such tools becomes all the greater when coupled with careful tool and fixture planning.

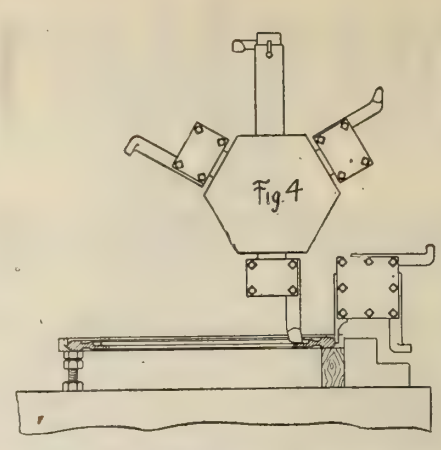


Fig. 4.—23" Sprocket machined all over from octagonal boiler plate.

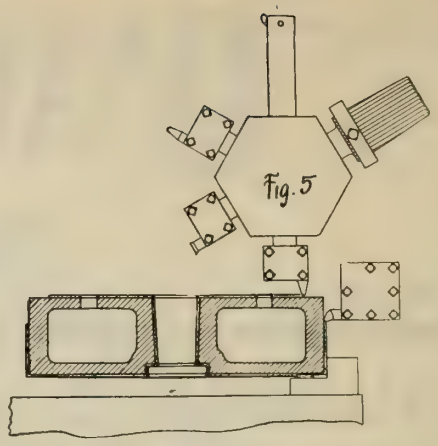
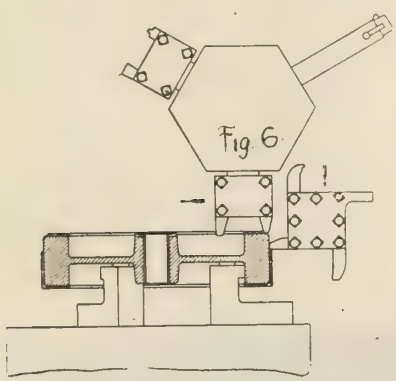


Fig. 5.—21" Steam Engine Piston being finished.



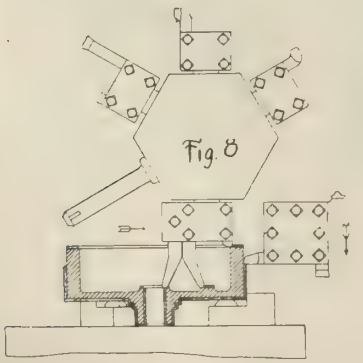
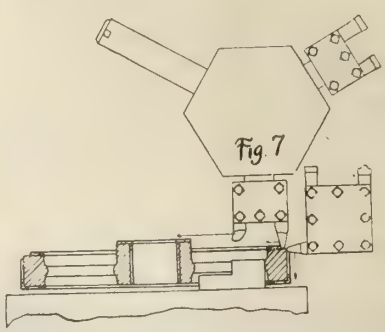


Fig. 6.—Machining an 18" Flywheel.
Fig. 8.—Machining a 20" Flywheel.



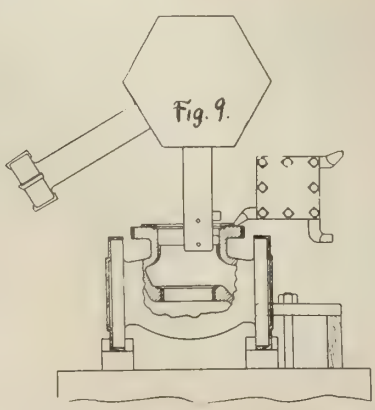


Fig. 7.—Machining a 21" Gear Blank.
Fig. 9.—Machining a 9" Globe Valve.

WATER POWER AVAILABLE

Professor Gibson, in addressing the Section of Engineering on "The Development of Water Power" at the British Association meeting in Edinburgh, said that the available horse-power of the world from the water was of the order of 200,000,000, of which approximately 25,000,000 were at present developed or in course of development. Great Britain, with 900,000 available, had developed only 200,000, the total available and amount used being the smallest of any country for which figures were known. Canada used, or was about to use, over 3,000,000 out of a possible 23,000,000, the remainder of the British Empire 700,000 out of a possible 30,000,000 to 50,000,000, the United States of America nearly 10,000,000 out of 28,000,000, France 1.6 out of 5.6, Germany 0.75 out of 1.5, Japan 1.5 out of 8 possible millions. The inland water resources of the United Kingdom were capable of supplying 27 per cent. of the horse-power that was represented in the total annual consumption of 55,000,000 tons of coal for industrial purposes, excluding railways and steamships.

ELECTRIC RUN-ABOUT CRANE

British cranes of every type are well known and it is not surprising to find a constant improvement being made. At a recent exhibition held in London a new type of run-about crane, propelled and operated by an electric battery was shown. The crane itself lifts 15 hundred weight at the rate of 20 feet per minute, and is stable in any position without anchorage. The jib has a rising and falling motion only, slewing action being obtained by rotating the whole machine on the ground. The structure carrying the jib is placed on a chassis which is roughly circular and has driving wheels at each side driven by separate motors, as well as steering wheels fore and aft. These wheels are so arranged that the whole truck will rotate in a circle little over 6 ft in diameter. The battery, which acts as a counterpoise, is capable of propelling the loaded crane at 300 feet per minute.

Designing an Effective Trussed Beam

A Thorough Understanding of the Strains Imposed Upon the Various Parts of the Beam is Essential—Diagrammatic Views Showing Different Conditions

By JOHN S. WATTS

FOR relatively long spans, and medium loads, the trussed beam is very frequently the most economical, but, probably owing to the average designer being rather unfamiliar with this type, other forms of beams are more commonly used which are not so efficient. To design a really effective trussed beam, it is essential to have a thorough understanding of the strains imposed upon the various parts of the beam, and not to erronously assume that a beam that is nearly strong enough to carry the load as a simple beam, will with the addition of a truss rod which looks about right as to size, be strong enough, as I have known some people to do.

As will be shown more clearly further on in this article, the main part of a trussed beam, acts as a strut, and therefore its whole sectional area is in compression, unlike the plain beam which is under compression on one side of its neutral axis, and tension on the other side. The strength of a section used as a plain beam, is therefore no criterion of its strength when used as part of a trussed beam.

Figure 1 shows diagrammatically the form of a trussed beam, the heavy lines indicating the parts in compression, the light lines, those that are in tension. It is clear that for such a beam to fail, the

$$S = \frac{w \times l}{D}$$

load must be sufficient to deform it as shown in figure 2.

A study of the two figures shows that the beam fails by the parts AB, BC, or CD, being too weak to stand the compressive strain, or because parts AF, FE, or ED, pulled apart under the tension, or the parts BF or CF failed under the compression.

To determine the strains on each of these parts, we will take the simplest case first; that is when the load is in two equal parts concentrated at points B and C. The moment of the weight w, at point C, is equal to w x 1, and is resisted by the tension in FE, which has a leverage equal to D. Calling s the tensional strain on FE, we have:

See cut No. 1.

By the same reasoning it can be shown that the compressive strain on BC, is the same as the tensional strain on EF.

To find the strains on the parts CD, DE, and CE, we lay out the triangle of forces as in Figure 3, the lines being parallel to the lines having the same letters in Figure 2, and the Line CE, being made to scale to represent the weight k. From this we find that the strain on CE, is compressive and is equal to w, the compression on CF is the same as that already determined for BC, and we can scale off the tension on DE, which will be slightly greater than that on the horizontal part of the tie rod FE.

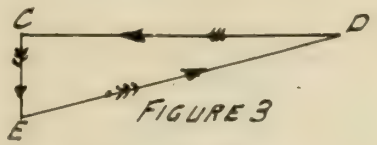


FIGURE 3

Obviously the greater the depth D is made, the less will be strains on all the parts except DE, and therefore the most economical truss will be that having a depth D, as great as can conveniently be made without reducing the head room under the truss too much.

The parts BC, CD, and DE, being under compression, must be designed to carry their load as columns, and the safe stress which can be placed upon them must be based on the ratio of the radius of gyration of the section to the length BC, CD, or DE, respectively.

The tie rod AFED, being in tension, is usually made of a circular bar, threaded at both ends and fitted with a turn-buckle in the central horizontal part to ensure that it will be tight, and so carry its proper share of the load.

The struts BF, and CE, are commonly made of cast iron, as they are not heavily loaded, and this makes it simple to get the required seat for the tension rod. The usual style is that shown in Figure 4.

When the load is concentrated, as in Figure 1, it is obviously desirable to place the struts BF, and CE, directly under the loads. But when, as is more common, the load is uniformly distributed, the length l is preferably made one-third of the span L, because the parts AB, BC, and CD, being all columns under the same load, will then be all of equal length, and therefore of equal strength.

To calculate the strains for a beam loaded with a uniformly distributed load, it is necessary to convert this load into its equivalent as a concentrated load at the points B, and C.

The bending moment for a uniformly distributed load being WL/8, and that for the two symmetrical loads as in Figure 1, being wl, where W is the total distributed load and w, the equivalent concentrated load it follows that if the two bending moments are to be equal:

$$wl = \frac{WL}{8}$$

$$\text{but } l = \frac{L}{3}$$

$$\therefore w \times \frac{L}{3} = \frac{WL}{8}$$

$$w = \frac{3W}{8}$$

The equivalent concentrated load at each point B and C, is therefore ⅜ of the total distributed load, the remaining part of the load being borne directly on the supports at the ends of the beam, that is ⅛ of the load on each support.

In addition to the strain which the parts AB, BC, and CD, carry as columns, there is also the strain imposed upon them by reason of their carrying the distributed load as beams between the points of support A, B, C, and D. This stress must be calculated and the compressive stress on the upper side of

(Continued on page 22)

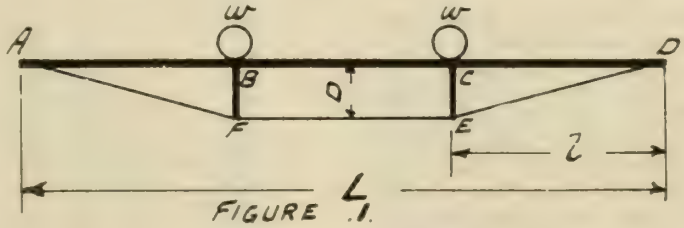


FIGURE 1.

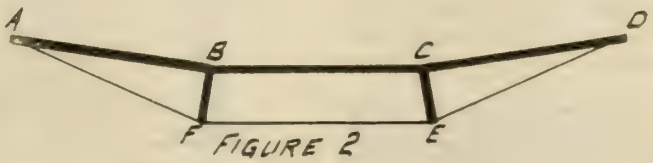


FIGURE 2

Figs. 1 & 2. Read Text for explanation

Elements of Machine Design—Lesson No. 4

In the Design of a Column Bracket Various Factors Must be Considered Such as the Rivets in Top Horizontal Angles—Rivets Through Web and Vertical Angles of Bracket

*By L. T. RUTLEDGE

CONTINUING lesson No. 4, from the December 15th issue, we find that after developing the theory spoken of on page 21 of that issue, it may be interesting to determine the stresses for a standard beam connection as given in two of the best known steel maker's handbooks. Fig. 20 shows the connection recommended for a 12 inch I—beam as copied from a 1912 edition. The 12 inch x 40 lb. I—beam calls for two 6 x 4 x ⅜ inch angles 7½ inches long. The same book gives for a span of 10 feet 43,720 pounds as the safe load uniformly distributed, so that the maximum fibre stress shall not be greater than 16,000 pounds per square inch.

Assuming the above loading, the end reaction will be 21,860 lbs. The direct shear on each rivet is 21,860 or 43,720 lbs.

The value of the turning force

$$T = \frac{Pa}{\sum d^2}$$

$$= \frac{Pa}{d_1^2+d_2^2+d_3^2+d_4^2+d_5^2}$$

$$= \frac{21860 \times 3.375}{1.125^2+2.74^2+1.59^2+1.59^2+2.74^2}$$

$$= 3455 \text{ Lbs.}$$

The secondary stresses on the various rivets are as follows:

On rivet No. 1=Td$_1$=3455x1.125=3887 lbs.

On rivets 2 and 5=Td$_2$=3455x2.74=9467 lbs.

On rivets 3 and 4=Td$_3$=3455x1.59=5493 lbs.

It is apparent that rivets 2 and 5 are the most highly stressed and it will be necessary to deal with them alone. Adding 4375 lbs. and 9467 lbs. vectorially, we get 11940 lbs. The safe value of a ¾ inch rivet in double shear is 8836, whereas the bearing value against the web of a 12 inch I—beam which is 0.56 inch thick is 8400. The latter value, being the least value, governs. The analysis shows that rivets 2 and 5 are stressed 40 per cent. above their safe value. Calculating the actual unit stress in the ¾ inch rivet, we find it to be 27100 lbs. per sq. in.

In the more recent editions of the steel hand-book, it is interesting to note that the end connections of many sizes of beams have been re-designed and for the particular case in question, it is now recommended to use two 4x4x7/16 inch angles 8½ inches long and furthermore only three ¾-inch rivets are specified. The intention in the latter design is to reduce the values of the secondary stress due to the eccentricity.

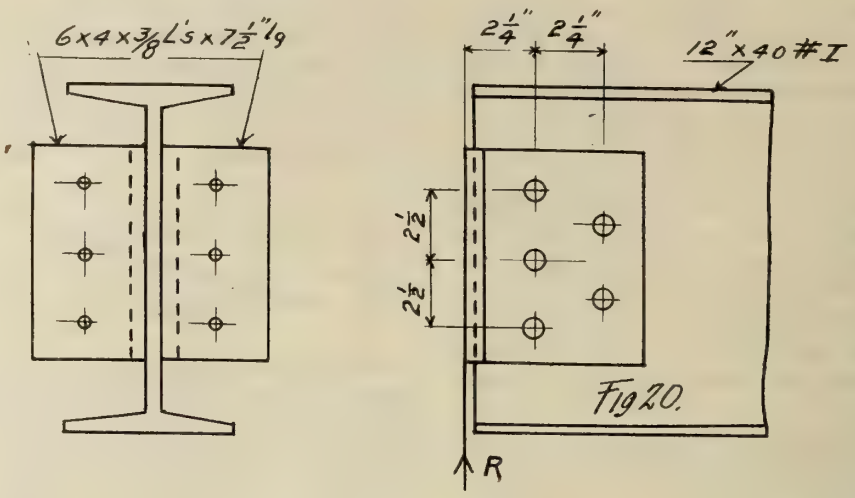


Fig 20.

4. Design of a Column Bracket

Fig. 21 illustrates a column bracket designed to carry a crane beam. The bracket is attached to a column consisting of four 5x3½x⅜-inch angles placed 14¼ ins. back to back and riveted to a 14x⅜ inch web plate, with their longer legs turned outwards. A 15-inch

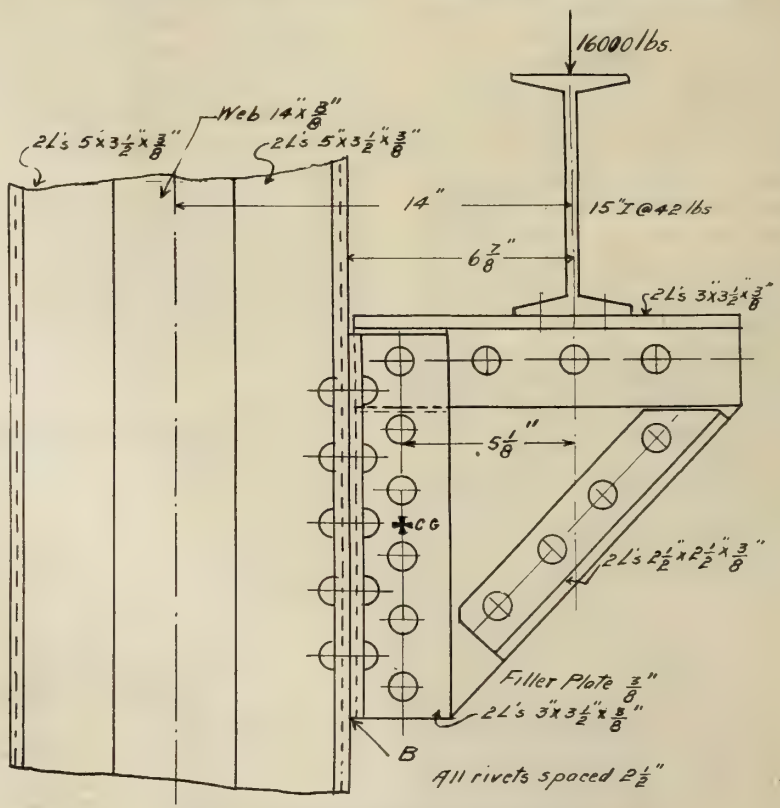


Fig 21.- Sketch of Steel Fabricated Bracket

*The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, Mr. Rutledge will be only too pleased to offer assistance. To save time, write direct to Kingston, explaining your trouble in detail.

I—Beam at 42 lbs. at right angles to the web of the column and 14 ins. from the centre line of the latter rests on the bracket. The assumed reaction is 16000 pounds. All rivets are ¾-inch diameter. In the bracket design, the following items are used:

2—top angles 3x2½x⅜ inch
2—vertical angles 3½x3x⅜ inch
2—stiffener angles 2½x2½x⅜ inch
1—web plate ⅜ inch.

It is required to design the riveted connections.

(1) Consider the rivets in the top horizontal angles.

Taking the least value of the ¾-inch rivet in double shear to be 8836 lbs. and in bearing against the ⅜-inch plate to be 5625 lbs., we find that, owing to the absence of eccentric loading in these angles $\frac{16000}{5625}$ or 3 rivets will satisfy.

So use 3 rivets spaced symmetrically relatively to the centre line of the I—beam as shown in Fig. 21.

(2) Consider the rivets through the web and the vertical angles of the bracket.

Assume 6 rivets. The direct shear on each rivet is $\frac{16000}{6}$ or 2667 lbs.

Here it is apparent, we have a case of eccentric loading.

The distance from the centre of gravity of the riveted area to the line of action of the force is 5⅛-inches. The turning moment on the connection is 16000x5⅛ or 82000 inch—lbs. Using a rivet spacing of 2½ ins., the turning force on the extreme rivet

$$= \frac{Pa}{\sum d^2} \times d_1$$

$$= \frac{82000 \times 6.25}{2\{1.125^2 + 3.375^2 + 6.25^2\}}$$

$$= \frac{82000 \times 6.25}{109.375}$$

$$= 4685 \text{ Lbs.}$$

Combining the direct and secondary stresses we have the maximum stress

$$= \sqrt{2667^2 + 4685^2} = 5390 \text{ Lbs.}$$

is a trifle less than the least value of the ¾-inch rivet. The assumption of six rivets spaced 2½ inches centre to centre was quite correct.

(3) Consider the rivets through the column and the vertical angles.

Assume 5 rivets in each vertical leg spaced 2½ inches apart and staggered relatively to the rivets in the other legs of the angles.

The direct force on each rivet will be 1600 lbs., there being 10 rivets to take the shear. The rivets are also in tension and 7000 lbs. per sq. in. may be taken as a safe value in tension. The least value of a ¾-inch rivet in tension is 3090 lbs. The turning moment of the load on the rivets is 16000x6⅞ or 110,000 inch-lbs. The joint tends to revolve about the point "B" as shown in Fig. 20. In this case, it will be reasonable to consider the four rivets at the top to be the ones called on to resist the tension. "d" for the extreme rivet is 14 ins. and for the second one 11½ ins. Then the secondary stress on the extreme rivet

$$= \frac{110000}{2(11.5^2 + 11.5^2)} \times 14 = 2346 \text{ Lbs.}$$

When the direct stress of 1600 lbs. is combined with the secondary stress of 2346 acting at right angles to the direct stress we get a combined stress of 2840 lbs. which is a little less than the safe value of the rivet in tension. Thus we will accept this number of rivets as being what is required.

(4) Consider lastly the stiffener angles.

The stiffener angles are used to keep the bracket web plate from buckling. The stress is a compressive one. Four rivets will be quite sufficient. No complex calculations are required in this case.

(5) A Fastener with Eccentric Loading

In Fig. 22 is shown diagrammatically an ordinary radial drill with a rectangular base. The column part of the drill is fastened to the cast iron base or bed with 8 cap screws which are located by the numbered holes 1 to 8 on the plan of the base.

When the drill is working, a thrust "P" will be brought into existence and its point of application will be at right angles to the drill arm and will act upwards as shown. The point of application of this thrust will depend on the position of the work. Let it be distant "L" from the left hand edge of the base at the point "A." When the thrust comes upon the drill, the tendency is to tip the column of the drill backward about the point A. This is due to the turning moment PL. For equilibrium this turning moment must be balanced by the resisting moments of the stresses in the screws about the same point.

Assume the loads coming upon the screws are Q_1, Q_2, Q_3, etc., and let the distances of the screws from A be l_1, l_2, l_3 and l_4 as shown. Then for equilibrium

$$PL = 2(Q_1 l_1 + Q_2 l_2 + Q_3 l_3 + Q_4 l_4)$$

Multiplying by 2, since there are two rows.

Now the stresses induced in the screws vary directly as the elongations; thus it must be apparent that the loads on the screws vary. Screw No. 4 has to stretch more than screw No. 1. The elongation in any two screws is directly proportional to the distance from A. Therefore we have the following relations

$$Q_2 = Q_1 \frac{l_2}{l_1}, Q_3 = Q_1 \frac{l_3}{l_1}, Q_4 = Q_1 \frac{l_4}{l_1}$$

Substituting these values in the equation of moments above, we have

$$PL = 2Q_1 \left\{ l_1 + \frac{l_2^2}{l_1} + \frac{l_3^2}{l_1} + \frac{l_4^2}{l_1} \right\}$$

$$= \frac{2Q_1}{l_1} \{ l_1^2 + l_2^2 + l_3^2 + l_4^2 \}$$

$$\text{so that } Q_1 = \frac{PL l_1}{2\{l_1^2 + l_2^2 + l_3^2 + l_4^2\}}$$

$$\text{but } Q_4 = Q_1 \frac{l_4}{l_1}$$

$$\text{Then } Q_4 = \frac{PL l_4}{2\{l_1^2 + l_2^2 + l_3^2 + l_4^2\}}$$

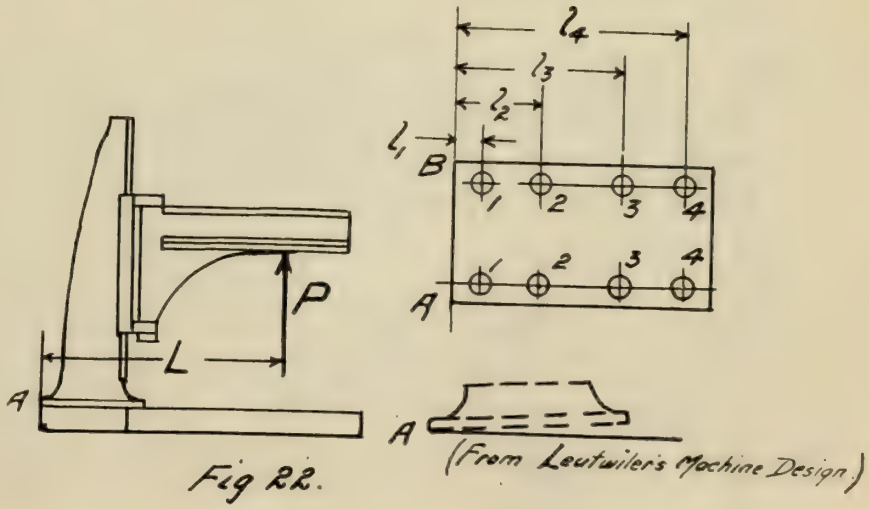


Fig 22.

(From Leutwiler's Machine Design)

and since the elongation in No. 4 is greater than in any of the other screws, the stress Q_4 is greater than that in any of the other screws.

In an actual problem where the thrust and the lengths are given it is a simple matter to solve for the value Q_4. The size of screw is determined by dividing the stress in the screw by the working stress for the steel of the cap screw. Since a radial drill is subject to shock loads, a factor of safety of 10 is recommended. Remember also, that the area of cross-section obtained will be the area at the root of the thread. So with this information, it is an easy matter to obtain the proper size of cap screw. The maximum will govern and they should be all alike.

The solution for a drill with a circular base is quite similar to the one for the rectangular base.

Where 2a is the outside diameter of the circular base and 2b is the diameter of the bolt circle, then the maximum load on a bolt, where six bolts are used to fasten the drill will be

$$\frac{PL}{3}\left[\frac{a+b}{2a^2+b^2}\right]$$

The student is recommended to attempt the derivation of this formula and if possible obtain a complete solution, being quite similar to the one given for the rectangular base.

It is also recommended that the student work the following problems:

1. For the riveted connection shown in Fig. 23, determine the stresses coming upon each rivet used for fastening the bracket to the column. Assume the magnitude of the load P as 4000 lbs. and the diameter of the rivets as ¾ ins.

2. Design the fastenings of a radial drill with a rectangular base 2 ft. x 3 ft. of similar appearance to the one shown in Fig. 21. Assume the thrust to be 3000 lbs. and the distance L as 60 inches.

EFFECTIVE TRUSSED BEAM

(Continued from page 19)

the beam must be added to the main compressive stress calculated as being imposed by the formulae

$s = \frac{Wl}{D}$. As the tensile stress on the under side of the beam reduces the main compressive stress, it may be neglected.

As all three parts AB, BC, and CD are under the same loads, and for simplicity are made of the same section, it is only necessary to calculate for one section. The stress will be determined from the formulae for a beam loaded with a uniformly distributed load, and supported at each end as follows:

$$\frac{W}{3} = \frac{8fz}{2} \quad \therefore f = \frac{Wl}{24z}$$

Where f= stress per square inch 'S
W= total load as before, but as each part as AB, is one third of the total length L, the load on AB will be —

$\frac{W}{3}$

z= Modulus of section.
1= length of part AB.

In general the beam will be made of a channel or I beam section or if of wood, of a rectangular section having the larger side vertical. Hence it will usually be found that having regard to the larger radius of gyration of the section in the vertical plane this additional stress will not bring the total stress above the allowable maximum. In other words if the truss is made of a channel section as shown in Figure 5, the strength of the part AB, as a column is fixed by its radius of gyration on the plane xx, the allowable stress being in accordance with the ratio of this radius of gyration to the length l. The radius of gyration on plane zz being larger will permit us to use a higher stress, so long as the additional load acts vertically only, and therefore if the total of the two stresses, that calculated as a column, plus that due to the part acting as a beam, do not exceed this higher permissible stress the beam will be safe.

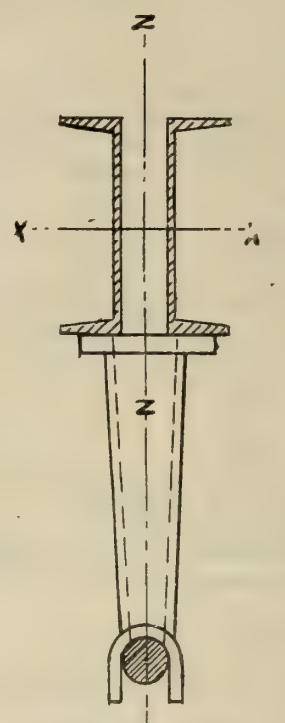


FIGURE 4

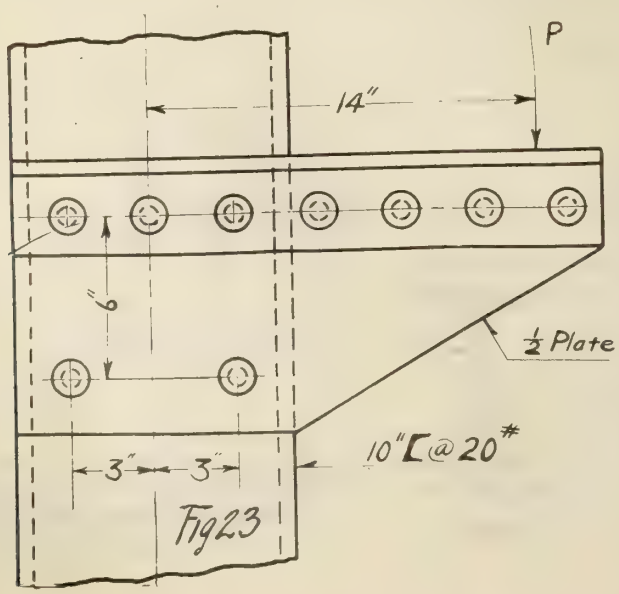


Fig23

NEW MINE RESCUE APPARATUS

Ever since the invention of the Miner's Safety Lamp by Humphry Davy, Great Britain has devoted keen attention to the subject of safety devices in mines. Experiments recently conducted by the British Scientific and Industrial Research Department have resulted in the design of two new types of rescue apparatus which are proving most successful. Both types of apparatus are what is known as "regenerative"; that is to say, the air expelled by the lungs is purified, supplied with oxygen, and returned to the lungs. Therefore, when a man wears this apparatus he is able to enter smoke or poisonous atmosphere without suffering ill effects. The apparatus and the lungs really form a closed circuit, and the lungs serve as a pump to circulate the air round that circuit. In one type of apparatus the oxygen is supplied from liquid air and in the other type it is obtained from a solution of compressed gas. Both pieces of apparatus are designed to enable the wearer to undertake continuous heavy physical exertion for at least two hours. As a matter of experience they can satisfy all the breathing needs of the wearer for three hours.

To Get the Best Out of a File—Treat It Right

Clogging of Teeth Should be Avoided Otherwise Greatest Efficiency Will Not be Secured—There Are Times When Oil Must Not Be Used—How to Economize on the Wear of a File

*By J. H. MOORE

CONTINUING the article on filing which appeared on page 25 of last week's issue, we come to the use of the file on lathe work. When used for shafting or lathe work the file should be constantly stroked against the turning of the revolving work, applying the pressure to the forward stroke, relieving it on the return stroke and giving the stroke a slight gliding or lateral motion to assist clearance of chips and to avoid filing ridges or scores.

For machine filing a special file is usually required and, where any very hard service is called for, the formation of the teeth should be such as to meet this special work. It must be remembered that files are almost always made with the intention that they are to be used by hand. The natural tendency of the workman to apply the pressure as required—to keep the file cutting or down to its work, using less pressure on the first strokes, (which prevents the finely shaped tooth point from being broken and dulled) and gradually increasing the pressure as the teeth lose their keenness—is in contrast to the fixed pressure of the machine and must be compensated for in the manufacturing of machine files. It is a well known fact that a file soon becomes dull and worthless if it be constantly stroked over the work without being held to it by pressure enough to keep it cutting. The hand workman's "feel" gives him the advantage over the machine at this point. However the importance of the work to be done must outweight the economical use of the file and when the machine is required it should be used and the file maker can produce teeth of the shape that will be far more effective for machine work than the ordinary stock file.

Drawfiling

Files are sometimes used for grasping at each end and moving them sidewise across the work, after the manner of using the spoke-shave. This operation is known as drawfiling and is usually performed in laying the strokes of turned work lengthwise, instead of circular, as left from the lathe finish, as well as when giving a final fit to the shaft that is to reveive a coupling: cases, generally, in which no considerable amount of stock is to be removed, and thus any defects in the principal of construction of arrangement of the teeth of the file are not so readily apparent.

Files as they are ordinarily made are intended to cut when used with a forward stroke, and the same file cannot work smoothly or to the best advantage when moved sidewise, unless care is taken that the face of the teeth present themselves, during the forward movement of the file, at a sufficient angle to cut, instead of scratching the work. To accomplish this, the angle at which the file is held with respect to the line of its movement must vary with different files, depending upon the angle at which the last or up cut is made. The pressure should also be relieved during the back stroke, as in ordinary filing.

When properly used, work may be finished somewhat finer and the scratches more closely congregated than in the ordinary use of the same file: as, in drawfiling, the teeth produce a shearing or shaving cut.

In economizing the wear of files intended for general purposes, consideration should be given to the kind of material to which they may be subjected in the different stages of their use. In the ordinary use of the machine [illegible] first wear of these files should be in finishing the larger surfaces of cast iron, bronze or grass metals, all of which require a keen cutting tooth; they may then be made to do good execution upon the narrower surfaces of these metals, and also upon wrought iron and soft steel; as a file that has been used more or less upon this kind will not tear the surface of these metals and will consequently do more effective work. To obtain the best results, the file suited for general purposes is not so well adapted to filing brass or other similar soft metals as those whose teeth are arranged for this purpose. New files, particularly double cuts are severely worn down by use upon narrow surfaces, as the strain comes wholly upon a few teeth and frequently breaks them.

Preparing Work

The corners or thin edges of iron castings are very likely to become chilled and a thin scale or skin produced over the entire surface of the casting, caused by the hot metal coming in contact with the moist sand of the foundry moulds; this outer skin is usually much harder than the metal beneath it, and many times the thin edges or orners are chilled so as to be harder even than the file itself.

To overcome this hard scale the casting is usually pickled by the foundry before it is sent out—a process of washing the castings in acid and grinding or snagging the edges, or particularly hard parts.

However, the casting, even after being pickled, retains a certain amount of sand and hardness on its surface and this will dull the best file made. Use an old file to break off this scale and clean off the casting and then a good file may be used without danger of injury to it.

The necessity, therefore, of removing this scale and chilled surface becomes readily apparent, and all mechanics who give any consideration to the proper and economical use of the file will be careful to see that the scale and sand are first removed by pickling, and the surfaces which have become chilled by grinding, before applying the file.

When Oil Should Not be Used

All files, when they leave the factory, are covered with oil to prevent them from rusting. While this is not objectionable for many uses to which the file is put, there are cases where the oil should be thoroughly removed, as when the file is to be used in finishing the larger cast iron surfaces which are of a glassy nature; the principal difficulty being to make the file "bite," or keep sufficiently under the surface to prevent glazing; otherwise the action not only hardens or burnishes the surface operated upon, but dulls the extreme points of the teeth, thus working against the desired end in both particulars.

When Oil May be Used

Oil may, however, be used to good advantage on new files which are put immediately to work upon narrow fibrous metals of a harder nature; in such cases, it is not uncommon, with good workmen, to fill the teeth with oil and chalk.

Oil is also useful on fine files in the finishing of wrought iron or steel, as by its use, the teeth will not penetrate to the same degree and the disposition to "pin" and scratch the work is materiallf less than when used dry.

Cleaning the File

The dust and small particles removed from the material operated upon are always more or less liable to clog and fill the teeth. This tendency is especially aggravated when the file is used upon wood, horn, and such other materials as will, upon being mixed with the oil in the teeth become baked when dry and thus prevent the teeth from penetrating the work as well as giving them the appearance of being worn and tending to injure them by rust.

In removing oil from the teeth of a new file, a ready way is to rub chalk or charcoal across the teeth and brush thoroughly. By repeating the operation a few times, the oil will be entirely ab-

(Continued on page 28)

We are indebted to the Nicholson File Co., for the use of this information.

Grinding Engineer Wrenches At High Speed

Disc Grinding is an Important Production Factor—Finishing Twelve Surfaces on Cap Screw Heads Simultaneously—Large Engineers' Wrenches and Smaller Sizes Can be Ground by This Method

*By J. H. MOORE

In a former article on "Disc Grinding," appearing in Canadian Machinery, June 2nd, the single spindle type of grinder only was shown. In the present article we will depict three examples of work performed on the double spindle type of machine, also one example of vertical disc grinding. Other operations performed by the disc grinding process will be described, but not illustrated, as with the previous, and present photographs, readers will be well acquainted with the style of machines used. We are again indebted to Chas. H. Besly & Co., Chicagt, for the use of these illustrations.

It is often advantageous to grind a number of pieces simultaneously. In such cases, enough parts are ground at one time to use up the power of the grinder, or the size of the disc wheel. Take for example Fig. 1. This view depicts a double spindle machine grinding cap screw heads on 6 screws and on 12 surfaces simultaneously. The work is accomplished on a No. 26-18-inch machine, from hot bar stock, using common wooden holders as shown. The one operator, and a boy helper who loads the holder, produce the following results: of the square head 1-4 inch cap screws at the rate of 2100 per hour; 3-8 in. size., 1821 per hour, and so on in proportion, up to 970 per hour on the 3-4 in. size.

On hexagon head screws, 1,115 1-4 in. screws per hour were produced, and 510 of the 3-4 in. size. On the 1-4 in. size 9 screws were held in the holder, 5 in the case of the 3-4 in. size. In between these sizes the production and number of parts held, were in similar proportion. These figures give a good idea of such a machine's productive possibilities.

Fig. 2 illustrates a similar style machine grinding brass hexagon nuts, twenty being held at one time in the fixture. On this operation it is the usual practice to grind as many nuts simultaneously as the capacity of the machine will permit, and of course the more you hold at one time, the greater the production.

At Fig. 3 is shown a rather interesting piece of disc grinding. In this case the machine used is a wet ring wheel grinder equipped with a sliding table and special work holder. The two sides of the head of extra large engineer's wrenches are ground at this operation, and their proportionate size to that of the operator is readily apparent. Single end wrenches 24 inches long, weighing 12 1-2 pounds each, with a 3 9-16 inch milled opening, are ground at the rate of 60 wrenches, or 120 surfaces per hour. Single end wrenches 44 inches long, 53 pounds weight, with 4 5-8 inch milled openings are ground at the rate of 12 wrenches, or 24 sides per hour. The small double end wrenches, shown resting on the table alongside of machine, are ground free hand, using an ordinary stationary work rest between the grinding wheels. The production in the latter case is exceedingly rapid, running as high as 600 wrenches, or 1200 surfaces per hour, per operator.

Many other interesting operations are being performed throughout the country by means of disc grinding, and as can be readily understood it is well nigh impossible to show even a small proportion in photographic form. In the next few examples quoted we will consider work pictures only.

In a certain plant, they are producing by disc grinding thin brass cover plates up to 6 in. by 10 in. These pieces are ground at the rate of 60 per hour, this figure, including both roughing and finishing. The parts are held in a special floating workholder, and the above production time is for one operator only. As the machine accommodates two men, the production is of course doubled.

At another plant they are finishing cover castings for automobile transmissions at the rate of 100 per hour. On this work they use a 24 inch wide face ring wheel at one end, and a 30 inch disc wheel at the other. The ring wheel has a vitrified wheel that makes for speed and economy, while the disc wheel, with its cloth back abrasive disc, gives the part the desired accuracy. Very simple workholders are used; three studs projecting from an ordinary angle plate forming a three-point bearing on the work. The piece is accurately located on this bearing by means of four heavy studs projecting from the face of the

*Illustrations through the courtesy of the Chas. Besly Co.

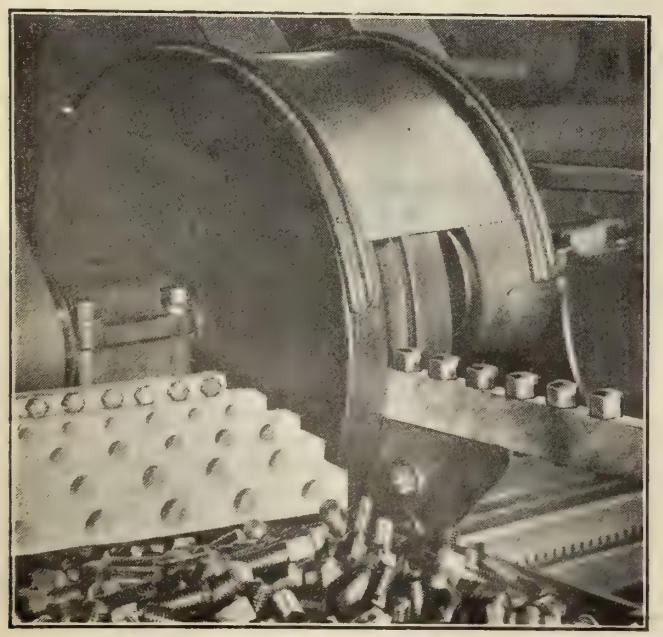


Fig. 1.—Grinding twelve cap screw head surfaces at one time.

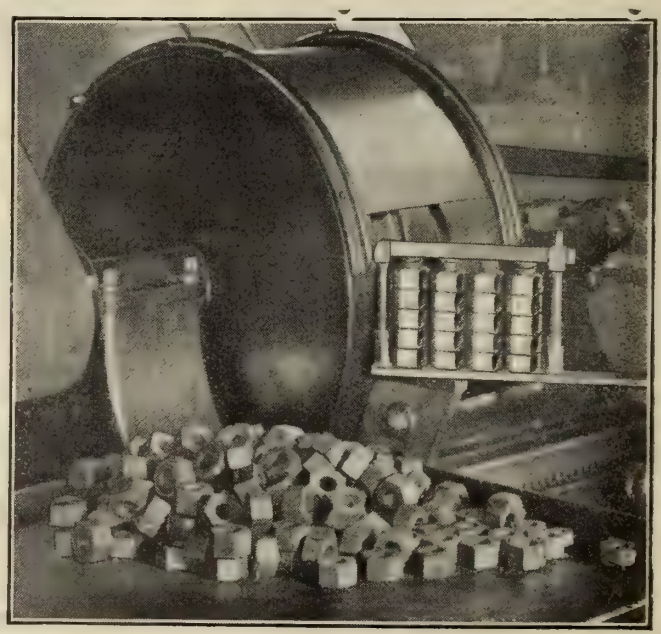


Fig. 2.—Grinding twenty brass hexagon nuts in one operation.



Fig. 3.—Grinding a large engineers' wrench.

angle plate. It will be noted that no time is used up in rigid chucking—The work floating against the grinding wheel. The production figure given above includes both roughing and finishing.

All disc grinding is not confined to flat surfaces, for in another plant they are grinding the circumference of friction draft gear shoes at the rate of 60 per hour. The pieces are made from cast steel, and the area of each surface is 50 square inches. The work is clamped into a chuck which swivels on a central stud; while the workholder is mounted on a geared lever feed table. The circle used is what is known as No. 16 Boxite, and a 26-in. machine is employed. These pieces are accurately held to a given radius.

Another operation, employing both the ring and disc wheel, is the grinding of pillow blocks and caps; the production in one particular plant being 90 rough and finished ground caps per hour, and 30 pillow blocks in the same time; the bottom of these blocks being 6 inches by 13 inches. The castings are recessed in molding to facilitate grinding, and are kept closely to both flat surface, and accurate height. The former planer time on this job was 3 minutes each.

It always pays to see if you can improve on the present method of manufacture. For example, a certain plant was producing iron castings for door locks, and the method employed was the use of two milling machines with one operator, five surfaces being produced per minute. After disc grinding was adopted the production soared to 10 pieces per minute, and a finer and more accurate finish was secured.

Wet Ring Grinders

Here are several production times on wet ring grinders. In one plant the grinding of hardened square blocks for pipe tongs, is accomplished at the rate of 240 pieces, 4 sides, or 960 surfaces in all, per hour. Three pieces are ground at a time.

Another plant finds that the wet grinder does good work in rough grinding piston rings. An automatic grinding fixture is used, and as high as 15,000 rings have been completed in ten hours. The rings are ground to within .0015 in. plus or minus of size, and within .001 in. of parallel. The Besly Co., commenting on this work, state as follows. "The proper speed is about 900 r. p. m., with right hand wheel running down and left hand wheel running up. The right hand wheel should run 45 to 50 r. p. m. faster than the left hand wheel. This will cause a slight spinning of the ring and help to keep it parallel. The castings should be within .015 inch of finished size, and not more than .010 in. should be removed at one cut. If the castings are hard and of wide face, a slower speed is better. All bumps and projections should be removed before grinding, and plenty of water should be used. A wheel of rather coarse grain and soft texture is best for such work."

The vertical spindle disc grinder also has a wide range. In one shop cast iron flasks, 22 inches by 38 inches, weighing 165 lbs. each, are ground in 10 minutes, whereas the former planer method produced only 6 every 10 hours.

The pattern shop must not be forgotten, for in many plants disc grinding machines specially adapted to pattern-making, and general woodworking have reduced expenses, increased the output, and given a greater degree of accuracy. On pattern work it is often possible to get the apprentice to do as good work as the most skilled workman, as he has a mechanical means of producing an even surface.

Cheaper pattern lumber can be worked, as these machines grind hard wood or soft wood equally well, cross grains, straight grains, knots, shakes, and even nails or screws which may protrude to the ground surface. Work which was considered trimmer work can be done quicker and better, and the grinder takes much of the turning and smaller machine planing, and a large portion of the hand work, such as sanding, planing, cornering and general hand-fitting and finishing. With such machines an ordinary workingman can make as good a glue joint as an expert, and the same applies to jointing split core boxes.

Referring once more to the vertical spindle type of grinder, or gravity feed grinder, as it is sometimes termed, Fig. 4 illustrates one of these machines in actual operation. On this style of grinder the work to be ground is laid on the face of the disc wheel, and grinds from a gravity feed. Where the work is too light to grind satisfactorily, the usual practice is to lay on additional weights to hold the work to the disc. In either event, it is seldom possible to get the same feeding pressure as you can with the lever feed on the horizontal type machine, therefore grinding by the vertical method generally takes more time than where the lever feed is used.

This accounts for the fact that the vertical type machine is used only on certain classes of work, such as jointing and flatting. It is especially suited where the work is too large or heavy to handle conveniently on the lever feed machines, or where a number of pieces can be ground simultaneously.

For example, in jointing cast iron split motor bearings by gravity feed it requires about ten minutes to clean up a surface. The same piece could be

(Continued on page 28)

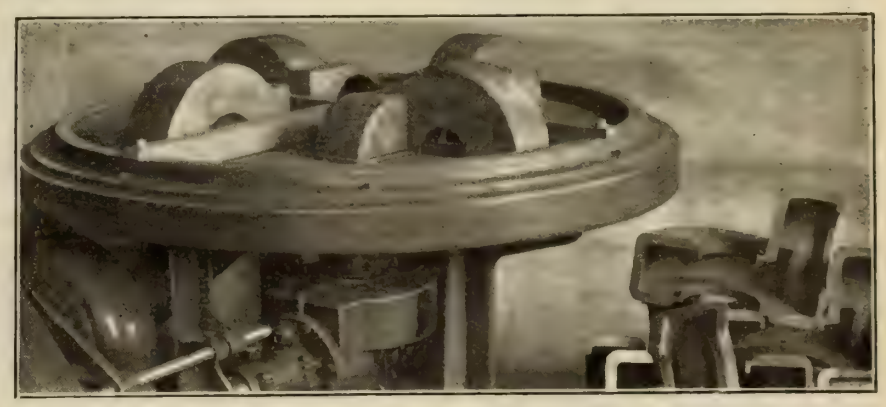


Fig. 4.—Producing work on vertical type disc grinder.



WELDING AND CUTTING



Points to Watch in Welding of Cast Iron

Skill and Experience Are Necessary Owing to Brittleness of the Metal and Necessity of Using Flux to Reduce the Oxide—Shape—Mold or Dam Welding

*By FRED L. ROGERS

THE welding of cast iron requires more experience and skill than welding steel, because of the brittleness of the metal, and the necessity of using flux to reduce and eliminate the oxide. Cast iron under the torch flame will not flow and blend until the oxide has been reduced by the action of a suitable flux. The molten metal appears "grainy" which betrays the pressure of oxide that must be eliminated by flux. The oxide of cast iron melts at a higher temperature than the iron itself, and hence cannot be ignored as in the case of steel.

The melting point of cast iron ranges from 1900 to 2300 degrees F., varying with the carbon content, the very soft iron containing as high as 2½ per cent. carbon melting at low temperatures, while the irons containing less carbon may require the higher temperature to fuse. The selection of welding rod for cast iron is highly important, more so perhaps than with some other metals because of the inferior characteristics of ordinary cast iron when used as welding rods. The use of an inferior grade of welding rod will produce hard spots and weak welds, and should in no case be tolerated.

Weight of Welding Rod Deposited Per Hour

When welding steel, using steel welding rod, the metal deposited will run from about 2¼ pounds per hour down to a few ounces depending, of course, on the size of tip and thickness of steel being welded. Welding ¾-inch steel plate at the rate of one foot per hour using a No. 9 d-b tip consumes about 2¼ pounds of welding rod per hour, whereas welding ½-inch steel at the rate of 1½ foot per hour consumes about 1⅛ pound of welding rod. Obviously, when welding say ¾-inch steel the consumption of welding rod decreases to a fraction of a pound. When welding cast iron, especially heavy sections, the amount of cast iron stick deposited may easily be as much as four or five pounds per hour, or more.

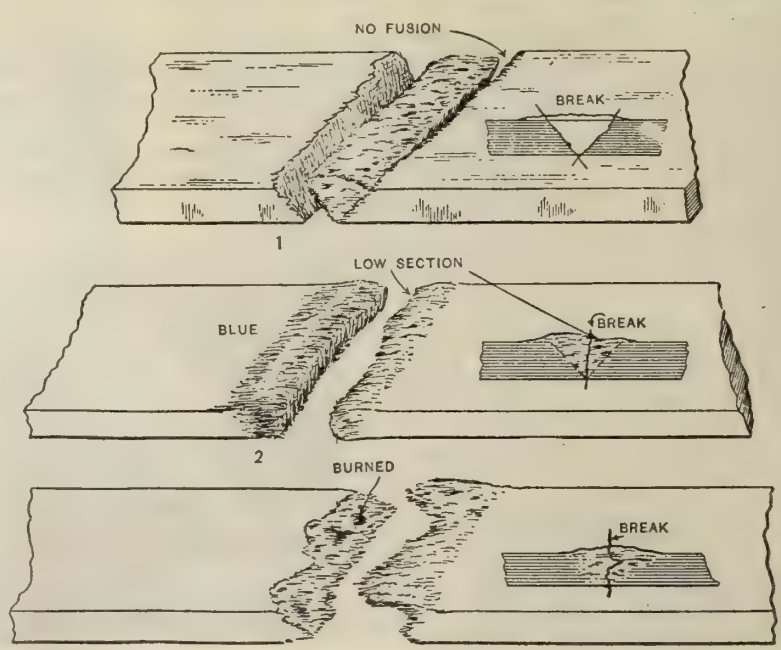
Use for Salvaging

What mechanic has not wished for a "putting-on tool" when he has turned a piece too small or has planed off too much by taking an injudicious depth of cut? The putting-on tool was a figment of the imagination and a practical joke until the oxy-acetylene torch came into use. It made the impossible not only possible but practicable.

It is now a not uncommon practice to salvage parts that have been spoiled by improper machining or that have been reduced by wear. Worn journals can be restored to the original diameters by welding a thin layer of steel to the surface. Of course, the welded metal on the journal must be turned and polished in a lathe before it can be used. There are many other machine parts that can be made whole again by building on adding material and machining to the required dimensions and finish.

One of the most frequent accidents to machinery is the breaking of gear teeth. A gear with a broken tooth is practically useless, and it may represent an investment of several hundred dollars. Ordinary methods of patching in a new tooth are mostly worthless as a patched tooth will have so little strength that it will be broken out as soon as an extra heavy load has to be transmitted. A tooth built up of adding material is as strong and durable as the original if properly done.

One of the interesting and unusual applications of the oxy-acetylene torch in this line is depositing a coating of cast iron on the seats of steel poppet valves used in gas engines. Cast iron resists the heat and abrasive action of exhaust gases better than steel. The cast iron forms a seat on the poppet valve equal to that in the cylinder casting, and out-



Characteristic defects in welded steel bars as shown by tensile test.

*From the author's book, "Welding and Cutting," published by the Davis-Bournonville Co., Jersey City, N.J.

lasts several steel seats, thus reducing the cost of up-keep. The cast iron coating of course must be accurately finished the same as the solid steel valve but being much more durable the cost is well repaid.

Shape Welding

There are two distinct kinds of shape welding, one being accomplished by torch manipulation alone and the other by the aid of dams and molds of high heat-resisting material. A boss can be built upon the face of a gray iron casting of any size and height by fusing on adding material in the quantity required. It is not difficult for the experienced welder to keep the margins from sloughing off or to control the shape or contour to simple forms. It is done by graduating the heat so that the molten metal at the edges is near the freezing temperature and flows only when the flame is held close. The moment it becomes too fluid the flame is whipped off and directed upon a colder part. The same manipulative skill is required as in finishing the end of a joint square. Less heat is applied than in the centre when finishing a joint and the torch is whipped up whenever the metal gives signs of breaking down and overflowing the edge.

Bosses can be built not only vertically but horizontally and at any intermediate angle at will. The usefulness of boss welding in repair work is obvious, and welders should practice it not only to acquire skill in forming bosses but to perfect themselves in the art of finishing welds square and in a workmanlike manner.

Mold or Dam Welding

When a new lug, ear or other part is required to replace one broken from a casting, it is generally advisable to make use of a mold or dam of some material like carbon blocks on carbonite which resist the heat of the torch flame and which can be readily cut, carved, sawed and drilled. Carbonite possesses these qualities in a most satisfactory degree, and is used generally for shape welding and also as a retaining wall for difficult side seam and vertical seam welding.

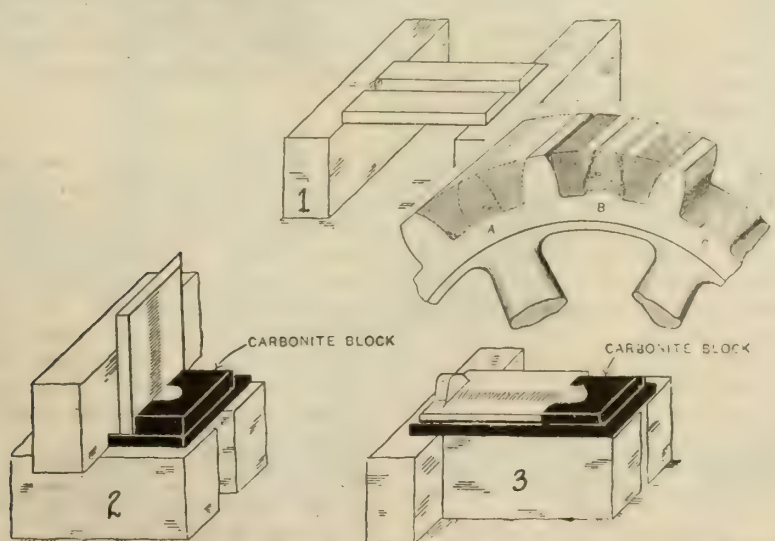
Suppose a lug has been broken from a casting and lost. To replace it is a matter of merely providing a carbonite mold of the shape required, open at the top and placing it against the casting with the opening opposite the break; the block is weighted down and the welder proceeds to fuse the face of the casting and supply adding material until the mold is filled to the required height. If the lug were not lost, it is often cheaper to build up a new one in a mold than to weld the old one in place. The preferable practice depends on the size and other conditions. Pre-heating the casting is advisable in order to prevent excessive expansion and contraction stresses, and the lug and casting should be covered with asbestos paper or other insulating material in order to prevent rapid cooling.

Carbonite Shapes

Carbonite is supplied in blocks or slabs, in various thicknesses from ⅜ inch to 1 inch, in width up to 6 inches, and in lengths of 36 inches. Rods of the same are furnished in diameters of ⅜ inch to 1 inch included. Carbonite rods are used to fill holes when welding radiating cracks. If properly placed, the walls will maintain their shape and thus render boring or reaming unnecessary. It will burn away slightly so that a little filing only will be required. In fact the judicious use of carbonite rods will often make welding feasible that otherwise would be impracticable on account of cost of subsequent machining.

Replacing Broken Gear Teeth

Broken gear teeth may be replaced successfully on all kinds of gray iron and steel gears but it is not advisable to attempt the replacement of the teeth of motor car transmission gears except as an emergency repair. These gears are generally made of alloy steel and specially heat-treated to give them toughness and durability, and unless the welded teeth are made of the same metal and heat-treated the job will not last. However, there are many other broken gears that can be repaired with uniform satisfaction.



Welding lugs to cast iron with aid of carbonite block. Restoring broken gear teeth with and without carbonite blocks.

The practice of replacing broken teeth depends on the gear and local conditions. A gray iron gear with cast teeth can be repaired by building up a new tooth alone, using carbonite blocks in the adjacent spaces to hold the new metal closely to the general thickness of the old tooth. Care must be taken in preheating not to crack the rim and the welded tooth must be protected from cooling down too rapidly when complete. When the welding is finished and the casting has cooled down the tooth is ground to shape with a portable emery grinder or chipped and filed to a templet.

If the gear has cut teeth and a gear cutter of sufficient capacity is available the preferable practice is to build in the broken teeth and adjacent tooth spaces solid with new metal, and then cut two spaces on the gear cutter. This should produce a solid well formed tooth. An alternative method less expensive but not so likely to produce a good job is to build in the tooth with carbonite blocks alongside, and finish with the gear cutter. The difficulty is that the cutter is at disadvantage in cutting, having to cut metal on one side only. Springing and chattering are bound to result making considerable hand finishing necessary.

Broken Pulleys

One of the difficult jobs that trouble the mill repair man is mending a broken cast iron pulley. This probably presents the most complex problem in expansion and contraction stresses that the welder ever meets. It is essential that the job run true when finished, and unless the piece is carefully treated and welded it may be far from true when finished. The chances are that the inexperienced welder will not only fail to secure a true job but he will usually break the pulley at another place.

Two conditions of broken pulley repair requiring quite different heating treatment will be found. The first case to be considered will be a broken spoke: The spoke should be chamfered or beveled the same as any other piece to be welded, and the rim should be preheated on each side of the spoke so that when the whole pulley is cooled there will be no internal stresses in the spoke or rim, and the rim will not be shrunk out of true. The degree of preheating and amount of expansion vary, of course, with the size of pulley, thickness of rim and spokes and other conditions.

Almost every case presents a new problem, and it is in handling such work that the experienced welder displays his skill and judgment. When the weld is completed the preheated and welded parts must be shielded from drafts, using asbestos sheets preferably for the purpose. The thickness of asbestos can be graduated so that the rim will cool at approximately the same rate as the spoke; the spoke usually will require more covering than the rim but not always.

When a pulley rim is broken between the spokes, preheating must be applied to the hub to throw the rim apart at the break. The joint should be beveled

both inside and outside. Again it is a case where the conditions will govern the practice and hardly two cases are alike. The same care must be taken to protect the welded joint and the hub when cooling down so as to equalize the contraction stresses and prevent fracture and distortion.

Welding Broken Gears

While the welder who is able to weld broken pulleys so that they require little truing up and stand up in service, is generally able to handle almost any job of cast iron welding that may come his way, he may be called on to weld broken gears that present even greater difficulties than broken pulleys. Generally speaking, a badly broken small gear is not worth welding, and the owner will save trouble and money by obtaining a new one. However, there are conditions arising where it seems absolutely imperative to weld a broken gear even though it is badly smashed and the actual cost of welding will be greater than a replacement. It is the time element that counts most in such cases.

For instance, in mills, factories and railway roundhouses there are special machines whose more or less constant operation is necessary to keep the business going. If a gear in such a machine breaks down it is necessary to replace or repair it immediately, and if no spare gear is available the welder will be put on his mettle to show what he can do. The procedure to be followed in such cases will vary of course with the size of gear and the fractures. If not more than four or five feet in diameter and if badly broken, the following is recommended:

Assemble the broken parts after having cleaned them thoroughly and line them up by the fractures as nearly as possible in the original relations. Make an iron band and shrink it on the rim so as to hold the parts true and firmly in position. If the gear has been broken through the hub these breaks should be beveled before assembling but the other breaks should not be beveled as the fracture surfaces intact will be required to line the pieces up. Having shrunk the band in place preheat the gear in a furnace to low red and weld the hub. Next, burn out the breaks on one side to a depth nearly equal to one half the thickness, and weld. Burning out breaks in cast iron is expensive in time and gas but for emergency work of this sort it is profitable inasmuch as the orginal fractures are required to line the parts up accurately. Having burned out and welded the breaks on one side the gear should be turned over and reheated for burning out and welding the breaks on the opposite side.

It will be noted that welding a broken gear as described is done with the parts held in place by the band which is shrunk on the outside. Care must be taken to prevent the band being overheated when preheating the gear. The effort should be to keep it tight and to prevent it becoming so hot as to give or stretch and thus loosen the grip.

TO GET THE BEST OUT OF A FILE

(Continued from page 23)

sorbed and the file will be in the best possible condition for use upon cast iron.

When the teeth of files are clogged with wood, or other soft substances which has become baked into them, if the file is held in boiling hot water for a few moments, the imbedded substance becomes so loosened that it may easily be carded out of the teeth. If the operation be quickly performed, any moisture remaining will be readily evaporated by the heat retained in the file.

This cleaning is done in several ways: sometimes, in the finer files, by rubbing the hand over them or by drawing them across the apron of the workman; in others, by striking their edge upon the bench or vise; and again, (which is a more common method with the large files), by the use of a strip of old or worn out card clothing, tacked to a piece of wood having a handle shape at one end—a device which is usually rudely constructed by the operator.

The file should be cleaned not only at intervals during its use, but carefully before being laid aside, if the best results are to be attained.

The File Card and File Brush will be found excellent tools, and master mechanics should see that every file-user in their employ is furnished with one or the other of these, and insist that they be used, if they wish to economize in the wear of their files.

Metals like copper, or brass with high alloy of copper, require a very sharp keen file, preferably of specially shaped teeth, just as these metals require a sharp pointed, keener lathe or planer tool. Special work may require a special file, but stock shapes and cuts will usually be found to meet nearly all requirements.

Care in Putting Away

One of the most destructive customs is that of loosely throwing files, fine and coarse, small and large, into a drawer filled with cold chisels, hammers, turning tools, etc., and then throwing the chisels, hammers and other tools on to the files.

When we consider how small a portion of the points of the teeth is worn off by extreme wear when the file is properly used and that to effectually dull them for some kinds of work requires but slight knocking upon a hard substance, it will be easily seen that the evils of this habit should be more carefully considered by the master mechanic, and suitable provision made to avoid its destructive tendencies.

Summarizing the various hints we have the following:—

Select the proper shape and cut of file for the work.

Handle properly.

Have work properly secured and at a convenient height.

Hold file in a manner to give best control.

Keep pressure on file sufficient to keep it cutting—less for a new file—more as it becomes dulled—but keep it cutting.

Keep file clean—a dirty file is a dull file.

Clean surface of work to be filed.

Take good care of your files. Don't abuse them. They are cutting tools.

GRINDING ENGINEERS' WRENCHES

(Continued from page 24)

ground by lever feed in half a minute, but the vertical type machine does it cheaper because 35 pieces can be ground simultaneously, and a laborer can be used to put the work on and off the grinding wheel. Thus the decision becomes largely one for the production engineer, and he must weigh carefully the two methods, before deciding which is the best for the plant to use.

Take as a typical case the grinding of cast iron bed plates for power pumps. These castings were 33 inches wide, by 38 inches long, and weighed 115 pounds each. The total ground surface totalled 100 square inches, and by using the vertical style grinder, the planer time was increased ten times the former figure.

In the example shown at Fig. 4, cast iron gear cases are being surfaced. These cases are 18 inches long, 13 inches wide, and are ground from the rough. They must be perfectly flat for an oil tight joint, yet they are completed in four minutes each. This excels the former planer by 36 minutes.

As previously stated, one could go on indefinitely telling of work performed by the disc grinding process, but we shall leave the subject at the point until some later issue.

FACTS THAT COUNT

Canadians who want to know about their vast country and its resources should secure a copy of a little booklet which the Natural Resources Intelligence Branch of the Department of the Interior has recently issued. "Compact Facts," as it is called, contains in concise form a useful variety of information regarding the Dominion, its extent, capital invested, wages paid, value of live stock, mineral resources, production, etc. Copies are available on application to the Department at Ottawa.

ERRATA

In the special article, in the annual review number of Canadian Machinery, dealing with the automobile industry, the words "total production" appeared over a table of statistics when they should have been "total registrations." Also the figure (I) was set where an (0) should have been, so that a sentence reading that the total number of cars registered in Canada in 1913 was 220, should have stated that the total registered in 1903 was 220.

On page 138 of the special issue appeared a table headed "Census of Knit Goods." This should have read "Census Figures of Woollen Textiles."



WHAT OUR READERS THINK AND DO



Testing of Locomotive Superheater Units

THE USUAL method of testing superheater units by means of the cold water pressure method is to use a pump to obtain the necessary pressure. However, in the Grand Trunk Railway Shops at Point St. Charles, Montreal, a clever apparatus for testing these units has been constructed whereby the pressure is obtained from the regular high pressure hydraulic lines of the shops. This does away with the necessity of a special pump. Two other outstanding advantages are the facts that the work is accomplished in perfectly dry surroundings, and that the water is completely expelled from the units into a pit at the conclusion of the test, which is accomplished in a remarkably short time.

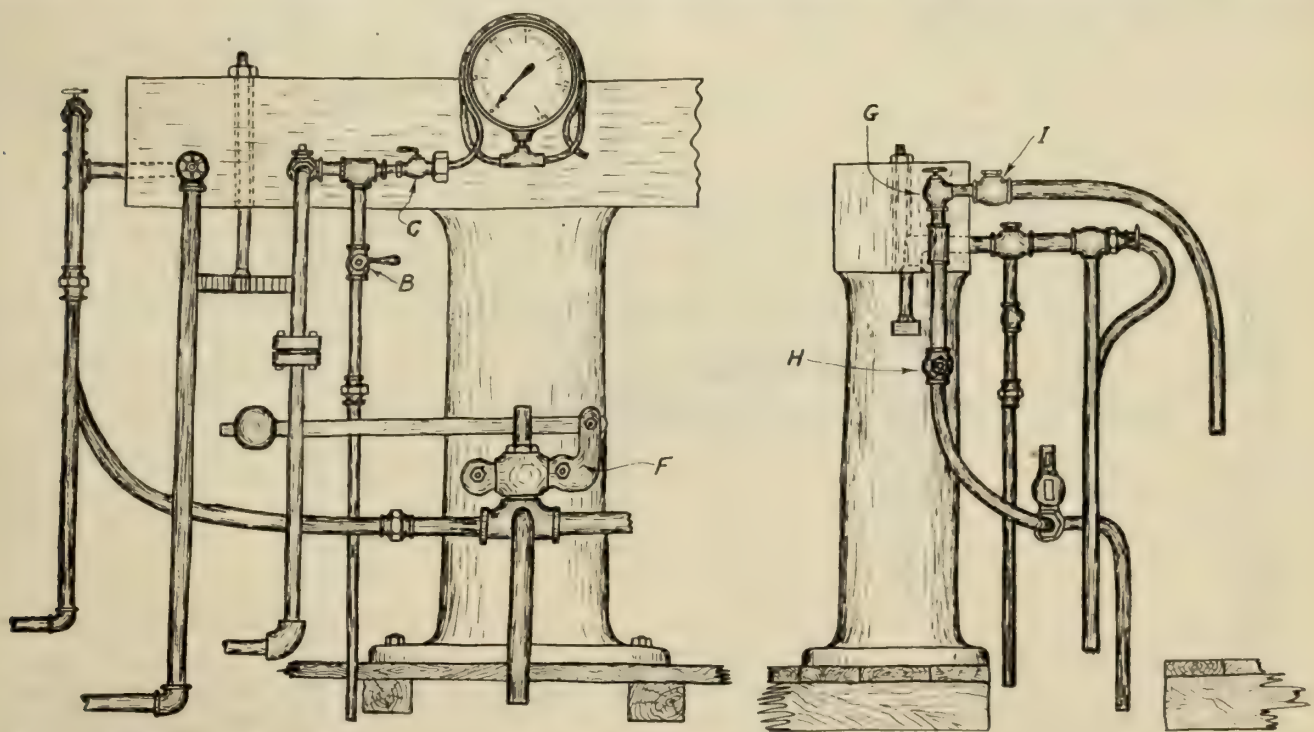
The sequence of operations, perhaps, would be the best method of describing the apparatus and its method of functioning. First the unit is clamped by one "T" headed bolt to one side of a "T" casting which takes the place of the superheater header in actual service. The 45 degrees bevel seat in the casting fits the spherically ground end of the unit. The outer end of the unit is supported on a special adjustable stand.

It might be well to mention here that the apparatus is of a dual nature. There are two sets of seats for units to be tested. While a unit is being removed and another one attached to one side, testing operations are being carried on, on the other side of the apparatus.

As soon as a unit is clamped in position, a valve "A" (Fig. 3) is opened that lets city water into the unit. At the same time the lever valve "B" (Fig. 1.) is opened which permits the air to be expelled from the unit. (It will be noted that water entering one arm of the unit through valve "A" expells air through the opposite side of the unit.) To this latter valve an overflow pipe is attached leading down into a pit below the floor, but the end of this pipe is at the same time in open sight, as will be seen in Figs. 1 and 2. When the unit is filled with water a solid water discharge from this overflow is seen. Then the valve "B" in the overflow line is closed. Immediately the full city pressure is conveyed to the unit, the lever valve "C" (Fig. 1.) is then opened and its corresponding valve on the opposite side of the apparatus is closed. The gauge now registers the pressure in the unit as supplied by the city mains. Following this the city pressure is cut off by closing valve "A".

The gauge is connected to a "T" from which two leads run, one to each side of the apparatus. In each of these two lines of 5-16 inch copper tubing, a small lever operated valve is placed to enable the gauge to indicate pressures on either side of the testing apparatus. Between the ¾ inch city pressure supply line valve "A" and the header casting is a high pressure brass check valve, "D" (Fig. 3.) also the nipple between the check valve and the header is made from high pressure piping. This check valve "D" is to prevent injury to the low pressure lines in the event of the operator carelessly leaving the valve "A" open. It also prevents any wasting of water from the high pressure lines.

The gauge as before mentioned, indicates the pressure in the unit at the time the city supply is cut off. Next, the high pressure valve "E" (Fig.3.) is opened with a detachable handle which fits on the square extension of the valve stem, and water from this line at a pressure of 1,500 pounds per square inch is introduced into the unit through an opening 1-8 of an inch in diameter. The gauge slowly climbs until a pressure of



Figs. 1 and 2, showing both the side and end view.

from 250 pounds to 275 pounds per square inch is indicated. At a predetermined point the weighted relief valve "F" (Fig. 1) is set to open. Discharge from this valve goes into the pit, as shown in Fig. 1. Then the unit is examined all over for leaks. Next the high pressure water is shut off and the overflow valve "B" (Fig. 1.) opened. Following this compressed air is forced into the unit by opening valve "G" (Fig. 2.) ejecting all the water into the pit below.

The unit is then removed, and another inserted. Should a leak develop a welding outfit is used to weld the pipe on the spot and again the pipe is tested. The relief valve is connected to both sides of the apparatus, and by means of two valves it can be placed in the line of the side in use. One of these valves is shown at "H" (Fig. 2.) They are operated by the same detachable crank as operates the valve "E."

Check valves are also provided in the air line so that no water can accidentally be admitted to the air lines. One of these check valves is shown at "I". (Fig. 2.) Each side of the apparatus is provided with separate and independent air, high and low pressure water, and overflow lines, with independent operating valves. The gauge and relief valves only, are common to both sides. They are thrown over from one side to the other by means of valves as shown.

The high pressure line delivering water to the unit is ½ inch high pressure pipe. That is to say it takes ½ inch fittings but the actual inside diameter of the pipe is about 5-16 of an inch. The lines leading to the relief valve are also ½ inch high pressure pipe. This permits of ample protection as the high pressure intake opening has been reduced to a diameter of ⅛ of an inch. Regarding this, it may be stated that a much smaller intake opening would be sufficient, but when using a smaller opening, say 1-32 of an inch, or 1-16 of an inch, difficulty is encountered with small bits of foreign matter in the water, clogging the opening.

The air line is ½ inch standard pipe, and the overflow line from valve "F" is ¾ inch pipe. Originally the seats in the "T" shaped header casting were spherical, in order that they fit the spherically ground ends of the units. These seats sometimes leaked and it was found that a 45 degree bevel seat, giving line contact gave practically perfect results.

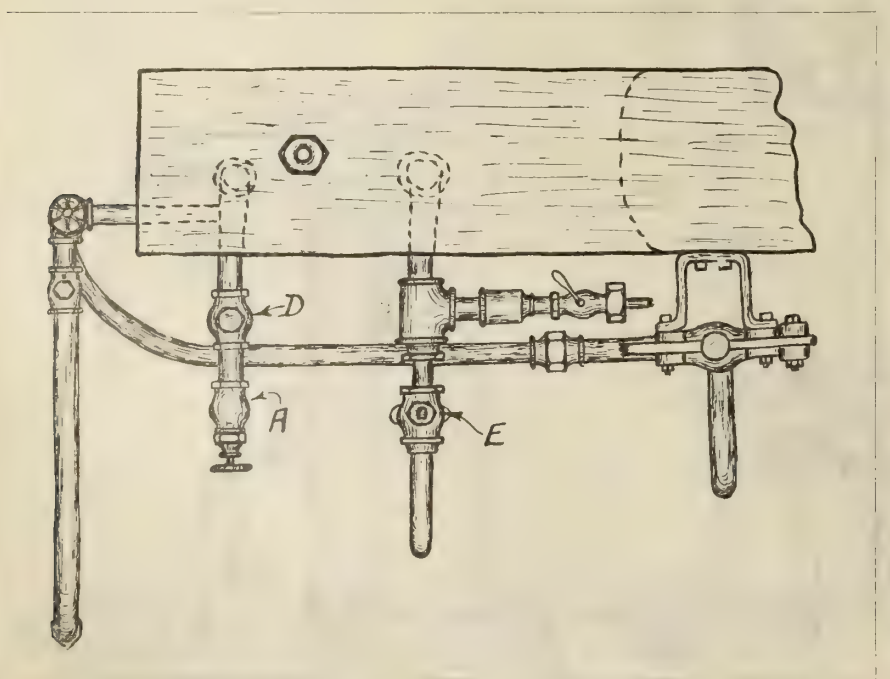


Fig. 3—A Plan View of the Apparatus.

QUICK PULLEY COMPUTATIONS

By W. F. Schaphoist

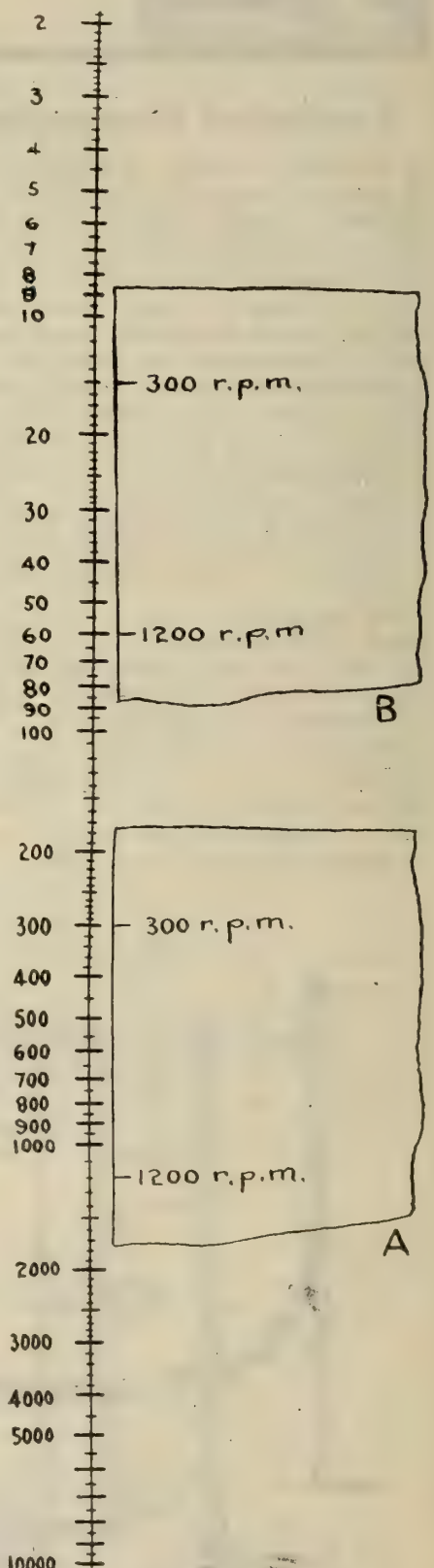
(All Rights Reserved)

The simple chart shown does away with formulas for making pulley computations. It will be found to be exceedingly quick. Just slide the slip of paper from position "A" to position "B" and the problem is immediately solved.

For example:—A motor running 1200 r.p.m. is to drive a line shaft at 300 r.p.m. What sizes of pulleys should be used? On the slip of paper in portion "A" make marks opposite the 300 and the 1200 as I have done. That's all you need do; but if you want to write down "300 r.p.m." and "1,200 r.p.m." also, all right—it doesn't make any difference.

Then slide the slip of paper up to wherever you want it. Position "B" shows that pulleys 15 inches and 60 inches in diameter respectively will do the work very well.

If those diameters are considered too large just shove the slip a little higher and choose the best diameter. No matter where the slip is placed, the ratio is always correct—no figuring is necessary. The chart also lends itself readily to the solution of such a problem as —knowing the pulley diameters, and knowing the speed of one of the pulleys, what is the speed of the other pulley?



This chart could well be clipped out and pasted to a piece of cardboard for general use.

Recent Developments in Mechanical World

Stainless Steel For Turbine Blades

STAINLESS steel, which was discovered in the research laboratory of a British steel works, has been developed recently in quite a number of engineering directions. One of the most successful is in connection with the blades of steam turbines. Hitherto these blades have been made of 5 per cent. nickel steel, which was the best known substance for the purpose. Nickel steel, however, was found to corrode and wear away under the action of the steam, and it occurred to the inventors of stainless steel that it would be worth while trying whether the new material would stand up better than nickel steel. Accordingly several stainless steel blades, together with some new nickel steel blades, were inserted in a steam turbine more than a year ago. When the turbine was again opened recently the stainless steel blades were found as clean and smooth as on the day they had been inserted, while the nickel blades were deeply pitted and their edges badly worn away. A British electrical engineering firm made a similar experiment for a longer period with the same result. As the pitting of turbine blades reduces the efficiency of the machine and involves costly replacement, it is practically certain that stainless steel will supplant nickel steel for this purpose. Apart from engineering uses, the most popular new application for stainless steel appears to be in connection with golf clubs. For this purpose stainless steel is ideal. Other familiar uses include mirrors, fenders, fire irons, knives, scissors and surgical instruments.

The Production Of Liquid Air

THE essentials of a plant producing liquid air by the Hampson process are the compressor, purifying train and liquefier. The compressor, usually of four stages, delivers air at room temperature and approximately 3,000 pounds per square inch. The compressed air purifying train consists of first, a trap for receiving oil and water, and secondly, suitable containers which are charged with chemical reagents, such as sodium hydroxide, calcium chloride, or lime, for removing carbon dioxide and water vapor. The air thus compressed and purified, says Scientific American, is delivered to the liquefier, in which, after passing through a coil of copper tubing, the air is allowed to expand freely to approximately atmospheric pressure. Where this drop in the pressure takes place there is a corresponding drop in the temperature of the air. The expanded air, before leaving the liquefier, is caused to circulate around the copper coil which contains the compressed air, thus cooling the coil and, in turn, the compressed air so that on continuous operation a cycle of progressive cooling is maintained until the temperature ultimately reaches the liquefying point. The liquefier is so constructed that the air which is condensed to liquid is delivered into a receiving vessel. The gaseous air exhausted from the liquefier is returned to the intake of the compressor for succeeding cycles because it has been purified, and when used repeatedly will be less exhausting on the purifying reagents. For laboratory production of liquid air this process leaves little to be desired.

New Oil-Gas Burner

A DEMONTRATION was given in London, England, of a new type of burner for use with oil. The oil is first converted into gas in a chamber filled with nickel gauze heated by the flame. The oil gas then passes through a regulating valve and issues as a jet which carries with it the air required for combustion. The mixture then passes into another chamber, where it is still further heated; and it issues from orifices arranged according to the services required. No carbon forms in the burner, and it does not require cleaning. This invention is said to be adaptable either for heating or lighting in conjunction with an incandescent mantle.

Important Coal Deposits

FROM a report to the dept. of Overseas Trade, we find that the most important coal deposits in Mexico are at Sabinos and Coahuila, and are estimated to cover about 400 square miles. The coal is of a good coking quality. About 1,000,000 tons per annum were mined before the revolution, but the output has now fallen to about half. All the coal produced is used in the country, the bulk of it being consumed on the plateau; foreign coal is imported on the coast. The coal reserved in the country is estimated at about 100,000,000 tons.

The Marvels of Aluminum

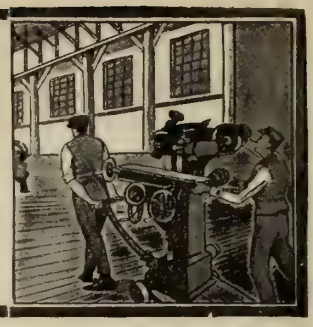
SINCE aluminum was produced in a commercial form the greatest interest has been taken in its application to various engineering structures where lightness with strength is desirable. It was soon found that when aluminum was alloyed with other metals its strength was greatly increased without any great change in weight. Various alloys of aluminum have been used in the structure of airships and aeroplanes, and the results have been so promising that a special committee was formed in Great Britain to undertake systematic research of the properties of aluminum alloys. A report recently issued by this committee embodies the results of seven years of research conducted in the National Physical Laboratory, which is subsidised by the British Government. This research has resulted in the discovery of many alloys which are of great promise for practically all kinds of engineering, particularly automobile manufacture, railway rolling stock, internal combustion engines and steam engineering. The only problem awaiting solution is the production of these alloys on a commercial scale. Already a beginning has been made in this direction by a British Government factory; and manufacturers are looking closely into the possibility of producing some of these substances for regular use in place of steel.

Smokeless Fuel

FOR YEARS a number of inventors in Great Britain and elsewhere have been trying to solve the problem of producing from coal a smokeless fuel which can be satisfactorily burnt in the ordinary open grate. The method adopted is to distil the coal at a lower temperature than is used in the ordinary gas works. When this is done, gas is produced together with valuable oils and other by-products, leaving a material which is roughly midway between coal and ordinary coke in composition. Many difficulties were encountered in the attempt to make this process mechanically good and commercially sound. These difficulties seem to have been overcome in a large installation now at work in Great Britain, capable of treating about 36 tons of coal per day. The fuel produced is hard enough to withstand ordinary transport and it burns brightly in a grate, giving off a large mass of radiant heat, and showing no trace of smoke. The success of this installation depends mainly upon an ingenious arrangement of the retorts. When coal is distilled at the low temperature mentioned it expands, and this expansion in the retort is apt to make the resulting coke very friable. In the new installation, however, the retort is fitted with a double internal partition; and as the coke expands the two parts of the partition are brought together giving room for the expansion and enabling the coke to retain a firm structure.



DEVELOPMENTS IN SHOP EQUIPMENT



PORTABLE PNEUMATIC TURBINE GRINDER ATTACHMENTS

The small pneumatic turbine recently placed on the market by the Onsrud Machine Works of Chicago, Ill., and described in these columns, has been fitted with two interesting attachments. One of these attachments makes a bench grinder of the machine, and it is thus capable of handling a large variety of light grinding. The other attachment makes the turbine grinder suitable for the accurate grinding of 60 degree centres. A detachable plug is inserted in the spindle of the tail stock of a lathe or other machine, and a bracket mounted on this plug holds the grinding wheel at the proper angle so when the tail stock is advanced on the centre the latter will be correctly ground. The tail stock plugs make the attachment applicable to both large and small machines.

NAMEPLATE "DRIVE-SCREW

The Parker Supply Co., of New York City, have recently placed on the market a "drive-screw" which was designed to present an easy and inexpensive method of permanently attaching nameplates, trademark plates, etc., to machine tools and other articles. The screw has a round head but is not slotted. The threads have a very coarse lead and the shank is somewhat smaller in diameter than the root diameter of the thread, for a short distance beyond the threaded portion. This cylindrical pilot is inserted in a hole slightly larger than diameter drilled in a machine to which it is desired to attach a nameplate. It is simply necessary then to strike the screws a blow with the hammer. These screws are hardened and heat-treated and the threads readily cut their way into iron castings, and as the heads are not slotted the screws are not easily removed by any person desiring to substitute another nameplate.

DOUBLE-HEAD HOLE GRINDING MACHINE

The Bryant Chucking Grinder Co., Springfield, Vt., have recently designed a hole grinding machine that is somewhat of a departure from standard practice, in that it carries two heads, one on the left hand, and one on the right hand end of the frame, also a chuck centrally located between the two heads. The machine was designed primarily for grinding piston pin holes in gas engine pistons. It is said to cut the time of this operation in two. The spindles through a special feed mechanism, can be arranged so that they will be fed automatically in the same direction, or in opposite directions. Holes can be ground from each end, cutting the time almost in half and avoiding excessive overhanging of the spindle which is the principal cause of bell-mouthing. A special diamond wheel trueing device is mounted on the machine as regular equipment so that finishing cuts can be taken while using both spindles. There are many innovations in connection with the feed mechanism which permits of a wide range of application to accommodate work of a diversified nature.

The machine weighs about 2,300 pounds and occupies a floor space of 3 feet by 6 feet. Pistons up to 4½ in. diameter and 4½ in. long can be accommodated. The tool is regularly supplied with a countershaft drive, but if an independent drive is required a 3 h.p. 1,720 r.p.m. motor is recommended. The standard equipment includes two standard internal wheel heads, an assortment of wheels, diamond and holder, countershaft and necessary wrenches.

GARAGE STAND

The Western Tool and Mfg. Co., Springfield, Ohio, have recently placed on the market a three-deck garage stand, under the name of "Champion." The bottom and top decks of the stand are trays for tools, the middle deck contains a number of pockets for small pieces, such as nuts, bolts, screws, etc. The three decks are substantially held together by means of a pipe frame. On the top deck is mounted one of the company's vises. Underneath the top deck is a drawer provided with a hasp and lock in which tools can be placed. A brake is provided, which can be easily operated by means of a lever located under the vise. When locked the brake prevents movement of two of the four casters on which the stand is mounted, thus providing a substantial work-bench. The height of the stand is 39 inches, the length of the top shelf is 42 inches and the length of the middle and bottom shelves is 43 inches. The width of the top shelf is 14 inches. The middle and bottom shelves are 26 inches wide. The drawer is 14 x 14 x 4½ inches.

MARKING MACHINES

A machine for rolling names and patent marks on small tubing has recently been brought out by the Noble and Westbrook Manufacturing Co., Hartford, Conn. The machine is power driven through a three-step cone pulley, the final delivery being through a worm and worm gear. The machine is equipped with a round revolving table mounted in a horizontal plane. This table is divided into six equal parts, each having a vertical mandrel upon which the work is fed by hand. As the table revolves it passes the work over the die and makes the mark. A cam next raises a lever, ejecting automatically the work from the machine. The operator has only to feed the work on the mandrels. A production of 10,000 pieces per day has been estimated. The machine will mark short lengths of any size pipe, and its weight is about 90 pounds.

ELECTRIC PORTABLE DRILL

The Black and Decker Co., Baltimore, Md., recently announced the development of an additional electric drill to their line of portable machines. The new drill has an aluminum alloy housing, and is provided with a universal motor which operates on either direct or alternating current at 110 volts. Motors which operate on 32 volts or 220 volts can be supplied on special orders. A die cast aluminum alloy fan is keyed to the armature shaft thus providing ample air for cooling the motor. Double-reduction, stub-tooth, heat-treated, chrome nickel steel gears, running in grease, are provided. The control is by means of a pistol grip and trigger switch. The chuck is of the three-jaw, geared-nut type for straight shank drills up to ½ inch in diameter. The net weight of the drill is 15 pounds. Standard equipment supplied includes 14 feet duplex electric cable, attachment plug, combination spade handle and breast plate and detachable side handle.

The terminal connections are fully protected, but by removing two screws a cover plate can be lifted off exposing these connections. Thus a cable can be quickly renewed. This drill fits the B & D post drill stand this enabling the machine to be converted into a bench drill very quickly.

VERTICAL SPINDLE SURFACE GRINDER

The Badger Tool Co., Beloit, Wis., have recently placed on the market a large type of disc grinder, of the vertical spindle type. The disc wheel is 42 inches in diameter, being made of steel, and completely faced with a special abrasive compound ½ inch in thickness. This compound is moulded directly on the steel disc wheel. The machine is direct motor driven, the motor shaft serving as the spindle. Special rigid dust proof end yokes are provided, also forced lubrication, radial and thrust ball bearings. A twenty horse power motor with a speed of 600 r.p.m. forms the regular equipment. A circular dust channel completely surrounds the periphery of the wheel and terminates in two openings to which the dust exhaust system is attached. This exhaust channel is completely exposed by removing the outside guard ring which forms the top wall of the dust channel.

Stop bars are attached to the guard ring to prevent work from revolving with the disc wheel. The machine is accessible from all sides so that when small parts are being ground, several operators can work at the same time. The weight is about 3,800 lbs. A chain hoist helps to speed up production.

ELECTRIC HOIST

The Shepard Electric Crane and Hoist Co., of Montour Falls, N. Y. have recently placed on the market an electric hoist. The crane is designed to operate on an overhead runway and can be easily attached to a standard "I" section of the proper size. A fully enclosed motor is furnished with interchangeable frames for direct and alternating current. The motor was especially designed and developed for hoist work, it being carefully insulated and impregnated to protect it from moisture.

The direct current motor is of the standard, series wound, interpole type. The no load speed is twice that of the full load speed, so that a light hook is handled twice as quickly as a full load. The induction motor furnished for alternating current may be either the squirrel-cage or the slip-ring type. The squirrel-cage motor is used with the single speed control and the slip ring type with the variable speed control. As just mentioned, single speed and variable speed controllers can be furnished for either type of motor. The direct current variable speed controller gives from eleven to thirteen speed changes according to the size of the motor. When alternating current is used eight running speeds are available. The controllers, like the motors, are readily accessible although fully enclosed and well protected against dust and moisture. All parts of the mechanism, including the resistance, can be removed without disconnecting a single wire. The contacts and brushes can also be removed without disturbing other parts of the controller. A mechanical brake of the multiple disc type is provided, the function of which is to automatically hold the load when the motor is at rest. It also prevents excessive speed when lowering. An electric brake of the multiple disc type brings the motor promptly to rest when the current is cut off intentionally or otherwise. An automatic limit switch prevents overrunning of the load hook.

NUT CHAMFERING MACHINE

The William H. Haskell Mfg. Co., of Pawtucket, R. I. have recently developed and placed on the market a machine for chamfering cold-punched square and hexagonal nuts from ¾ to 2 inches. The machine is made in two sizes. The nuts are placed in a chute at the front of the machine from which a feed-finger takes them, one at a time, and places them on a hardened steel die. While on this die they are chamfered and then ejected into a truck or other receptacle.

COMBINATION VISE, DRILL JIG AND MILLING FIXTURE

The W. B. U. Tool Co. of Worcester, Mass., have recently brought out a combination vise, drill jig and milling fixture which is designed to hold work with accuracy. The vise is designed to hold work on which two or more cuts are to be taken at different angles and such operations can be accomplished without resetting the work. Adjustments to the jaw as well as to the swivel base are provided and graduations throughout the whole 360 degrees are also available. The equipment is especially suited for use on those machines where work can be tested with a square directly from the work-table. The equipment is provided with a solid drill bushing plate having eighteen holes ranging from 7-64 of an inch to 3-8 of an inch in diameter. Round, square or flat stock can be accommodated in the vise by "V" blocks or other special plates to accommodate the above mentioned shapes. Round stock from 5-16 to 1 inch in diameter can be accommodated. Screw adjustments are provided throughout. When the vise is used for filing operations it is unnecessary for a toolmaker to remove the work frequently in order to ascertain whether it is being filed square, as reference can be made directly from the plane surface, on which the vise may be placed.

SCREW-BLADE PROPELLER BLOWER

The Coppus Engineering & Equipment Company of Worcester, Mass., have recently placed on the market a screw-blade propeller blower, suitable for a variety of applications. It is being marketed under the trade name of "Vano". The blower is equipped with an air turbine dryer or can be driven by means of an electric motor. The air is delivered from the blower in the same direction as that in which it enters. The principal feature is a stationary guide vane beyond the propeller which has individual blades that radially sub-divide, without shock, the air currents leaving the propeller. These blades, which have a curvature that increases in the direction of the propeller rotation, concentrate the air current and give it a further acceleration inside the stationary guide vane, so that a considerable portion of the pressure is produced in the latter. A large part of the end thrust is thus taken up by the stationary guide vane casing. The air streams into which the flow of air is subdivided by the blades rotate slightly as they leave the guide vane casing, and converge toward the axis so that the smallest section of the air flow is beyond the casing.

COMBINED WORM AND SPUR-GEAR SPEED TRANSFORMER

The Nistisch Gear Works of Brooklyn, N. Y. have recently placed on the market a speed transformer which by changing the ratios of the gearing speed reductions ranging from 75-1 to 600-1 can be accomplished. The case is of cast iron and is oil tight and rust proof. The application of this speed transformer is said to be very wide.

MOTOR-DRIVEN BLOWER UNIT

The Chicago Flexible Shaft Co., Chicago, Ill., have combined the Stewart positive-pressure blower with a motor on a common base-plate to supply an apparatus which will serve a heat-treating furnace independently of the main power plant. The application of the apparatus is where it is desired to run a heat-treating furnace without starting up the main plant. It is also particularly adaptable for installations in remote quarters. Four regular sizes are manufactured which accommodate blowers Nos. 3 to 6 with motors varying in power from 1 to 2½ horsepower. The motors for the standard equipment are supplied in varying types to accommodate various conditions.

A NEAT GAS ENGINE ACCESSORY

It often happens that when the spark apparatus of a gas engine fails the magneto is alleged to be at fault, whereas the trouble is due really to imperfect insulation. A British firm has brought out a simple appliance for testing the insulation without dismantling. This appliance consists of a handle carrying a stem on which an insulated plug and a pivoted lever are united by means of simple connections. The magneto may be tested for spark and the pole-piece for leakage.

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The Value Of Courtesy

AMONG the entries which should appear on the credit side of every business firm's ledger is the word courtesy. It is an asset and may be capitalized.

With the keen competition which modern conditions and methods have brought about has come a public temperament of quick and keen impression. It is susceptible to politeness, to attentiveness and to finesse of manner, the abrupt, indifferent or churlish person has no place except at the tail end of the line. Even there his legs will eventually prove too weak to carry him far.

Courtesy is an intangible factor. Its value cannot be easily measured or appraised, but it is just as essential in the factory, shop, office or wareroom as is quality in steel. Men who rise to responsible executive positions early learn its importance. They also develop its power and are constantly appreciative of the employee who displays the virtue which lifts a man above his fellows.

One of the first attributes of a boy entering an office with the hope of securing a position, is courtesy. The word should be written on the face of every traveler as distinctly as his name is printed on a calling card. Presidents and general managers generally realize its meaning long before they rise to places of trust. The higher they get and the wider their experience, the more they employ it in relation to the highest or lowest around them.

What big men have found it wise to do, smaller men should consider it worth while to try.

The File Is a Cutting Tool

ON ANOTHER page of the present issue will be found an article containing various hints and suggestions regarding "Filing." Mechanics as a rule are apt to look upon a file as something which can be used a few times, thrown away, and another secured. They give little thought to the cost, feeling that—well, the management pays for them.

The result is, that the manufacturer views with alarm the number of files purchased every year; makes up his mind the brand used is of poor quality, and switches over his trade. If he does not do this, he at least refuses to purchase more than a certain number every year, with the result that the workman himself, as well as the maker of the file, suffers.

If the manufacturer turns his trade over to someone else, the file maker is the loser, for his product may be equally as good, if not better, than the new ones purchased, but the workers have not been giving them a fair chance. On the other hand, should the number of files ordered be reduced, the efficiency of the worker drops. The task of working with a blunt file is irksome, so that the temper of the employee is also to be reckoned with. All these troubles can be avoided if the mechanic will only take to heart the suggestions contained in the article in this issue, together with the portion which appeared last week.

A splendid point brought out in the article is the first use of a file. Were mechanics, shop superintendents, and executives generally, to study their filing operations they would find that many files thrown away as useless could be used to good effect on some minor operation. The chilled edge of iron castings has spoiled many a good file, the name and manufacturer being roundly cursed, instead of the workman who used it in such a manner.

When executives see that every file used has a suitable handle, that work benches are at a proper height, that every worker is provided with a card and brush, and above all, that mechanics are educated to understand that a file is a fine cutting tool and requires care to produce its best work, then a great step forward in efficiency will have been made.

That Canadians may well look forward to the future with confidence is the view expressed in a public statement issued on December 21st by Sir Henry Drayton, Minister of Finance, in a review of the financial situation of the Dominion. Business conditions, he says, have slowly but surely improved during the past year. Notwithstanding a year of falling values and business difficulties, the finances of the country have wonderfully maintained themselves. The revenue, exclusive of railways, instead of falling, as of December 1st, has actually increased. Generally speaking the returns give reason to believe that Canadians can face the next year with a feeling of optimism.

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MARKET DEVELOPMENTS



Mills Operating at Better Rate Than Expected

Steel Mills Did Not Close for Holiday and Production Has Been Held—Buyers Stocks Are Low and Business is Expected From That Quarter—Strip Steel Down in Price

A MORE optimistic spirit exists on the market. Pittsburg reports that the mills are operating at a better rate than was expected, in fact there is a probability they will be producing at a still higher rate about the middle of the month.

Buyers' stocks are low so that business is looked for in that quarter. While dealers are not expected to stock up to normal, the mills look for them to purchase up to 70 per cent. normal anyway.

The American Steel & Wire Co. has reduced its price on cold rolled strip steel from 3.75c to 3.50c. Continued price cutting by independents is responsible for this change.

Connellsville coke is softer all around, and the demand for foundry coke has been very poor since the middle of December, prices ranging from $3.75 to $4.50 according to brand. There is a movement existent for $4.00 and $4.25 coke, the theory being that foundrymen are jealous of what business they have and will not take chances on quality of product for the sake of saving a trifle on the coke used.

Montreal reports that the recent contract for Government Ice Breaker has been cancelled. No reason is given for this move. The various markets are very quiet in this district, although building operations are picking up.

Business is a little better in Toronto. Dealers are more optimistic regarding the future and feel that better times are coming. They realize, however, that to secure business they will have to go out after it. The small tool market expects a decided improvement shortly, when factories have completed their stock taking.

STEEL PRODUCTION BETTER THAN EXPECTED—STRIP STEEL REDUCED

PITTSBURGH, Jan. 9, 1922—The outstanding feature of the steel situation this week is that the mills are operating at a better rate, and have more business on books, than would be expected from the reports given out quite universally in December of there being a very dull market in steel products. Production and shipments, of course, constitute the crucial test of conditions in steel. Sometimes mills are disposed to paint the picture of their condition in colors that are somewhat too bright, but now it appears they have been selecting more sombre colors than were justified. Perhaps the explanation is the highly competitive market that has existed for months, the individual mill now being fearful lest its competitors think it has acquired more business than its share, and accordingly turn in and compete more strenuously still.

There has been very little closing of mills over the holidays, not enough to make any material difference in a month's production of the industry, and there is a distinct possibility that mills will be operated at a higher rate at the middle of this month than they were at the beginning of December. If this occurs it will be due to buyers having started to replenish stocks, which they reduced to the absolute minimum, far below normal, as the old year closed.

While the Carnegie Steel Company may not be a criterion of the industry as a whole, its case is important since besides being the largest subsidiary of the Steel Corporation, it is the biggest steel producing company in the country. In December the Carnegie Steel Company booked more business in actual shipping orders, than it filled, and December was the only month of 1921 in which it made such a showing.

Buyers' Stocks

At the beginning of 1921 many buyers had stocks of no small importance and some buyers added to stocks in January and February, not slowing down mill deliveries to them in keeping with the decrease in their actual consumption. Afterwards there were the most strenuous efforts to liquidate stocks. It was during this process of liquidation that steel production, at the middle of July, fell to a rate of no more than 20 per cent of capacity, represented by a rate of steel ingot production of barely over 10,000,000 tons a year. So low a rate could not possibly be representative of actual ultimate consumption, even if business generally was decidedly dull.

Probably the last of the excess stocks were liquidated by some time in October, that being the estimate of one very well posted observer. All buyers desired to have their inventory December 31, as low as possible, for a variety of reasons. There was the financial reason, and then there was the uncertainty in the minds of many buyers as to prices, and finally there was the natural desire, after the unusual times for two years previous, to get down to bottom and make a fresh start.

Tendency to Build Up

It is quite certain that stocks of practically all buyers are very low, and much below normal. There is a strong probability that there will be a tendency on the part of many, if not to a great majority of buyers, to build up stocks, not necessarily to normal or the average of previous years, but at any rate to an amount that will enable business to be conducted smoothly and efficiently, which is not the case when a large distributor or manufacturing consumer is constantly running to the mill with an order for a mixed carload to be rushed, and that is substantially what buyers have been doing for the past few months.

One can go farther than to say that this is a strong probability, for it is a fact that in some important cases the process of building up stocks has begun, in that orders were placed in December for shipment after January 1, for stocking-up purposes. One estimate is that buyers who adopt this policy will aim to restore their stocks to 70 per cent

of the quantity they have previously considered normal, or average.

Stocking up along this line probably represents the first improvement the steel industry can expect in demand, over and above the demand it has had in the past three months, represented by a mill operation at the rate of about 23,000,000 tons of ingots a year. Too much emphasis can hardly be laid upon the fact that this rate does not necessarily represent any increase in actual ultimate consumption over the early months of the year, even though it compares with a rate as low as about 10,000,000 tons at the middle of July and a production for 1921 as a whole of between 19,500,000 and 20,000,000 tons, for in 1921 there was a liquidation of large stocks.

It follows that something like 23,000,000 tons a year represents the minimum of steel demand, upon which there can be a building up or increase, as buyers replenish stocks and ultimate consumption increases by underlying financial and commercial conditions improving. A rate of 25,000,000 to 30,000,000 tons in steel ingot production may be attained before summer.

It is much better to look at mill operations from this tonnage standpoint than constantly to reduce the tonnage to a percentage of "capacity," for it is not proved that the capacity needs to be busy in order that the country be busy consuming steel. Many more people are engaged in consuming steel than in producing steel, and estimates of general activity should be based on the consumption of steel rather than on the percentage of productive capacity that is active. The productive capacity has doubled since 1910, but it does not follow that it requires twice as much steel to make consumers busy. The capacity is estimated now at 52,500,000 tons of ingots a year.

Reduction in Price

The American Steel and Wire Company has reduced its price on cold rolled strip steel from 3.75c to 3.50c, on account of continued cutting of the 3.75c price by independents. Otherwise nothing at all has occurred in the matter of steel prices in the past week. The market is really quite steady, both in that few changes are occurring in quotable prices from time to time, and in that the ordinary market prices are subject to much smaller concessions, for large and attractive orders, than was the case a few months ago.

To illustrate, the open or regular prices on bars, shapes and plates last August were several dollars a ton higher than regular prices now, yet a very large order could possibly be placed at as low a price then as now. The great increase in market steadiness is likely to encourage buyers to take hold in a broader way, instead of doling out orders for single carloads each at the last minute.

The market is quotable as follows: Bars, shapes and plates, 1.30c; hoops, bands and hot rolled strip, 2.00c; plain wire, 2.25c; wire nails, $2.50; standard steel pipe, 71 per cent basing discount; black sheets, 3.00c; galvanized sheets, 4.00c; tin plates, $4.75. Blue annealed sheets are not closely quotable. The lighter gauges seem to be on a base price of 2.25c while the heavier gauges appear to be chiefly a plate mill proposition.

Pig iron remains dull and quotable at $20 for Bessemer, $18.25 for basic and $19.50 to $20 for foundry, f.o.b. valley furnaces, freight to Pittsburgh being $1.96.

While $3.25 to $3.50 was done recently on furnace coke contracts for first quarter, $3.25 could be shaded at the present time, while spot can be picked up in small lots at down to $2.75. Demand for foundry coke has been particularly poor since the middle of December, prices generally ranging from $3.75 to $4.50, according to brand. A point about the market is that while usually the major part of the business is done at the lowest prices, just now there is more movement in $4.00 and $4.25 coke, the theory being that foundrymen are very jealous of what business they have and will not take chances on quality of product for the sake of saving a trifle on the coke used.

POINTS IN WEEK'S MARKETING NOTES

Locally, the steel business is in fairly good shape. Orders are not very frequent, but stocks are both low in quantity and price. This is an off season for the steel trade and lack of orders was expected. The chief point is that dealers are more able to cope with the situation than they were at the beginning of last year.

The metal market expects an improvement shortly, and small tool dealers are likewise looking forward to better business. The machine tool trade locally is not very brisk, but dealers are hopeful as to the near future.

Pittsburgh reports that the steel industry is in better shape than was expected. The mills have not closed over the holidays as was expected, therefore the production rate has kept up. In fact there is a possibility that the middle of the month will see a still higher production rate.

Dealer and buyers generally are expected to build up their present low stocks to about 70 per cent normal, according to Pittsburgh. This would mean a steady flow of business to the mills.

Cold rolled strip steel has dropped in price from 3.75c to 3.50c. Price cutting is responsible for the change.

The recent order for a Government Ice Breaker at Montreal has been cancelled. It is said that an Ice Breaker intended for the Russian Government has been substituted

Building operations in Montreal district are improving. Conditions in Nova Scotia are quiet, the Dominion Coal Co. operating only two days a week. All other lines in Montreal market are very quiet.

ALL MARKETS ARE IN BETTER SHAPE

TORONTO, Jan. 9, 1922. Although very little business is being closed on the local market, conditions generally are much better than they were a year ago. For example, take the iron and steel situation. At this time last year, dealers found themselves with a very heavy stock of high priced material, or rather, steel which was purchased at high prices, but could not be marketed at anything near the purchase figure. During inventory dealers had to incur very heavy losses, with the result that the market was in poor shape.

Sheets bought at current prices, dropped overnight; other lines made similar spectacular dips, leaving the buyer in a quandary as to the proper time to place his order. To play safe, he withheld his business up to the last possible moment, the dealer being the loser. So much for 1921.

Today we find dealers taking inventory once more, but in this case stocks are low, both in quantity and price. Not that the supply on hand is inadequate, but simply that dealers have followed out a careful policy throughout the year.

As one merchant put it: "We have incurred several losses during 1921, but they have all been marked off. What happened last year is a closed book, so far as we are concerned. Our stocks are just of the correct proportions. It is material purchased at a reasonable figure, so tha we have brought our prices down to present levels, without difficulty."

Improvement Expected

Everyone in the steel business is convinced that the present year will be an improvement over the last, but that this upward tendency will only come through hard work. "We've got to dig deep to get the business," is the way one dealer put it. Steel men realize that the small town business, namely "Farmer" trade, will be poor this year. The farmer has had a tough time of it during the past season, and he is not going to spend any more money than he can help.

Another large user of steels, the agricultural implement manufacturer, is feeling the present depression, with the result that dealers are practically eliminating them from their list of possible buyers. In fact we were told on good authority, that a certain implement fac-

tory had actually more bars to SELL than a local steel dealer has in stock. As long as this condition exists, merchants cannot look for business from that quarter.

In spite of the above, the steel market, taken as a whole, is in much better shape than the spring of 1921, and as mentioned before, dealers are convinced 1922 will see an improvement, but only a gradual one.

The Metal Market

Metal merchants are up to their eyes in stock taking. This market is also in a much healthier condition than it was last year, and dealers feel that better times are ahead. They do not expect them to improve at once, but look for a gradual upward trend. There are no changes in price, the market remaining firm in all lines. Another two or three weeks should see a strengthening tendency in various lines, according to some dealers in this business.

Machine Tools

It is almost too soon after the new year to expect much improvement in the machine tool market. Several interesting enquiries are being received which look like good business in the near future. One dealer has secured additional space for the placing of new machines in stock and, as he says, "this step should show conclusively that I believe the Canadian machine tool market has a prosperous future. We will have to go out after business," remarked this dealer, "and I feel sure we will find it eventually." There is a better feeling on this market which is worth noting.

Small Tools

Dealers in the small tool lines are simply marking time. They feel that until manufacturers are through inventory there is not much chance for them. Once the stock on hand is compiled, the various plants will be sending out their requirements, and the small tool market will pick up accordingly.

IMPORTANT CONTRACT CANCELLED BUSINESS IN ALL LINES VERY QUIET

MONTREAL, Jan. 9.—The first week of the New Year has been one of the quietest of many years, in the metal working industries. The production of steel is at a low point and the price continues to be correspondingly weak. Owing to the general dullness of the times many firms have closed down for short periods, and do not exhibit any great desire to re-open their premises. Business in merchant bars and structural steel shapes has fallen to a very small volume. For the last few weeks the amount of trade in sheets and plates has dropped off a great deal. Other lines of steel are quiet, more so than usual, as business has not been resumed in a normal way since the interruptions of the holiday season.

The recent ice-breaker contract placed with Canadian Vickers' has been cancelled. No definite reason is given, but the fact remains that this much desired order has for the time being, at least, vanished into thin air.

Industrial Conditions

Building operations in the city of Outremont amounted to $1,297,115 for the year 1921, which figures have only once before been exceeded, and that was in 1913. Building prospects for this city in the coming year are very good. Over $400,000 worth of building is already contemplated for the early spring.

Industrial conditions in the Eastern Townships appear to be in good shape, and the city of Sherbrooke reports a very satisfactory year.

The large engineering industries in and around Montreal have not had a very successful year, as was to be expected. These concerns, have in most cases made net profits, but in order to fully meet the demands of dividends on their stocks and bonds, have been compelled to draw upon the large reserves built up in the last few years.

Conditions in Nova Scotia continue to be very quiet. The Dominion Coal Company are operating only two days a week pending a settlement of the wage disputes.

The pig iron producers have experienced one of the quietest weeks in their history. There are no new developments in prices while the demand has fallen off to practically nothing.

Machine Tools

In the machine tool field, business is equally as quiet. It was a foregone conclusion that there would be little moving in machine tools before spring, so present conditions were not unexpected.

The small tool and supply business has suffered badly during the last few weeks, but there is every prospect that it will soon improve when machine shops are re-opened.

Metal Market

Non-ferrous metals are very quiet. Practically no business is offering, and no changes in price have been noted with the exception of aluminum, which is gradually coming down, following the lead set by the other metals some time ago.

The scrap metal market remains as before, no activity in any line being evident.

Did you ever do repairing and lose money on it? Read in the January 19th issue of Canadian Machinery how it can be done at a profit. The special article will be "Repair Jobs that made us a Good Profit."

AUTOMOBILE INDUSTRY IN GREAT BRITAIN

"The automobile industry of the United Kingdom is passing through the most trying period in its history." This is how Trade Commissioner J. E. Ray at Manchester, England, sums up the automobile situation. Inquiries instituted among the manufacturers in Manchester and district reveal very discouraging conditions unrelieved by any promise of better times in the immediate future. The high costs of production and the general slump in trade are responsible for the dearth of orders. Further, optimism during the trade boom of 1919-20 swelled the sources of supply, so that the manufacture of automobiles and transport vehicles was overdone. In 1919, trade journals and newspapers, inspired probably by the example of producers in the United States, were insistent upon mass production as an indispensable lever for raising Great Britain to a more secure footing in the markets of the world.

Business men caught the malady, continues Mr. Ray, especially the automobile manufacturers who undertook bold extensions of plant, and it is only just beginning to dawn upon them that industrial methods, though successful in one country, are not of necessity bound to be successful in every other country. Defenders of the mass production system may seek refuge in the unforeseen trade depression, but it has to be admitted that several British concerns, which set out to reduce costs of production by the mass system, have found their unit expenditure to be higher than that of firms producing on a similar scale but on the unit system.

Statistics show that the imports of touring cars to the end of September 1920 were 4,276; of commercial vehicles 2,112, and of chassis 3,019, more than half of which came from the United States, with Canada, France and Italy next in order. These imports were nearly 30,000 less than in the corresponding period of 1920, and nearly 2,000 less than in a similar period in 1913.

The exports of automobiles for the first nine months of 1921 were 1,557, of commercial vehicles 591, of chassis 847, and of motor cycles and tricars 7,039, which were less than half of the numbers exported during the corresponding nine months of 1920, and considerably lower than the exports of the corresponding period of 1913.

Doubtless the industry is terribly strained at the present time. A good deal of price-cutting is taking place with a view to stimulating demand. Quite a number of manufacturing concerns, some of them owning huge plants, have gone into liquidation, concludes Mr. Ray, and it is believed that, apart from trade depression, a good number of producers must ultimately be squeezed out by excessive competition.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29.15

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	**6 00**
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 60
Tank plates, Pittsburgh mill price	1 60
Structural shaues, Pittssburgh mill prices	1 60
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	3 48
Structural shapes	3 58
Plates	3 78
Small shapes under 3-in.	3 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Gross Montreal	Toronto
Lake copper	$17 75	$17 50
Electric copper	17 50	17 50
Castings, copper	17 25	18 00
Tin	38 00	38 50
Spelter	7 25	7 50
Lead	6 50	6 75
Antimony	6 75	8 25
Aluminum	26 00	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 90	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.08	.....	.....
3 inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.59	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and less	55
Coch and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, fl. and rd. hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	$1.25
Nuts, hex., tapped off net list	75c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets	$43 50
Open-hearth billets	43 50
O.H. sheet bars	39 00
Forging billets	48 50
Wire rods	48 00

NAILS AND SPIKES

Wire nails, base	$3 90
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list. Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	0 87
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	57
Class B	22	32
Class C	14	22

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 75
Sheets, blue ann., No. 10	4 00	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B. W. G.	7 75	....
Fleur-de-Lis, 28 B.W.G.	7 25	....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	....
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz.	6 85	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60 0/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 25
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 75
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	4 00

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

XXX Extra	.17	Atlas	.19
Peerless	.22	X Empire	.14
XX Grand	.16	Ideal	.18
Superior	.21½	X Press	.13
X L C R	.15		

Colored

Lion	12½	Popular	10
Standard	11	Keen	9
No. 1	14	Fancy	14

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored. 13
Mixed colored. 14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 8 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



Experiments in Ceylon have proved that tractors are very useful on coconut plantations.

Moving pictures, accompanied by lectures are being used extensively in China to show the progress of industries both there and in other countries.

It's the litt'e things that count. Just what this means to the trade will be understood after you read "Repair jobs that made us a good profit," in the January 19th issue.

It is reported that a cement works with £500,000 capital will be started at Brogan's Creek in the Rhylstone district of New South Wales.

The Pronovost Universal Wheel Co., Montreal, Que., has been incorporated to manufacture automobiles, etc., with $50,000 capital stock.

The Collins Power Co., Windsor, Ont., has been incorporated to manufacture automobiles, machines, engines, etc., with $1,000,000 capital stock.

Brazi ian farmers are increasing their use of up-to-date agricultural machinery, and a return to better conditions will bring a renewed demand for such articles.

A firm of engineering specialists in refrigerator plant and pumping machinery in the Orange Free State request particulars from Canada in the above line, including compressors.

The Black & Decker Manufacturing Co., Baltimore, Md., announce that effective January 3, 1922, they will make a freight allowance on shipments of 100 lbs. or over to points in the United States and Canada.

A Chinese automobile, said to be equal in quality and workmanship to the foreign make, has been turned out by the Yantze Machinery Works. The intention is to compete for the China market.

The Canadian Department of Trade and Commerce is inviting tenders, which will be received up to January 31st, 1922, for a weekly or fortnightly steamship service from Halifax or St. John to the West Indies and British Guiana.

The Newfoundland Government has decided to pay a bounty of $30 per ton on all schooners over 25 tons, and up to and including 50 tons register built on the island this winter and fully equipped and ready for sea about July 1st, 1922. The object is to assist the merchant marine to replace the numerous vessels lost last year and to provide employment for those out of work.

The city of Winnipeg, Man., have recently purchased 3,000 meters from the Canadian Westinghouse Co., the Packard Electric Co. and the Samgamo Co.

Electrical contracts have been awarded for the High School to be erected at North Toronto at an estimated cost of $160,000.

The Canadian Electrical Supply Co. are now handling the "Brantford Locomotive" electric washer manufactured by the Brantford Washing Machine Co. The territory includes Eastern Ontario and the Province of Quebec.

Steel motor coaches, having accommodation for 60 to 80 passengers and a speed of 45 miles, are being placed on the Canton-Kowloon railway line by the Chinese Government. Several cars have been purchased in San Francisco.

The following are new trade inquiries for Canadian products: A firm of Canadian agents at Bridgetown, Barbados, would like to obtain a Canadian connection for a supply of wire nails, rivets, bolts, nuts, etc.

Electrical contracts have been awarded on the 10-room school being erected at Melrose and Verdun Avenues, Verdun, Que., at an estimated cost of $100,000.

The Gaspereau Light and Power Co. have recently placed contracts for the installation of a new power unit to be installed in their White Rocks, Nova Scotia, plant. This new unit will add about 50 per cent. to the present production.

The Ontario Gazette announces the incorporation of the Matachewan Co. with a capitalization of $1,000,000. Head office, Toronto, Ont. It is understood that they will develop water power from the Montreal River, in the Matachewan area, Northern Ontario.

About 41 men were taken on the Collingwood Shipbuilding Co.'s drydock on January 3rd at Kingston, Ont., and were set to work on the steamer Keybell. It is expected that more men will be taken on during the week.

London, Ont., is making an addition to the London Technical and Art School to be erected by the Board of Education at an estimated cost of $100,000. The program for the year provides for the erection of new buildings to cost about $400,000, including a new 14-room school in West London and the first unit of what will be a 17-room school in the Ealing district of East London.

The city council of Sydney, N.S., plan alterations and improvements to water works to cost $150,000.

At Dauphin, Man., a by-law has been passed authorizing expenditure of $160,000 for the erection of a hospital.

The Beeby Range Co., Brockville, Ont., has been incorporated to manufacture stoves, furnaces, etc., with $500,000 capital stock.

General contract at $299,135 for erection of a school costing $425,000 on Main Street at Hamilton, Ont., has been awarded.

The erection of a hotel at Quebec City, Quebec, at the cost of $300,000, is contemplated by Mr. N. L. Dhan, Palace Hill.

In the city of New Westminster, B.C., the city engineer, Stewardson, is preparing plans for reconstruction of water works to cost $250,000.

Plumbing and heating contracts for memorial hospital costing $110,000 for the hospital board of Orillia, Ont., have been granted.

Building figures for the city of Windsor, Ont., for 1921 show an increase of $272,820 over those for 1920. Buildings valued at $5,123,130 were erected there last year. A million-dollar hotel is included in the total.

Tenders have recently been received for the erection of a 44-room school at Hamilton, Ont., and it is expected that P. H. Secord & Sons will receive the contract. The total cost of this school will be $400,000.

Mr. A. Mason, Acton, Ont., has purchased an old electric power plant and will remodel and equip the plant as a woollen mill. He plans to build an additional storey next year, at an estimated cost of $36,000.

A Johannesburg firm of agency engineers make inquiry re obtaining in Canada an agency in all lines needed for engineering supplies, except belting and pulleys. One of the largest engineering firms in Johannesburg are requesting quotations for bare copper wire, copper press bar and rods.

Arc welding for repair and reclamation, general applications of arc welding, and arc welding for manufacturing processes are described and illustrated in Leaflet 1825, just published by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa. A story is told of how costs are reduced by the use of arc welding.

The value of permits issued for December by the city architect's department of the city of Toronto was $2,100,606 as compared with $1,117,083 in December of 1920. This total shows an improvement on the November figures.

ROTARY DIE-HEAD

Various large consignments of German goods have been arriving in Argentina, according to a report from England. These goods included agricultural machinery, boiler tubes, barbed and fencing wire, constructional iron, paint, pianos, rails, refrigerators, sewing machines, and steel tubes.

Britannia Beach, B.C., lists have been received on structural steel necessary for the rebuilding of the concentrator plant. The estimated cost of the steel equipment for the new building is between $150,000 and $175,000. The completed concentrator will cost approximately $500,000.

A $3,000,000 highway through the island of Montreal, to extend from the Bridge terminal at the extreme east of the island to St. Anne de Bellevue, will soon be started on. Work is expected to begin during the coming year. It is to be built in sections and will be 150 feet wide altogether.

Vancouver is advancing among the Pacific coast ports and is becoming one of the world's distributing centres, particularly for cargoes from the Orient. This is borne out by the customs department figures for that port for 1921. Customs receipts for the year ending December 31 amounted to $12,662,772 compared with $10,442,332 for 1920 and $8,547,689 for 1919. Shipments of British Columbia lumber for 1921 by water from mainland ports in the Province of British Columbia to foreign countries reached a grand total of 164,000,000 feet.

An exhibition will be held in Singapore on the occasion of the visit of the Prince of Wales. It will open from March 31st, to April 8th, 1922, and will be under the auspices of the Governments of British Malaya, Borneo and Sarawak. Further information may be obtained from the Malay States Agency, 88 Cannon Street, London, E.C. 4.

Industrial conditions in Brantford have shown some vast improvements. The Massey-Harris Co. now has 600 employees, a gain of 200 in the last two weeks. They are working 3 days a week, 8 hours a day. The Cockshutt Plow Co. has 350 men 3 days a week 8 hours, with foundrymen working 9 hours. The Waterous Engine Works is going 5 days a week 9 hours a day with 150 men employed. The foundrymen are working 3 days a week but it is expected that they, too, will take on the full week.

After extensive and thorough experimentation, blotting paper of the finest quality is now being produced in Canada. Hitherto all blotting paper used in Canada has been imported, the imports being valued at about $500,000 per year.

Niagara Falls, Ont. The month of December shows a successful building year; 263 permits were issued valued at $1,145,589. Comparing this item with $473,065, which was the total last year, it shows a considerable increase.

The Rt. Hon. Stanley Baldwin, M.P., President of the Board of Trade, speaking at Liverpool, England, recently, said: "I am advised that in India the bottom has been reached, and that they have had an excellent monsoon, which generally means the purchasing power of that country is improved for the ensuing season. I am told that there are signs of improvement in Japan, the first country to feel the slump. Our advice from the Dominions and South America is that feeling is a good deal more hopeful."

Other reports from Sydney, Australia, state the recent improvement in business is sufficiently marked to warrant importers indenting on an increased scale and indicate that the greatest slackness has most probably passed. A steady demand is being experienced by wholesale merchants in New Zealand, who also report a shortage in a large number of individual imported lines. Reports recently received from all parts of Chile confirm the opinion held by prominent business men in Santiago that the commercial outlook in Chile is brighter than it has been for many months.

The total amount of contracts awarded for construction in Canada in 1921 are given in the Canadian Building Review. This figure was $240,133,300 for the year 1921 against $255,605,500 in 1920, $190,028,300 in 1919 and $99,842,100 in 1918. Of these totals the amount of business buildings erected was practically unchanged and constituted the largest, at $84,721,700 against $86,075,200 in 1920. Returns for December, 1921, show $19,118,500, being the second largest December total on record, being exceeded only once, and that in the boom time of December, 1912.

The British Agent at Moscow reports that as the result of a special agreement with the Commissariat for Foreign Trade of the Russian Soviet Government, a company known as the Russian Export and Import Company, has recently been formed in Moscow to do business with foreign countries on behalf of the Soviet Government, on a commission basis. The founders of the company, according to the Empire Mail, were formerly leading merchants in Moscow, and were in close business relations with important British and foreign firms. The formation of this company, which is the first step towards removing the foreign trade of Russia from the direct management of the Commissariat for Foreign Trade, is for the purpose of exporting Russian produce abroad and importing foreign goods in Russia. The goods offered to the company for disposal abroad include flax, goat skins, horsehair, bristles, caviare and scrap iron.

Fire losses in Canada during the week ending December 21st are estimated by the Monetary Times at $798,400, compared with $457,500 the previous week.

The Chile Copper Co.'s plant calls for an increase in capacity from 15,000 tons to 35,000 tons a day as soon as conditions warrant. This should give the company a capacity for producing 300,000,000 pounds of copper annually and on the basis of 1920 cost of producing more than one-third of this amount, it is estimated that Chile should then send out its copper for 8c per pound, if not lower.

The total value of permits issued by the building department at Montreal for the year just ended passed the $21,000,000 mark, an increase of approximately $7,000,000 over the 1920 figures. Montreal's record building year was 1913, when construction to the value of approximately $27,000,000 was carried out. However, last year's increase was very satisfactory and prospects are even brighter for 1922.

Another large hotel is rumored at Quebec City, P.Q. Mr. C. J. Lockwell, representing the Canada Hotels Co., it is reported, briefly waited on certain city officials and submitted a scheme for the erection of a ten-story hotel to cost between $1,500,000 and $2,000,000 on Montcalm market. This company, Mr. Lockwell stated, intend erecting a string of eight hotels in large Canadian cities, including the following: Quebec, Montreal, Toronto, Three Rivers, London and Kingston.

The production of chromite during 1920 in the Province of Quebec, amounted to 10,585 tons, valued at $247,730. This is a slight increase compared with the previous year, when the figures were 8,184 tons valued at $223,331. The greater part of the chromite produced is in the form of concentrates running 50 per cent. and over of chrome sosquioxide, although a small quantity is also shipped in lumps, locally called crude ore, which is ore sufficiently rich to be shipped without requiring concentration.

In 1919 there was published by the Engineering Station of the University of Illinois a bulletin, No. 111, dealing with the forms in which sulphur occurs in coal. The research work in connection therewith was conducted in the Chemical Laboratory of the University of Illinois by S. W. Parr and A. R. Powell, who developed successful methods for determining quantitatively the different chemical forms of sulphur in coal. Bulletin No. 125, by H. F. Yancey and Thomas Fraser, just issued by the Engineering Experiment Station, deals with the manner of occurrence and the distribution of the various forms of sulphur in the coal bed. The experimental work was undertaken as a part of the

United States Bureau of Mines plan of research on coal preparation, and the application of the information secured to the problem of producing cleaner coal was the principal objective. The solution of this problem must of necessity rest to a considerable extent upon an intelligent knowledge and appreciation of the physical and the chemical forms in which sulphur occurs in a particular coal, and how it is distributed through the coal in the bed. Copies may be had without charge by addressing the Engineering Experiment Station, Urbana, Ill.

Two British shipping companies have been successful in getting important contracts in America, although competition was said to be unusually keen. The Cunard Company has been awarded by the Standard Oil Co., of New Jersey, the contract for the transportation of case oil to Levantine ports in 1922; and the Furness Withy Company (Prince Line) has been given a contract by the Baldwin Locomotive Co. for carrying 85 locomotives from Philadelphia to Buenos Aires.

The knitting goods trade is looking towards the New Year with confidence. In spite of the disturbances in commercial affairs during the past twelve months, a satisfactory volume of business was done. The year of deflation has been passed and toward the end of the year there was very satisfactory activity in most of the Canadian mills. A number of the mills enjoying good connections with the wholesale and retail trade were unable to handle all the business that was offering in goods for autumn delivery. Some were working on double shift, endeavoring to meet hosiery requirements, and even then had to turn away some business.

New Machine Shop at Dresden, Ont. Herbert Lamb, formerly with Vickers & Maxim, Barrow-in-Furness, Eng., but for the past eight years head road man for The Canadian Fairbanks-Morse Co., Toronto, and W. D. Lawrence of Dresden, have opened a machine shop at Dresden, under the firm name of Lawrence and Lamb. They will specialize on the installation of water-works systems, fire-fighting pumps and apparatus, also individual lighting systems. They have been operating since December 1st and have already booked several good contracts. They are well pleased with the prospects for the coming season.

Before the engineering section of the A.A.A.S. now in convention at the University of Toronto, Mr. John Hartman, consulting mining engineer of Montreal, pointed out that in the most active periods some 38 per cent. of the total tonnage covered by the Canadian National Railway system come from the products of Canadian mines. Mr. Hartman outlined the progress of mining in Canada during the past fifty years, dealing emphatically with the remarkable increase in output of silver in the last decade. In this connection he noted that in the last twenty years Canada's silver production increased from $3,000,000 to $13,500,000 annually, while the annual gold production has shown a decrease in the twenty-year period. In the same period the production of coal had grown from 6,500,000 tons to 16,000,000 short tons.

Speaking on conditions in the United States, the National Bank of Commerce, New York, says that everything seems to indicate that the year 1922 as a whole will be more satisfactory to business than the year just ended. Their forecast is that profits will depend more on economy of operation than on expansion of volume. With the many favorable factors now operating, they continue, business men should not fear to make plans for the new year, but they should plan with care and conservatism, and with constant effort toward reduction of costs.

Financial improvement continues. Progress has been made in reduction of excess stocks of manufactured goods. Accumulations of raw materials have been reduced. The rate of production in the major industries has shown little change during the closing weeks of the year. Losses in some lines have been offset by gains in others, the net result being that the gains over the low level of the earlier months of 1921 have been held.

Dresden, Ont. The water commission have completed their new pumping system which consists of two double suction pumps direct connected to two 25 h.p. three phase, 25 cycle, 550 volt motors. The equipment also includes a centrifugal pump, direct connected to a gasoline engine. The pumps are attached to a tank 135 feet high which keeps pressure on the mains even though the pumps are stopped. The former installation of two steam pumps and two boilers is still intact but will be discontinued as it is considered that the gasoline can be depended upon in case of a possible shortage of electricity.

It is the intention during the coming summer to change the water supply, which is simply that of the Sydenham River to wells similar to those sunk in connection with the water system, London, Ontario, thereby insuring an abundance of the purest of water for domestic purposes. Mr. Herbert Lamb was the engineer in charge of the installation of the present system.

An entertainment will be given on January 14th, 1922, at the Massey Hall, Toronto, under the auspices of the Ontario Safety League which should prove of special interest to those who are directly or indirectly concerned in accident prevention. The programme will principally consist of a play on shop life, entitled "Fixing the Responsibility for an Accident." This was staged by members of the National Safety Council at their Milwaukee Convention a couple of years ago and repeated in Hamilton under the auspices of the Public Safety Committee of the Hamilton Chamber of Commerce before an audience of about 3,000, with such success that the committee in charge have been asked by the Ontario Safety League to repeat it at Massey Hall. Moving pictures will also be shown which depict the dangers and hazards of the streets in the business section of large cities where automobile traffic is heavy. Every conceiv-



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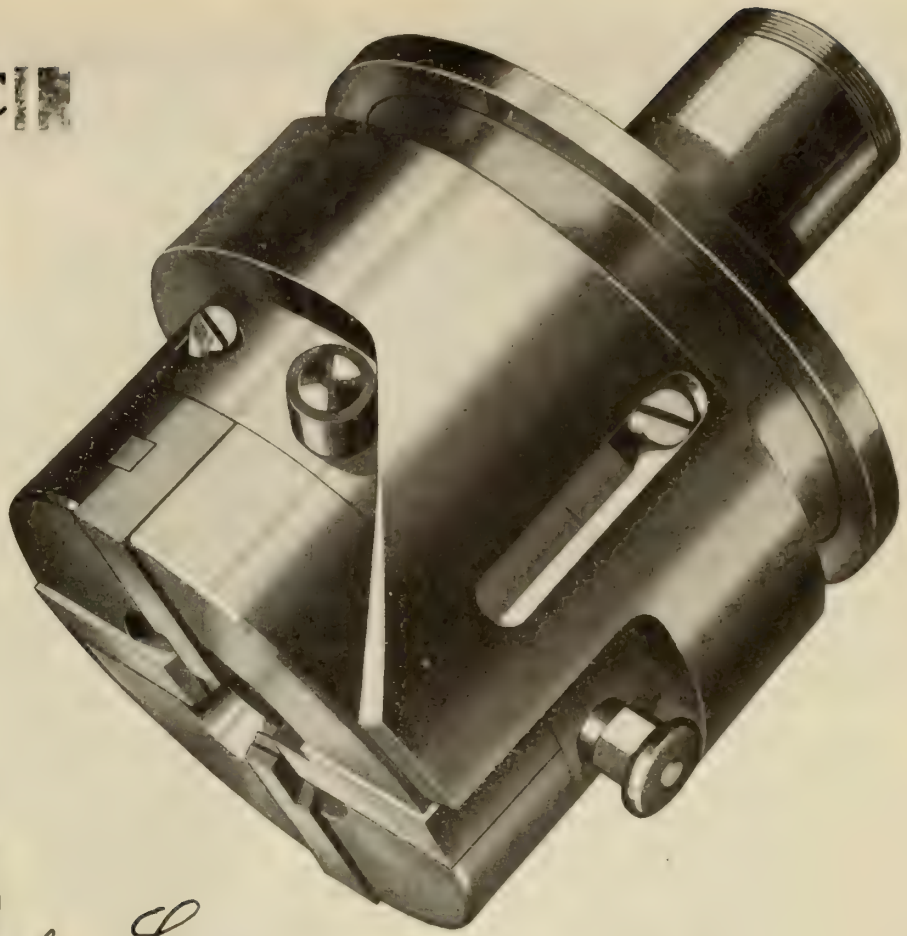
Massachusetts Ave., Washington, D. C., is prepared to supply to those interested, free information about scientific instruments, apparatus and supplies, laboratory construction and equipment. The following are samples of requests answered recently: "Where may we purchase inexpensive photomicrographic apparatus?" "Where may a human skull be purchased?" "Who manufactures a good grade of selenium cells?" "Advise where lantern slides on European Geography may be obtained." "Where may the Lummer-Brodhun cube be obtained?" "What concern makes gauges recording in fractions of an ounce?" "Where may apparatus and accessories for the study of sensitiveness of photographic plates be secured?"

The Natural Resources Intelligence Branch of the Department of the Interior has published a map showing the leading natural resources of each province. In Nova Scotia mixed farming, mining and fishing predominate; in Prince Edward Island fur-farming and agriculture. New Brunswick has large areas of timber, while mixed farming and fruit growing are outstanding interests. In Quebec may be found a wealth of timber for pulpwood, al minerals such as asbestos, graphite and molybdenite, while in Ontario somewhat similar opportunities exist. In the Prairie Provinces the prospective settler may obtain adequate returns on capital and labor in either grain growing, mixed farming or ranching, while in British Columbia timbering, fishing, fruit-growing and mining are among the leading industries. In addition to information on natural resources, the map shows all railways and trade routes. An interesting and valuable feature is a series of comparative diagrams illustrating the production and exports of the various provinces. A copy of the map may be obtained free of charge upon application to the above mentioned department at Ottawa.

Industrial Works, Bay City, Michigan, is distributing free upon request Catalog No. 113, illustrating and describing the Type BC "Industrial" Crawling Tractor Crane of 20,000 pounds capacity.

This crane is pre-eminently adapted to the needs of road contractors, lumber and coal dealers, gravel, sand and stone producers, foundries, railroad reclamation and storage yards, and moderate-size manufacturing plants.

GEOMETRIC ROTARY DIE-HEAD



Right on the Lead

One of the Die Heads that has put production on the increase and costs on the decrease.

This Rotary Die Head, which made itself famous on the Geometric Threading Machines, is adaptable for rotating on other types of machines, such as Drill Presses, Bolt Cutters, etc.

Let us know the machine on which you desire to use the Geometric Rotary Die Head, and a suitable shank will be applied.

To Get Quick Production of Screw Threads Without Waste, Try a Geometric. They are sent on trial to Reliable Concerns.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Williams & Wilson, Ltd., Montreal.

Canadian Agents:
The A. R. Williams Machinery Co., Ltd. Toronto, St. John, N. B., Halifax, N.S. Vancouver, B. C.

BASIC BUSINESS CONDITIONS ARE MUCH IMPROVED—COSTS ARE DOWN

THE business world enters the New Year with hope and optimism. The trials and difficulties of the adjustment year have not been in vain. Business is fundamentally in a much sounder condition than it was twelve or six months ago. This should be manifest in a gradual revival of activity from now on, in the re-opening of factories, and in the lessening of the volume of unemployment.

The year just closed, says "Financial Post," witnessed the working out of a broad process of price deflation and liquidation. Commodity prices now represent a sharp discount from the rates prevailing a year ago, and the average wage level is likewise substantially reduced. Goods offered to the public in the coming months will have been manufactured at the lower costs of production, and one of the chief deterrents of trade throughout the past year—the relatively high costs of manufactured goods—will have been largely eliminated.

Stocks Have Been Reduced

Retail stocks have been very drastically reduced during the past twelve months, and on the whole now are incapable of supplying public demand for longer than a comparatively short period. The Christmas trade was an encouraging feature of the season's business. Turnover on the whole was above that of the previous year, although actual revenue will show a small decline. The public bought freely, however, and the demand did much to bring merchants' stocks to a state of near depletion. Such a situation must lead to replacement on a larger scale to keep pace with the public demand, and this will in turn mean larger business for the wholesaler and manufacturer.

Sentiment at the new year is particularly hopeful, and is based upon specific instances of larger business pending. To quote one case, the clothing industry will benefit to a very considerable degree by the large orders that will be placed for uniforms for certain classes of municipal employees. For example it is understood that the Dominion Government will shortly place a contract for 5,000 Boy Scout officers' suits; the postal department will contract for some 10,000 postal employees' uniforms in January. It is reported that the Toronto Transportation Commision will shortly order 2,500 blue and grey uniforms for the street car employees, to be priced around $37 per suit; the Hamilton Street Railway will likewise let contract for 1,200 uniforms, and the Winnipeg Electric Railway, 1,400. Throughout the country there will be a fairly extensive ordering of uniforms for police and fire departments, bringing the aggregate of this class of work to a fairly substantial total, and spread around among the different clothing manufacturing concerns will enable these firms to get their organizations together in readiness for the larger business ahead.

Necessity for Replacement

The most important factor entering into the business situation at the present time is the necessity for replacement of all classes of goods. The public has been buying conservatively, likewise the retailer and wholesaler. The manufacturer too has radically curtailed his output.

Goods have been gradually reduced without a production to keep pace with the rate of depletion, and the result is that the world's supply of goods and commodities is now very substantially below nomal. To the aggressive business man this situation lays open the door of opportunity. If he can produce the goods at a price and of a quality to meet the public appeal the goods can be sold, but if prices are to be still maintained at inflated levels, then the depression in trade, and in his industry especially must continue. A period of the keenest type of competition lies before, and the dealer and manufacturer who is the first to thoroughly eliminate inflation from his prices through lower production costs and production efficiences will be placed in a position of inestimable advantage in the contest for business.

Cost Adjustment

Fortunately much progress has already been made in this direction. The breakdown in prices of raw materials, the decline in the cost of living, and reduction in wages, have reduced the cost of manufacture in all staple industries. Aided by the recent substantial adjustment of the exchange markets toward par there is the further possibility of competing successfully in the world's markets, and very little is needed to set the machinery of industry and commerce going.

International trade has been at a standstill, through the unsettlement of international exchanges, and thus conditions have but served to intensify worldwide and local depression. There has been a gradual improvement of Canada's trade balance of late, due in part to the decline in the importation of raw materials, but with exchange gradually strengthening there is a basis for the belief that the improvement may be of a permanent character.

Recent advances in the price of government bonds is one of the phases in the cycle of adjustment and denotes an increasing easiness of money. When industrial conditions are righted this money which is now going into securities will be turned into productive channels.

If a fire starts from kerosene, do not throw water on it as water will spread the flames. Sand or flour is the best extinguisher, or it may be smothered with a woollen rug, table cloth or carpet.

CATALOGUES

Safety Switches and Panel Boards is the subject of catalogue 12-A, dated 1921-1922, which is now being distributed by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. This catalogue is profusely illustrated with views of installations of safety switches in the shop, in the office, and in the home. Dimensions and list prices of these switches are given in detail. Some of the subjects that are discussed are the railway type safety panel boards, the safety car lighting panels, the auto-lock control panels, the dead-front and dead-rear safety switchboards, the live-front knife switches and many other devices.

We have received from the Sterling Engine Co., Buffalo, their catalogue illustrating gas and gasoline engines for driving centrifugal pumps, for use in water works, industrial plants, and fire protection systems. Several of these units have been installed in Canadian cities. The catalogue is well illustrated and all the necessary information is included. Diagrams showing the space occupied by different sized installations are also given.

The Canadian Ingersoll Rand Co., Montreal, have issued in the form of a bulletin the paper on "Steam Condensing Plants," read before the Baltimore section A. S. M. E. in May last. The paper is a very interesting one, and contains much valuable information for those interested in the operation of this type of apparatus. Bulletins 1028, 1094, 9032, and 9224 covering low level and surface and Barometric condensers are now available and will be supplied to readers of Power House on request by the Canadian Ingersoll Rand Co.

Westinghouse Turbine Generator Units are described and illustrated in Circular 1094-B, just issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This publication contains a discussion of the reactance and impulse types of turbines, both the semi-double flow type and the multiple cylinder type. Bleeder turbines and geared turbines are described, and each part of the turbine is elaborately treated. The generator is also discussed in detail, and illustrations are given to show the latest types of construction.

The Combustion Engineering Corporation, New York, announce the opening of a new branch office at 806 First National Bank Building, Pittsburgh, Penn. This office will be in charge of Mr. C. W. Stripe, formerly manager of the Philadelphia office.

Hoar frost presents beautiful crystalline forms because the atoms of water, when deprived of the degree of heat necessary to keep them in a fluid condition, arrange themselves in groups, giving rise to what are called crystals.

Classified Opportunities

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

FOR SALE

FOR SALE — FORTY HORSE-POWER VERtical Boiler 120-lb., steam, Ontario inspection, 129-2" tubes 5' 9" long, 74 of them new. Complete with grates, smoke stack and cast iron base. $500.00 F.O.B. Port Arthur.

Return Tubular Boiler 72" x 18' for 115-lb. steam, Ontario inspection, 84-3½" tubes, straight seams, triple rivetted butt joint. This boiler with full flush front and doors, arch-plates, soot doors but no grates or fittings, for $900.00 F.O.B. Port Arthur. Port Arthur Boiler Works. (c2m)

FACTORIES FOR SALE — TWO DESIRABLE plants; one at Mount Forest, constructed of brick, floorage over 40,000 square feet, formerly operated by Weir Wardrobe Co.; and the other at Guelph, stone florage over 50,000 square feet, formerly operated by Dominion Casket Co. Apply Box 777G, Canadian Machinery.

SPACE FOR RENTAL

FLOOR SPACE — SEPARATE ENTRANCE— Suitable for machine shop or light manufacturing, with power, reasonable rental with long lease if desired; also small foundry building, suitable for 4 to 6 moulders; in good manufacturing town; railway centre. Apply Box 789T, Canadian Machinery.

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

REGO
WELDING
and
CUTTING
APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and [illegible]
(TF)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

POSITIONS WANTED

MECHANICAL DRAFTSMAN DESIRES A change; age 30; married. Experienced in tool, jig and machine design. If you are looking for a young man who by practical shop experience, knows his job from the drafting office to the shipping platform, arrange interview, at your convenience. Box 798, Canadian Machinery. (c4m)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W.H. Sumbling Machinery Co., Toronto. (etfm)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

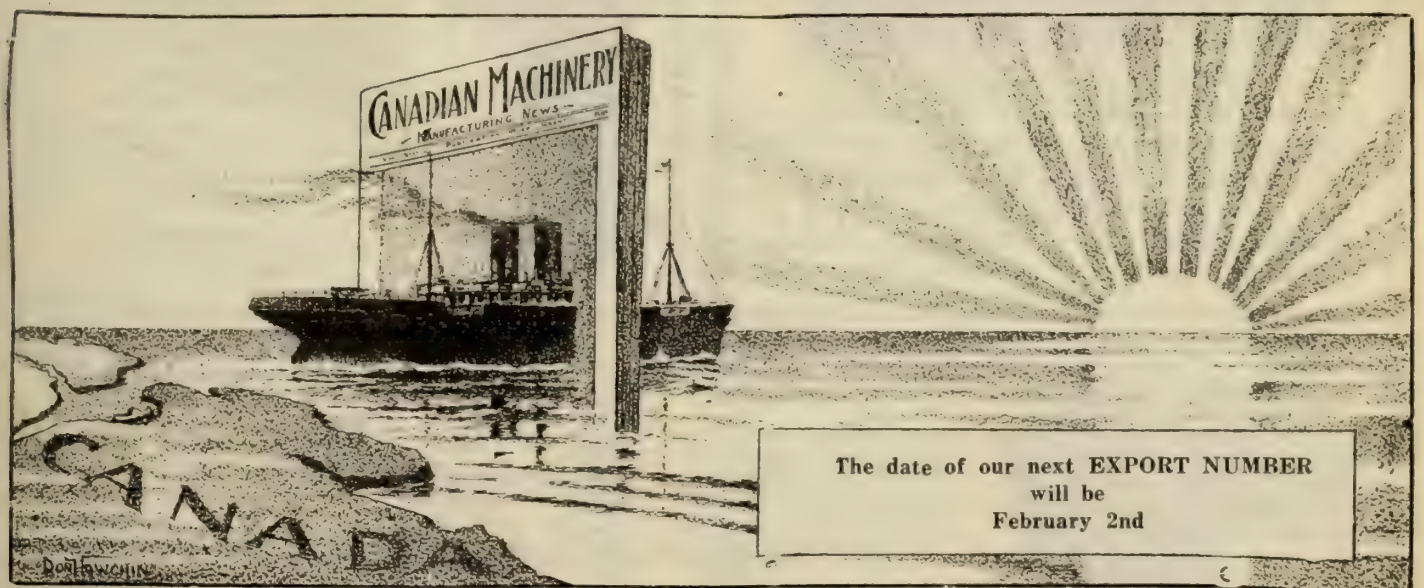
WE BUY ANYTHING IN BOILERS, TANKS, general shop, mill and factory machinery, electric motors, gas engines, air compressors, etc. The A. R. Williams Machinery Co., Limited, 64 Front Street west, Toronto. (cfm)

WANTED — ONE DRILL PRESS, ONE shaper, one planer, several lathes up to 24". Give description and lowest price. Box No. 799H. Canadian Machinery.

WE BUY IDLE EQUIPMENT OR MACHINERY; call or write. H. W. Petrie, Ltd. (cfm)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.



The date of our next EXPORT NUMBER will be February 2nd

HINTS TO BUYERS

Torrington MACHINE SCREWS

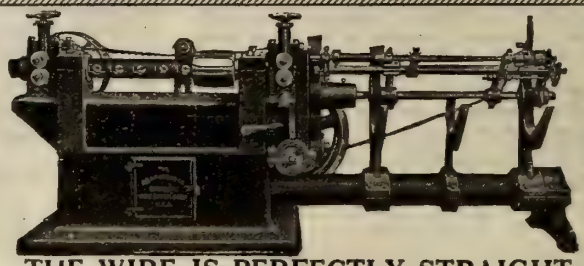
Side Knob and Lock Cap Screws



Let us quote you our prices on your next order. Our quality and service are sure to please you.



THE TORRINGTON COMPANY LIMITED
UPPER BEDFORD, QUEBEC



THE WIRE IS PERFECTLY STRAIGHT
and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?
The F. B. SHUSTER COMPANY, New Haven, Conn.
Formerly John Adt & Son. Established 1866.
Also makers of Riveting Machines, Sprue Cutters, Cotter Pin Machines, etc.

FOR SERVICE ON
Jigs, Fixtures, Gauges
SPECIAL MACHINE TOOLS
SPECIAL MACHINERY
General Machine Work and Repairs
Write
The Crescent Machine Co.
LIMITED
20 Longueuil Lane Montreal, Que.

DAVIS-BOURNONVILLE

Tube welding machines for producing 100 per cent. strength tubing from commercial sheets or rolled strip stock in steel, brass, nickel and other metals. Equipment for swaging and drawing tubing to square, rectangular and other shapes required in furniture and bedstead manufacture. Tube plant layouts.
Oxy-acetylene welding torches, pressure regulators, acetylene generators.

WELDING AND CUTTING DAVIS APPARATUS DAVIS-BOURNONVILLE CO.

Davis-Bournonville Company
Jersey City, N. J.
Branches in Principal Cities 4



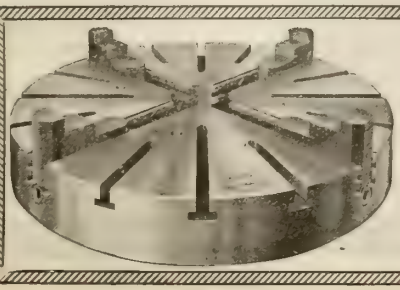
HIGH SPEED STEEL
Tool Steel for Every Purpose
Twist Drills, Music Wire, Steel Balls
Pilot Steel & Tool Co., Ltd.
332 St. James. - - - Montreal



Built to Give Satisfaction

BLOUNT Grinders are built to stand up under the hard service which is the usual lot of a grinder. They are just as good in every detail as we can make them. They are fast, accurate, strong and rigid —dependable in every sense. Let us send you full particulars.
"We will accept Canadian funds at par."

J. G. Blount Co.,
Everett, Mass., U. S. A.



***IRON BODY* INDEPENDENT CHUCKS**

They represent strength and economy with high-speed cutting tools. Accurate and dependable always.
Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.

UNION MANUFACTURING COMPANY
New Britain, Conn. New York Office: 26 Cortlandt Street

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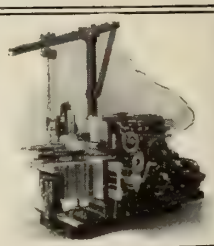
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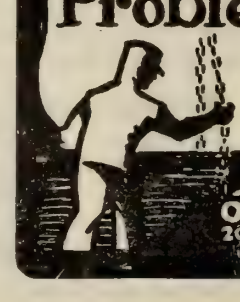
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Oakey & Sons, Ltd., John, London, S.E., Eng.

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Ford-Smith Machine Co., Hamilton, Ont
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Pyribul Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

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Union Mfg. Co., New Britain, Conn.
Williams & Wilson, Ltd., Montreal, Que.

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Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Dom. Steel Products Co., Brantford, Ont.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
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Skinner Chuck Co., New Britain, Conn.
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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Oakley Chemical Co., New York, N.Y.

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Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

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Norton Co. of Can., Ltd., Hamilton, Ont.

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Counters, Engine
Durant Mfg. Co., Milwaukee, Wis.

Counters, Revolution
Durant Mfg. Co., Milwaukee, Wis.

Counters, Revolution
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Durant Mfg. Co., Milwaukee, Wis.
Starrett Co., L. S., Athol, Mass.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Dominion Foundries & Steel, Ltd., Hamilton, Ont.

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Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Bilton Machine Co., Bridgeport, Conn.
Can. Link-Belt Co., Toronto, Ont.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
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Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Bilton Machine Co., Bridgeport, Conn.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Cylinder Reaming Sets
Wetmore Reamer Co., Milwaukee, Wis.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton.
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Ackworthie, Ltd., John, Birmingham, Eng.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Prest-O-Lite Co. of Can., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oliver Machy. Co., Grand Rapids, Mich.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machine Heads
United States Machine Tool Co., Cincinnati, Ohio.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Garlock-Walker Mchy. Co., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Barnes Drill Co., Rockford, Ill
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertram & Son Co., Ltd., The John Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Can. Ingersoll-Rand Co., Ltd., Sherbrooke, Que.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, High Speed Twist
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Hart Products, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Emery Wheel Dressing Tools

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Eyeglasses, Safety (See Goggles, Safety)
Prest-O-Lite Co. of Can., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings, Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto Ont
Strand & Co., N. A., Chicago, Ill.

Flux, Galvanizing
British Smelting & Refining Co., Ltd., Montreal, Que.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Flour Mill Units.
Pollard Mfg. Co., Niagara Falls, Ont.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Stewart & Co., Duncan, Glasgow, Scot.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., W land, Ont.
Dominion Forge & Stamping Co., Lt Toronto, Ont.

Forgings, Hammer
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Canada Foundries & Forgings Co., W land, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Dom. Foundries & Steel, Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
N. S. Steel Co., Ltd., New Glasgow, N.S.

Founders & Machinists
The Vulcan Co., Ltd., London, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.
The Vulcan Co., Ltd., London, Ont.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Armstrong Whitworth Co. of Can., Lt Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis.
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Ackworthie, Ltd., John, Birmingham, Eng
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom. Foundries & Steel, Hamilton, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Dom. Steel Products Co., Brantford, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que
Hamilton Gear & Machine Co., Toronto Ontario
Hepburn Ltd., John T., Toronto, Ont
Jardine & Co., A. B., Hespeler, Ont
Jones & Glassco, Montreal, Que
McDougall Co., Ltd., R., Galt, Ont
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited. Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Dom. Steel Products Co., Brantford, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.
The Alexander Milburn Co., Baltimore Md.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Blanchard Machine Co., Cambridge, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Perfect Machine Co., Ltd., Galt, Ont.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Norton Co., of Canada, Ltd., Hamilton.

Grinding Machines, Die
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio
National Machinery Co., Tiffin, Ont

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

BUYERS' DIRECTORY

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock-Walker Mchy Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Foss Machinery & Supply Co., Geo. F., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.
McKenzie Machinery Co.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto.

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Armstrong-Whitworth of Canada, Ltd. Montreal, Canada.
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Flexible Steel
Quaker City Rubber Co., Philadelphia, Pa.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Hospital Equipment
Hartz Co., Ltd., Toronto, Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
William Hamilton Tool Co., Peterborough, Ont.
Stewart & Co., Duncan, Glasgow, Scot
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Bilton Machine Co., Bridgeport, Conn.
Crescent Machine Co., Ltd., Montreal, C

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machy. Co., Grand Rapids, Mich.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Rockford Machine Tool Co., Rockford, Ill.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Archibald & Co., Chas. P., Montreal, Q.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Archibald & Co., Chas. P., Montreal, Q.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Machinery Corp., Galt, Ont.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Porter-Cable Machine Co., Syracuse, N.Y.
Roelefson Machine & Tool Co., Toronto,
Rockford Lathe & Drill Co. Rockford, Ill.
Jas. I. Ryerson & Son, Chicago, Ill.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machy. Co., Grand Rapids, Mich.

Lathes, Threading
Hendey Machine Co., Torrington, Conn
Warner & Swasey Co., Cleveland, Ohio.
Queen-Gray Co., Philadelphia, Pa. N.Y.

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Machinery, Woodworking
Cowan Co., Ltd., Galt, Ont.

Machinists
Parker Co., Charles, Meriden, Conn.
McKenzie Mach. Co., Guelph, Ont.

Machinists' Small Tools
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Measuring Machines
Durant Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
British Smelting & Refining Co., Ltd. Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
F. F. Barber Machinery Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
McKenzie Mach. Co., Guelph, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Garvin Machine Co., New York, N.Y.

Milling Machines, Automatic
Bilton Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
United States Machine Tool Co., Cincinnati, Ohio.

BUYERS' DIRECTORY

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal Q
Ford-Smith Machine Co., Hamilton, Ont
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Bilton Machine Co., Bridgeport, Conn.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinary
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
The Alexander Milburn Co., Baltimore, Md.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Quaker City Rubber Co., Philadelphia Pa.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Pattern-Shop Machinery (See Woodworking Machinery)
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Wraggis Pattern Works, Galt, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
British Smelting & Refining Co., Ltd., Montreal, Que.
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto,

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Murchey Machine & Tool Co., Detroit, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Canada Machinery Corp., Galt, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Pollard Mfg. Co., Niagara Falls, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Rockford Machine Tool Co., Rockford, Ill.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shi...
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Archibald & Co., Chas. P., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont
Privibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich
Can. Fairbanks-Morse Co., Ltd., Montreal
National Engineering Co., Sarnia, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal

Presses, Foot and Hand
Stewart & Co., Duncan, Glasgow, Scot
Brown, Boggs & Co., Ltd., Hamilton, Ont
Perry & Co., John C., Birmingham, Eng

Presses, Hydraulic
Baird Machine Co., Bridgeport, Conn.
Bertram & Son Co., Ltd., The John, Dundas, Ont
Cleveland Twist Drill Co., Cleveland, O
Perrin Ltd., W. R., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Niagara Machine Tool Co., Buffalo, N.Y.
Hepburn Ltd., John T., Toronto, Ont
Rockford Machine Tool Co., Rockford, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa
Can. Fairbanks-Morse Ltd., Montreal Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.
William Hamilton Tool Co., Peterborough, Ont.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Stewart & Co., Duncan, Glasgow, Scot.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener
Excelsior Tool & Machine Co., East St. Louis, Ill.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland

Pyrometers, Electric
Bristol Co., Waterbury, Conn
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Gisholt Machine Co., Madison, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Machine Expanding
Wellman Reamer Co., Milwaukee, Wis

Reamers, Solid
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que
Can. Detroit Twist Drill Co., Walkerville, Ont.
Cleveland Twist Drill Co., Cleveland, O
Excelsior Tool & Machine Co., East St. Louis, Ill.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.

Regulators, Oxygen & Acetylene
The Alexander Milburn Co., Baltimore, Md.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Bilton Machine Co., Bridgeport, Conn.
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Robustar Co., F. B., New Haven, Conn
Stewart & Co., Duncan, Glasgow, Scot

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Roofing Asbestos, Corrugated and Gypsum
Robertson Co., H. H., Cleveland.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que
Dominion Foundries & Steel, Ltd., Hamilton, Ont.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sanding Machinery
Oliver Machy. Co., Grand Rapids, Mich.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I
Oliver Machinery Co., Grand Rapids, Mich

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
McKenzie Machinery Co., Guelph, Ont
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Privibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis

BUYERS' DIRECTORY

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.
Stewart & Co., Duncan, Glasgow, Scot.

Saws, High Speed Steel
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.
Oliver Machinery Co., Grand Rapids, Mich.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Clemson Bros., Inc., Hamilton, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
William Hamilton Tool Co., Peterborough, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Swing Cut-off
Oliver Machinery Co., Grand Rapids, Mich.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Leg
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Skylights
Robertson Co., H. H., Cleveland.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
N.S. Steel Co., Ltd., New Glasgow, N.S.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
McKenzie Machinery Co., Guelph, Ont.
Roelefson Machine & Tool Co., Toronto,
Rockford Machine Tool Co., Rockford, Ill.
Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shapers, Wood
Oliver Machinery Co., Grand Rapids, Mich.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Niagara Machine Tool Co., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.
Selson Engineering Co., New York, N.Y.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Excelsior Tool & Machine Co., East St.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Corrugated
Robertson Co., H. H., Cleveland.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont

Siding, Corrugated and Plain
Robertson Co., H. H., Cleveland.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
British Smelting & Refining Co., Ltd., Montreal, Que
Canada Metal Co., Ltd., Toronto, Ont.

Snap Flasks
Oliver Machy. Co., Grand Rapids, Mich.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber
Excelsior Tool & Machine Co., East St.
Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio
Wetmore Reamer Co., Milwaukee, Wis.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

Stamping Machinery
Excelsior Tool & Machine Co., East St.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.
Can. Atlas Crucible Steel Co., Toronto,

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,
Can. Driver-Harris Co., Walkerville, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton Ont.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
Can. Atlas Crucible Steel Co., Ltd., Toronto, Ont.
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Driver-Harris Co., Walkerville, Ont.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Whitworth Co. of Can., Ltd., Montreal, Que.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Surface Plates
Bilton Machine Co., Bridgeport, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Garvin Machine Co., New York, N.Y.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Lamson Machine Co., Springfield, Vt.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Jones & Lamson Machine Co., Springfield, Vermont.
Landis Machine Co., Inc., Waynesboro, Pa

Thread Gauges, Special
Wetmore Reamer Co., Milwaukee, Wis.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn
Murchey Machine & Tool Co., Detroit, Mich.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Bilton Machine Co., Bridgeport, Conn.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong-Whitworth of Canada, Ltd., Montreal, Canada.
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis.
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dom Steel Products Co., Brantford, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
Jones & Lamson Machine Co., Springfield, Vermont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Warner & Swasey Co., Cleveland, Ohio

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis

Tyres.
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Ltd., Oshawa, Ont.

BUYERS' DIRECTORY

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.
Quaker City Rubber Co., Philadelphia, Pa.
Voorhees Rubber Mfg. Co., Jersey City, N.J.

Ventilators
Robertson Co., H. H., Cleveland.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Company, Wallace, Hamilton,

Watchman's Clocks, Portable and Stationary
Chicago Watchman's Clock Co., Chicago, Ill.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
The Alexander Milburn Co., Baltimore, Md.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

MACHINE SHOP AND FACTORY SUPPLIES

Chas. P. Archibald & Co., Montreal, Que.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont

POWER EQUIPMENT AND SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

Chas. P. Archibald & Co., Montreal.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Yeates Machinery Co., London, Ont

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Oliver Machy. Co., Grand Rapids, Mich
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
The Alexander Milburn Co., Baltimore, Md.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont
Prest-O-Lite Co. of Can., Toronto, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Welding Supplies
British Smelting & Refining Co., Ltd., Montreal, Que.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Prest-O-Lite Company, Toronto.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wiping Cloths
The Levi's, Toronto, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Northern Electric Co., Montreal, Que.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.
Prest-O-Lite Co. of Can., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Oliver Machinery Co., Grand Rapids, Mich
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

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Send for Catalog No. 22 "3."

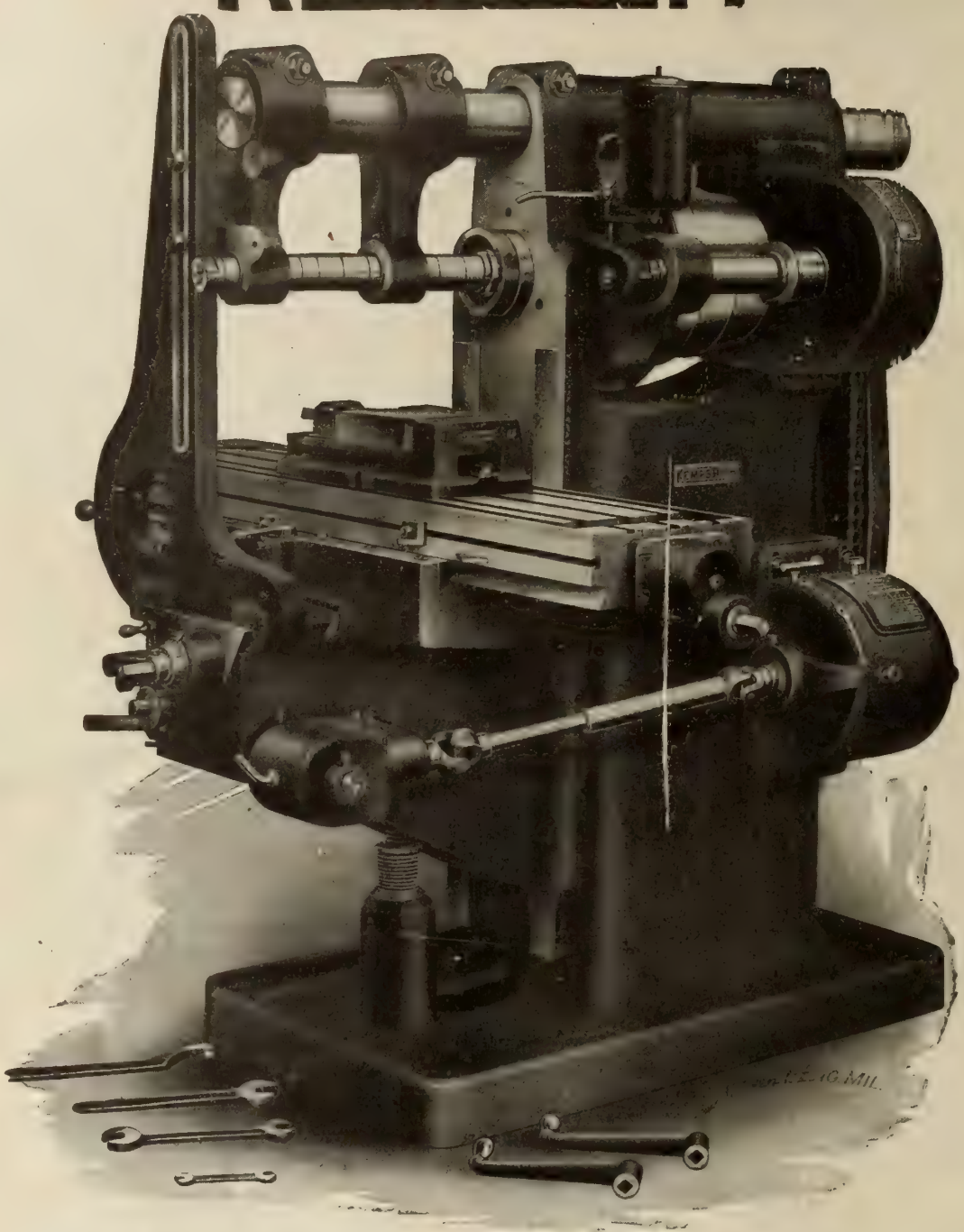
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The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

12-267

Use Starrett Tools

KEMPSMITH



KEMPSMITH No. 3 Plain Milling Machine

Double Back Geared

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy today.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVII. No. 3 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Jan. 19, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Announcing Another Step in the Path of Progress

OSBORN'S
RUSTLESS PLASTIC STEEL
(RUSTLESS IRON)

for articles and parts of machinery which do not require a cutting edge or particular hardness but are subject to corrosion; and which must be kept bright and free from rust.

PROPERTIES:

Neither rusts nor tarnishes.

Non-rusting characteristics are the same as ordinary Rustless Steel, but it is very plastic, hence the name.

Is much softer than ordinary Rustless Steel, and requires no special treatment to bring out its rustless properties, but tensile test results varying from 68,000 to 180,000 lbs. per square inch can be obtained by special treatment.

Can be stamped, punched, pressed, chased or engraved in the cold condition and none of the difficulties experienced in the drop stamping of ordinary Rustless Steel are encountered.

Can be bent cold in its polished state to a diameter equalling its own thickness without showing signs of fracture.

Can be put in a **silver bright condition before being worked,** and, if cold worked it is only necessary to highly polish the article after it has been made, thus saving the hardening which is a trouble and which causes distortion.

Is stronger than brass or nickel and therefore in many cases less than half the weight is required to give the same strength. It is also tougher than iron.

Requires no polishing, but dirt can be removed easily by a hot damp cloth.

Can be brazed, hard soldered, welded and cast into moulds.

Can be supplied in **bars** of all shapes, bright rolled **strips, wire and sheets.**

MADE BY

Samuel Osborn & Co., Limited, Sheffield, England

Pioneers in 1870 with MUSHET STEEL and still in the forefront

SOLD IN CANADA BY

Sam'l Osborn (Canada) Limited, Montreal, Toronto & Cobalt

All the Fine Qualities That Good Work Demands

Pratt & Whitney Small Tools enjoy an enviable reputation for excellence that has been well earned in the high production shops of the country. Where stamina as well as exceptional accuracy and precision are required P & W Tools have more than held their own. Our line is complete. It includes taps, dies, milling cutters, reamers, punches, drills, etc., both of standard and special design and in sizes to suit every requirement.

Prompt service is assured at our nearest store, where P & W Small Tools are carried in stock for immediate delivery.

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OF CANADA

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WINNIPEG
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WALKERVILLE
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VANCOUVER
B. C. Equipment Co.

HALIFAX
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The BERTRAM Page

MACHINE TOOLS

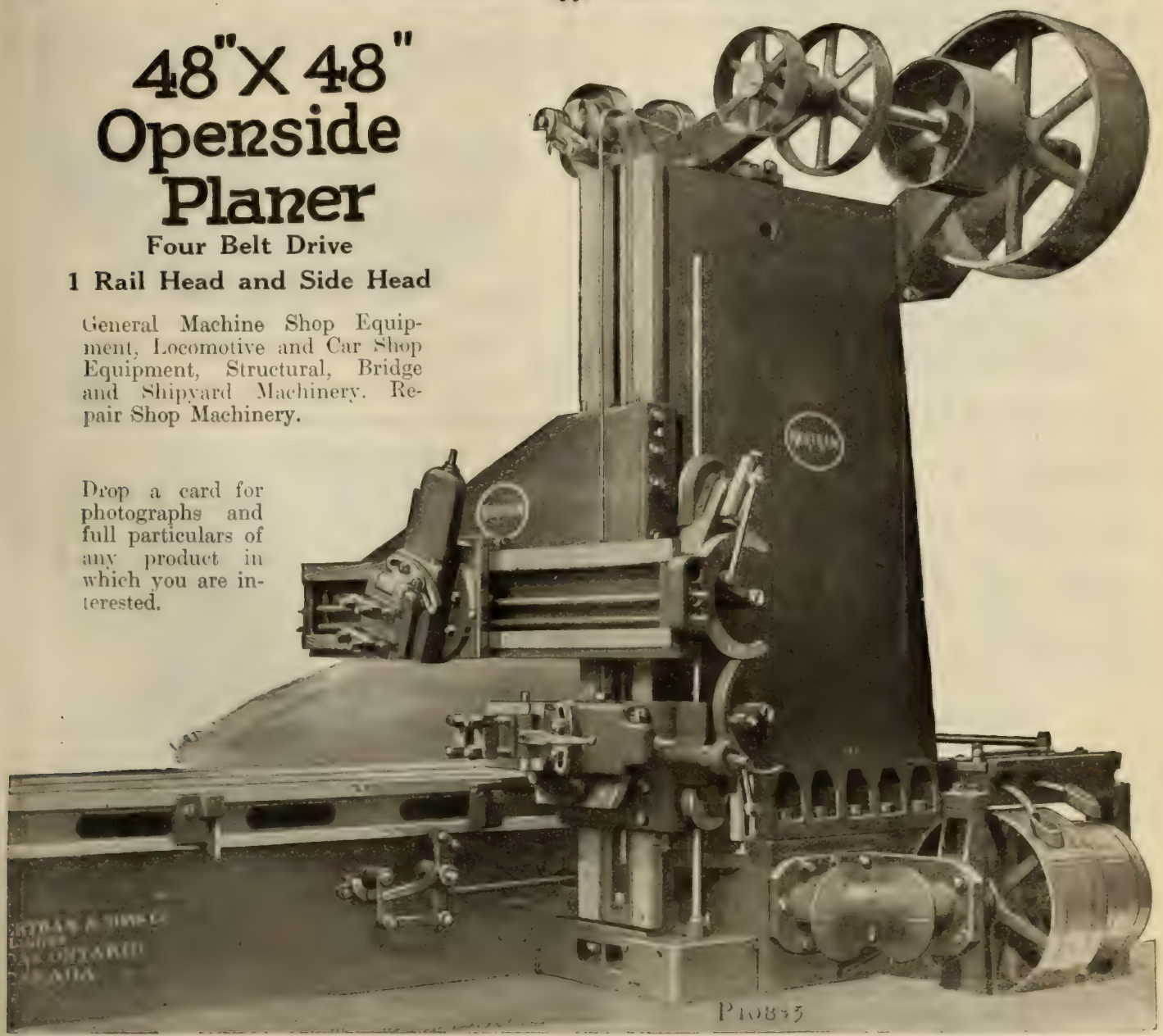
48"X 48" Openside Planer

Four Belt Drive

1 Rail Head and Side Head

General Machine Shop Equipment, Locomotive and Car Shop Equipment, Structural, Bridge and Shipyard Machinery. Repair Shop Machinery.

Drop a card for photographs and full particulars of any product in which you are interested.



The John Bertram & Sons Co., Limited

DUNDAS. ONTARIO. CANADA.

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The efficiency-point of a file has been passed as soon as its teeth have lost their sharpness.

It pays to watch closely for signs of wear.

Discard the file then—a new file costs less than the labor-time wastefully expended on an old one.

Long efficient service from every file is ensured by ordering one of these famous brands:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario

TRADE MARK
BRISTO
REG. U. S. PAT. OFFICE
PATENTED SAFETY SET SCREWS



SET A NEW STANDARD

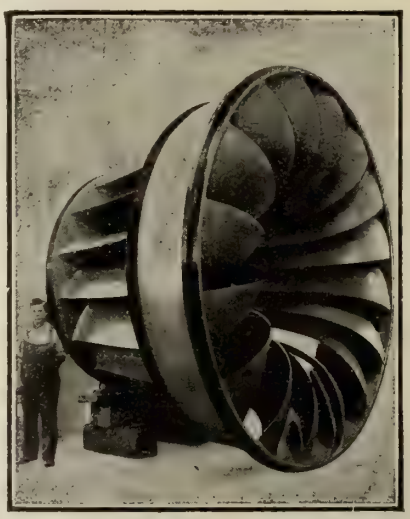
The distinctive dove-tail slots or flutes of the "Bristo" safety set screw are one of the features which put "Bristo" in a class by itself. "Mushrooming," for instance, is impossible, and splitting or cracking have been removed from the list of your manufacturing worries. As the wrench turns, the unique "Bristo" design contracts the screw; on releasing the pressure the screw tends to expand—a tremendous gripping factor.



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THE BRISTOL COMPANY
Waterbury, Conn., U. S. A.

M-39



Large, Difficult Castings for Machine Builders

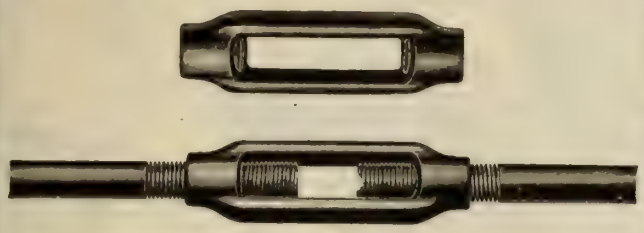
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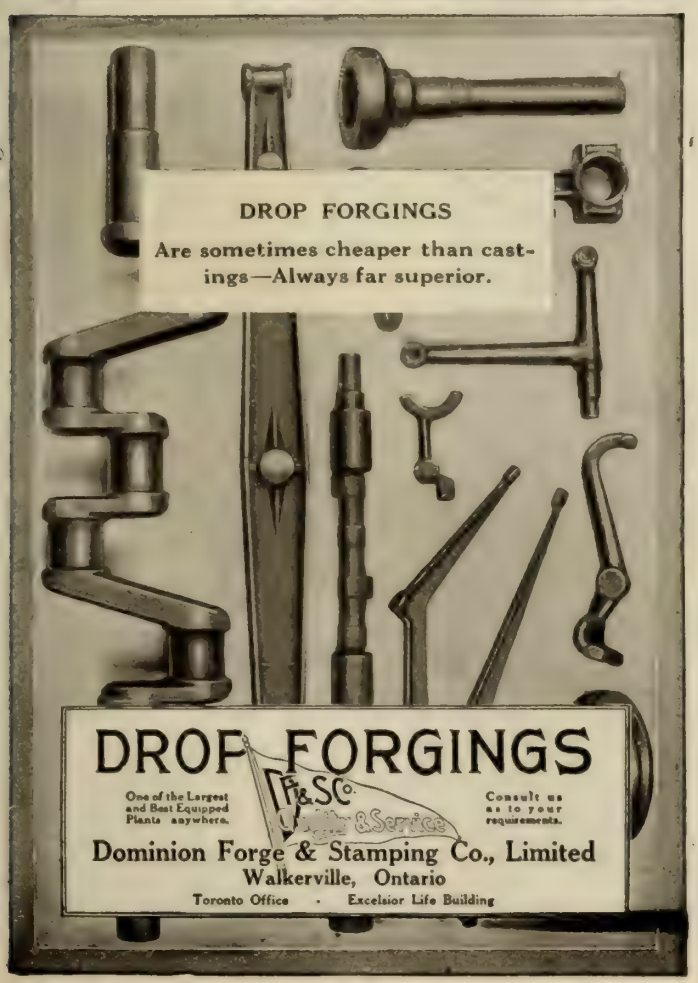
Drop Forged Steel



SOLID—NOT WELDED

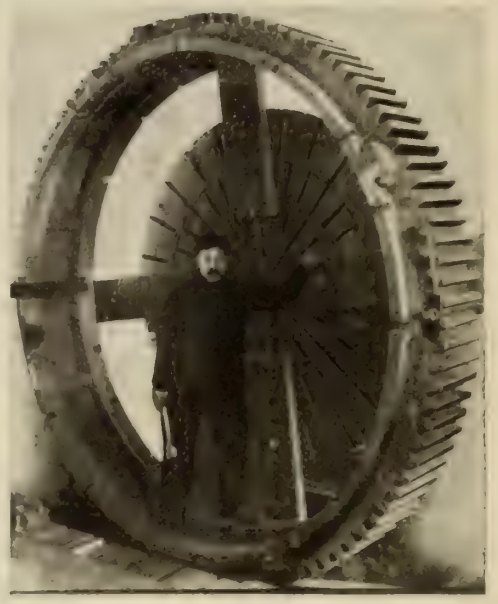
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Welland, Ont.



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Cement Mill and Mining Machinery, Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.

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"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber and labor is something to be considered.

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CHROME-VANADIUM
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Open Hearth Quality
(All sections from 12 lbs. to 100 lbs. per yard)

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PIG IRON
BASIC, FOUNDRY—
MALLEABLE

SULPHATE OF
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SLABS

STRUCTURAL STEEL

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IRON, BRASS AND
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All of these steels we supply in

HOT ROLLED BARS

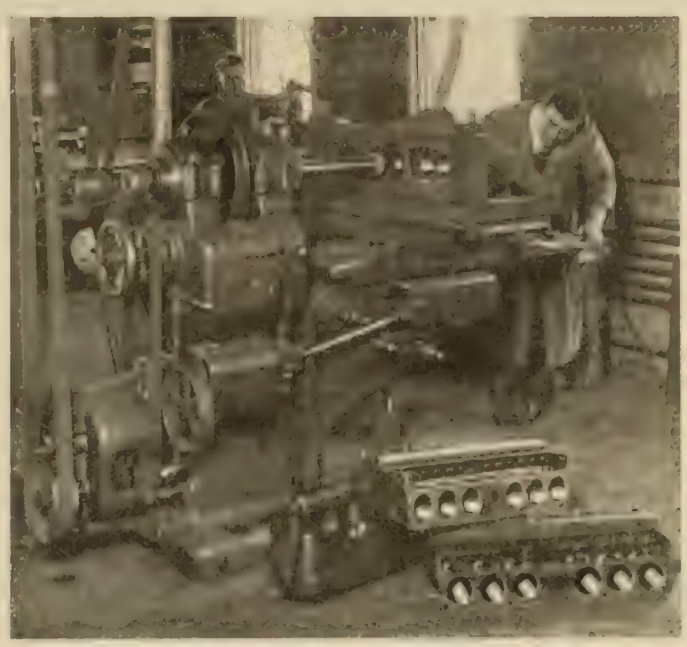
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BLOOM, BILLET AND
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Order from us and you'll get both quality and prompt service. A trial is convincing.

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Are You Equipped to do Cylinder Regrinding?



Grinding one of the twin sixes at the Packard Motor Co. of Ontario.

Probably you have been too busy hunting up enough miscellaneous jobs to keep the wheels turning to give much thought to this question. Again, perhaps you considered the automobile was the garage man's game and let it go at that.

The garage may be the headquarters for the majority of ordinary repairs but the machine shop is proving to be a Mecca for regrinding. Already located and equipped with practically all the tools needed, and having operators, who have run grinding machines, and with no reason to cause jealousy or prejudice among the small garages who send in work, by simply putting in a Heald you are ready to start in at once on work that is waiting for someone to come after.

You can command a trade that will keep you as busy as the proverbial one-armed paper hanger and profits will pile up in spite of money tightness. We say HEALD because it is used exclusively in the manufacturing field and thus has an established reputation. There are two types of HEALD CYLINDER GRINDERS, either of which is unapproachable in the field.

The Style No. 55 is simple, moderately priced, self-contained and has a very large capacity and range, easily taking care of all styles and sizes of blocks. Many just going into the regrinding business are purchasing this machine.

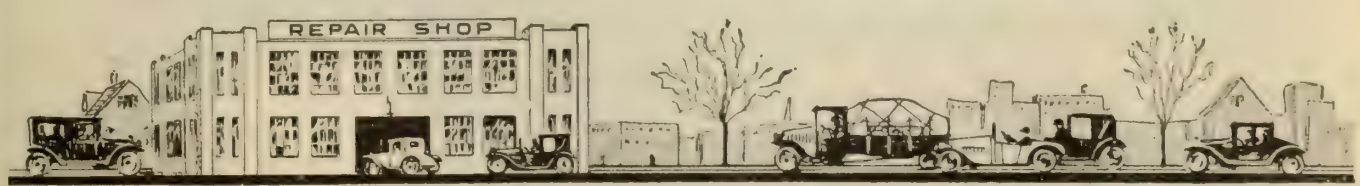
The Style No. 65 was primarily built for manufacturers, but scores are buying it for regrinding. When equipped with the HEALD UNIVERSAL JIG, it becomes an ideal machine for this class of work as it is unusually rigid and massive, and has a large number of speeds and feeds.

How much longer will you wait before sending for convincing details?

The Heald Machine Company

51 New Bond St. - Worcester, Mass.

Branches at New York, Philadelphia, Chicago, Detroit, Cincinnati, Cleveland and Buffalo.
Canadian Agents: H. W. Petrie, Ltd., Toronto. Geo. F. Foss Machinery Co., Montreal.





TO the man who is looking for a *cost-reducing* machine tool we can point with pride to the list of famous machinery manufacturers we represent exclusively. For the man who *is not sure* we have a staff of experts who know machines and who know costs. From a roll of belting to the most powerful lathe your search for dependable equipment ends at the doors of

H. W. PETRIE LIMITED

TORONTO and HAMILTON

MACHINE TOOLS, WOODWORKING MACHINERY, BOILERS, ENGINES, TRANSMISSION EQUIPMENT, SMALL TOOLS.

Canada's Dependable Machinery —and Supply House



Oakite CleansSteel Tubes 15 Times Faster

A MANUFACTURER now cleans drawn sheet steel tubes with Oakite at the rate of 2400 every five minutes, as against only 152 tubes in the same period with another cleaner.

Judged by the cost per pound, the alkali cleaner formerly used was the least expensive. But with this cleaner only 152 tubes could be cleaned in five minutes. Oakite costs more a pound, but cleans 15 times as much work in the same time. In practice, therefore, Oakite is found by far *the most economical cleaner to use.*

The saving made by this manufacturer shows the importance of practical information on the subject of *Modern Metal Cleaning* such as is contained in the booklet we offer to send you without charge or obligation.

The net result of many years of experience of all sorts of work is given in concise, plain, every day shop language. It is knowledge such as this that has increased production and lowered operating costs for others.

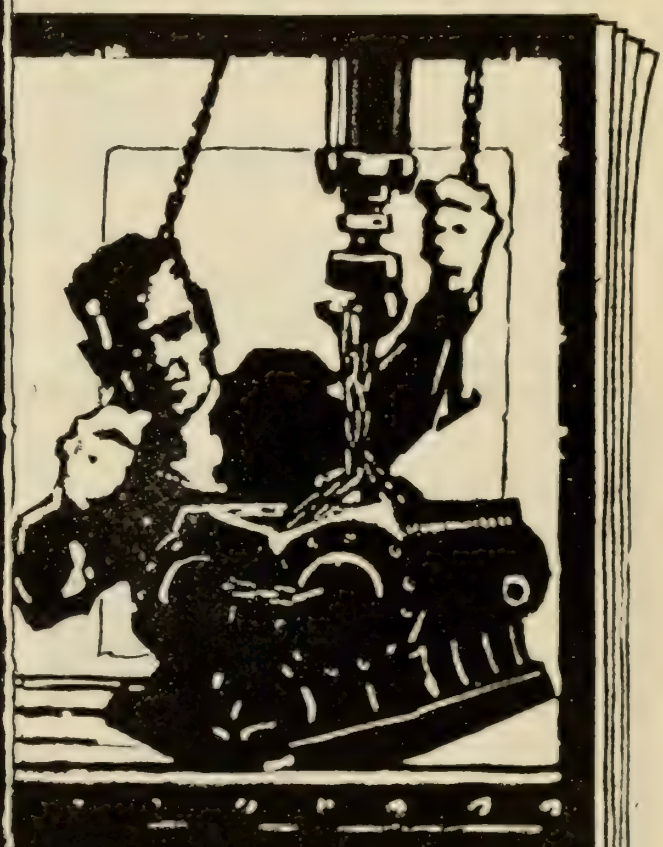
As an expression of what we mean by Oakite Service, we shall be glad to send you a copy of this booklet free Write us today.

OAKITE

MANUFACTURED BY

OAKLEY CHEMICAL CO.

THAMES STREET · NEW YORK



MODERN METAL CLEANING

Resident Canadian Representatives: Mr. C. P. Murphy, Toronto, and Mr. C. Burgin, Montreal.

This Advertisement is one of a series based on actual occurrences

After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

HANNA

M.A. HANNA & CO.

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THE JOHNSON FRICTION CLUTCH

Friction Clutches From Stock

Johnson Clutches, both single and double, can now be obtained from stock in our standard slow speed type to fit all common shaft diameters and all standard pulley bores, within the range of light and medium horse powers that we cover.

State definitely —

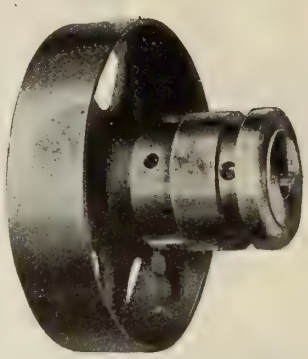
Just what the clutch must drive.
Actual maximum horse power.
Speed of clutch shaft.
Diameter of shaft.
Diameter, width and bore of pulley.

We Will Select the Proper Clutch and Make Immediate Shipment on All Ordinary Requirements.

Friction Control Means Better Machinery

And the Johnson Clutch is supreme among friction clutches. Adopt it as your standard — always dependable and always promptly obtained.

Complete engineering service to consult on your problems and to handle special installations of any kind.



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TURRET LATHES
Hand Operated
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AUTOMATIC TURRET LATHES
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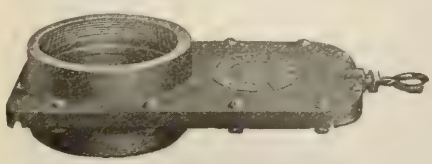
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Air-Tight Blast Gates are giving very good satisfaction, and our operators prefer them to either valves or cocks for the air line.

LINCOLN MOTOR CO.

There are many reasons why—Low first cost and upkeep—Easily and quickly operated—Afford full area of the pipe.



NEW AIR-TIGHT BLAST GATE
Light, Strong, Compact, Inexpensive, Quick-Acting

An ideal substitute for heavy, cumbersome, expensive and slow-acting gate valves and stop cocks.

This New Air-Tight Blast Gate is made in sizes from 2 to 16 inches, threaded and flanged. Descriptive circular 210—T gives detail dimensions of all sizes. Write for copy.

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Heavy, Cumbersome, Expensive, Slow-Acting



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

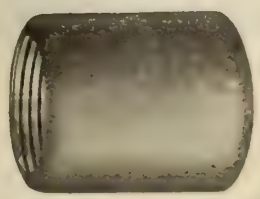
CANADIAN STEEL FOUNDRIES LIMITED

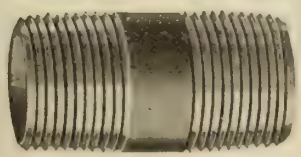
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Each length of M.R.M. Pipe is tested to withstand a pressure of 700 pounds per square inch.

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U.S. STANDARD CAP AND SET SCREWS



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V. & U. S. S. Semi-finished Nuts

V.,U.S.S. & S.A.E., Cap Screws

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SPECIAL

Screw machine product up to 2¼" diam.—to specifications

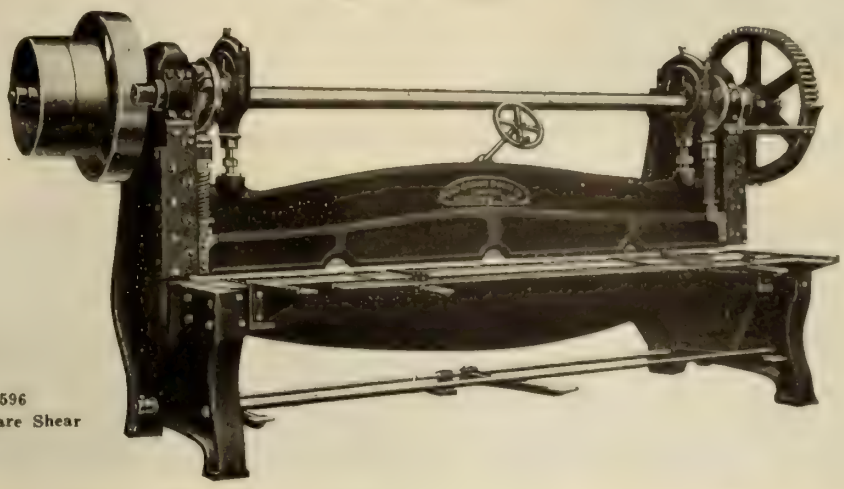
Hardened & ground screw product—to specifications.

The National Acme Company

Montreal, Que.

BROWN-BOGGS

B B



No. 596
Square Shear

Foot and Power Shears
that satisfy the workman's own ideals



No. 449—Shear

NATURALLY every workman has his own opinion of how a machine should operate and what it should accomplish.

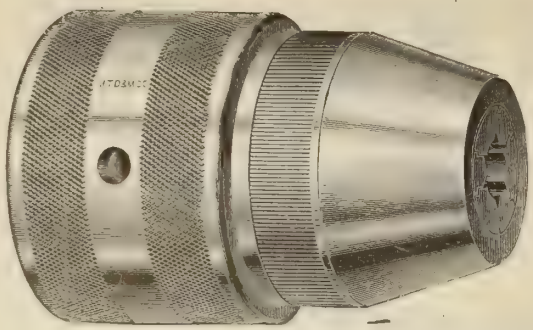
"B-B" Foot and Power Square Shears always head the list for productive ability—for the simple reason that they line up closely with the workman's own ideals.

The material used throughout is the very best; wearing surfaces are large; gears are machined from solid stock. The knives are carefully tempered and are easily removed for grinding.

"B-B" Power Square Shears are made in "Overhead Driven" and "Underneath Driven" Types. Power Gap Shears in the same types. Foot Shears in many styles.

Catalogue No. 25 gives full details of the complete "B-B" Line of Metal Working Tools. Write for a copy.

THE BROWN-BOGGS CO. LIMITED
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This Stetson Chuck

MADE BY

Morse Twist Drill and Mch. Co.

New Bedford, Mass., U.S.A.

Is Strong and of Heavy Construction

The jaws are controlled by separate drivers and are guided in that part of the chuck which is attached to the driving spindle. Extra jaws furnished when required.

No. 2 holds from 0 to 3/8 inch diameter. No. 3 holds from 1-16 to 1/2 inch diameter. No. 4 holds from 3-16 to 5/8 inch diameter.

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METAL SPECIALTIES OF ALL KINDS

The Banfield plant is thoroughly equipped, with real engineering ability, for the manufacturing, machining or assembling of Metal Specialties of all kinds.

If you have anything in metal to place on the market, let us give you prices.

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THE MORSE CHAIN CO.

are the

Largest Manufacturers in the world

of

High Speed Silent Chains

The superiority of **Morse Rocker Joint Silent Chain** has never been seriously questioned.

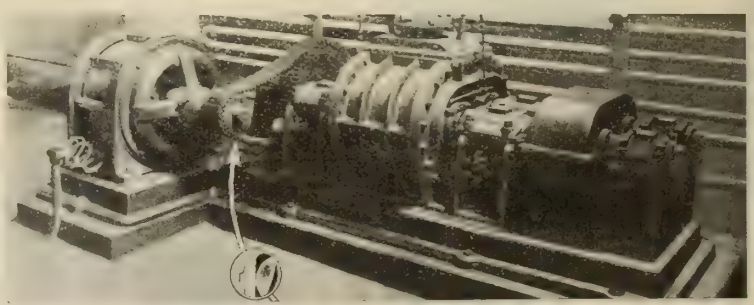
They speed up production, cut belt expense and overtime wages.

Catalogue Free.

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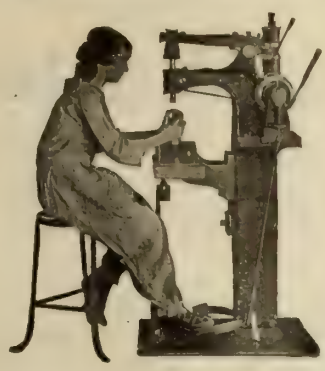
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25 H.P. Morse Silent Chain to Positive Blower.

The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.
Built in eight sizes.
Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
Send us sample assembly parts with rivets or sketch of your work,
and
Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.

ROCHESTER, N.Y.

De Valera Michael Collins Arthur Griffiths
Using these three Babbitts, could get the Irish Free State moving without friction.

Some Job!



IMPERIAL GENUINE



For Heavy Engines and Extraordinary Hard Work

HARRIS HEAVY PRESSURE

THE COPPER COATED CAKE

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.

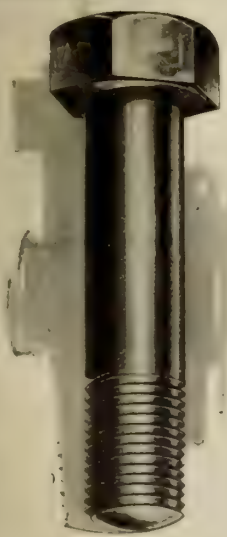


Matchless

Suitable For Slow-Moving Bearings
Write For Prices

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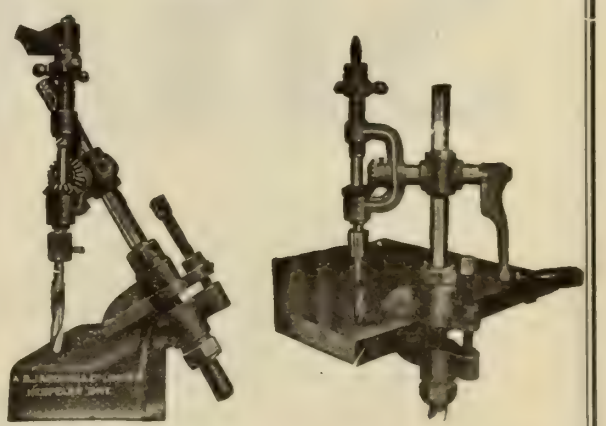
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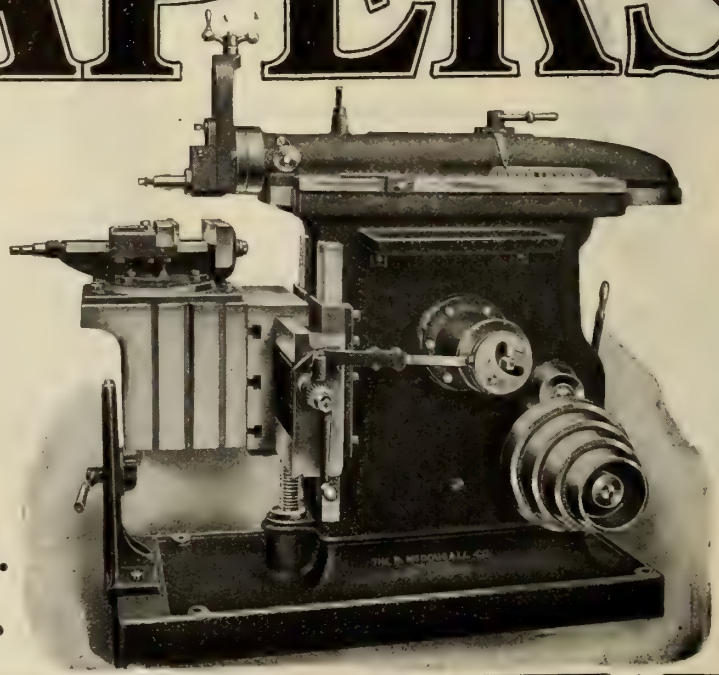
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII No. 3. JANUARY 19th, 1922

Repair Work Should be Handled to Show Profit

It is Useless to Attempt Repair Work Without Suitable Equipment—A Simple Cost System Should be Used, Otherwise Owner Will Never Know Where He Stands—Miscellaneous Repair Jobs

By H. A. WILSON

PROBABLY no class of work that enters a shop presents as many problems, or is as hard to take care of at a profit, as that of repair work. The work, as a class, is not universally popular with the men or the shop owners. Yet there is a certain volume of this work which must be done, and many shops are handling it at a profit. Thus the repair problem is one that will bear careful study.

In the first place it is useless to attempt to accomplish repair work in shops that are not properly equipped. Even a layman can appreciate that no matter how well a shop is equipped for a line of quantity production work, it would be useless for repair work. Thus the first asset one must acquire, in order to execute this type of work, is proper equipment. Probably when we speak of machine shop equipment we think of machine tools, jig fixtures, taps, dies, etc. In the case of the repair shop, however, there is a certain line of equipment that cannot be tabulated or easily described. It is that accumulation of material such as odd taps and dies, special straps and bolts of all kinds, angle plates, planer, vises, lathe and drill attachments, and odd lots of metal in the form of forgings, castings, etc., which have served their purpose in one or more ways on jobs of days gone by.

In addition to this list of tangible equipment, the greatest asset perhaps is to have a seasoned organization of mechanics, led by an even more thoroughly seasoned superintendent and engineer, but in addition we must have suitable machine tools. In any specific line of manufacturing, special purpose machines or automatic machinery, play an all-important part, but in repair work we require only the basic type of general purpose tools. In such a category the engine lathe heads the list. There should be at least one tool room lathe of say 12-inch swing with a bed about 6ft. 0in. long. Then there should be an 18 inch heavy duty, and a heavily constructed gap lathe which would swing from 26 in. to 30 in. over the ways. Long beds are useful in the repair shop. Additional equipment in the way of lathes would vary according to the volume of the business and size of the work likely to be handled. A definite recommendation of any stated size or type of lathe, except suggestions in a general way, would be nothing short of presumption, and the figures mentioned above are not to be considered as hard and fast, but rather as approximations.

Thus, we have in a general way expressed ourselves regarding the size of the machines. However, we are very positive and definite in our recommendations of the heavy duty type of machine. A lathe that cannot stand up to high speed practice is a money loser. Hollow spindles, compound rests, double back gears, quick change feed gear boxes, and the screw cutting thread dials are all money savers, as well as the ability of a lathe to pull through a heavy, steady cut.

Value of All Around Capability

All types of drilling machines have their uses, but for all around work it is hard to find a drilling machine that has a wider field of application than the universal type of radial drill press with an arm of at least six feet. The floor plate, block, and pit provide means of taking care of an extremely wide range of work. The purchase of other types of drilling machines will be largely influenced by the general characteristics of the work presented. One or two planers are essential, one for large work and one for medium work, a shaper, a milling machine of the universal type, a bolt cutter, a universal tool and cutter, grinder, and a power hack saw, comprise the list of essential machine tools. Local conditions, of course, and the general class of work available, may cause a somewhat different list of machine tools to be desirable. However, in the general run of repair work the suggested list will fill the bill.

Of course, a large range of small and portable tools is necessary. A wide list of twist drills in both carbon and high speed steels, taps for all standard R. H. threads, a range of straight and taper reamers, with a full range of drill chucks and hand wrenches for same, large and

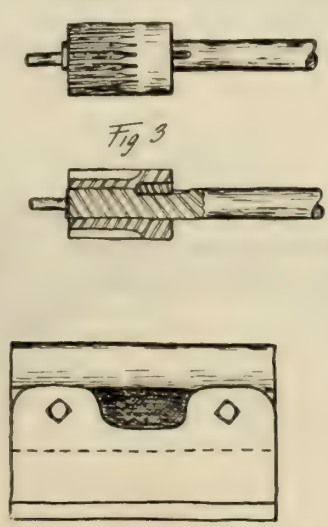
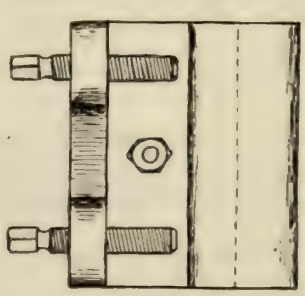


FIG. 1—Simple boring bar holding fixture.



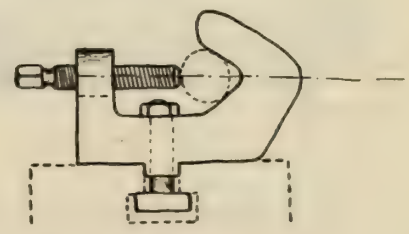


FIG. 3—Showing lathe gear repair.

small face plates for all the lathes, as well as chucks, steady rests, and follower rests, all should be provided. Practically every lathe should have a fixture which could be bolted to the carriage, and which could be used to hold a boring bar, as shown in Fig. 1. A range of boring bars should be provided which would take care of holes of very small diameters up to the largest holes likely to be met with. A large dividing head or indexing head is also very valuable. A good supply of mandrels, parallel blocks, parallel strips, angle plates, clamping bolts, straps, goose necks, babbit mandrels, nuts for "T" slots, hardwood blocks, etc., are among the odds and ends that are invaluable. Thus, it may be seen that the equipment of a first-class repair shop is not entirely purchased, but is accumulated slowly.

The Blacksmith

So much for the machine shop equipment. A repair shop must of necessity be equipped with a first-class blacksmith shop. Generally speaking there should be one or two small forges, and a large forge. An anvil, or two, for hand work should be provided together with a full set of tools and tongs. If work of any decent size is handled, a power hammer of the belt-driven type might be useful. For the very largest work, steam hammers are used. An oil or gas fired furnace fitted with a pyrometer is extremely useful for various lines of work, especially for small tools, gauges, etc. It is quite customary to have a babbitt melting pot and sometimes a brass-melting furnace in the blacksmith shop, provided same is conveniently located to the main machine shop.

If plate and sheet work is done, there should be rolls, shears, punches, riveters, presses, etc., available. Foundry facilities would have to be available, either in the shape of a foundry operated by the shop, or one situated nearby, that was equipped to handle a wide range of jobbing work.

Many jobbing shops are successfully operated without a plate and sheet shop, and some without even a blacksmith shop. The explanation is that these facilities are provided by nearby shops, who cater to the jobbing and contract business. Such connections sometimes work out to good advantage, but they are also frequently the source of a great deal of worry and trouble.

The Problem of Costs

Now that the equipment required has been touched on, we will turn our thoughts to the problem of costs. Quite frequently orders for repair jobs are placed, (after the shop man has looked over the work to be done and has acquainted himself with what is required), at a stated figure, which has been arrived at by an estimate of the time and material involved. In computing the cost of repair jobs a real problem is presented. The layman, however, sees only two items of cost, namely time and material. Now the cost of a repair job has to cover many unusual items. The material costs can be easily taken care of. If one cares to consider all other charges against a job as time, then this item has to cover the labor spent on all special tools and equipment, time actually spent on patterns, cleaning castings, machinery pieces, assembling, testing and gauging, power bills, maintenance, insurance, taxes, interest on money invested in real estate, machine tools, equipment and supplies, advertising, all office expenditures, time spent going to and coming from outside jobs, supervisors, depreciation, lost time between jobs in slack times, cost of small tools and supplies, heating, etc. All these items are pooled together and called overhead expense.

The time expended by men on a repair job is a simple thing to obtain. Thus the overhead charges are the only uncertain quantities in the calculation. These overhead charges are usually expressed as a percentage of the hourly rate paid the mechanic, machinist or millwright. Some well managed shops claim that on average jobs if an overhead of 50 per cent. is charged the shop will break even. Of course these figures would only apply on straight jobs which have no uncertain or complex features, and when the shop was operating at practically full capacity. If a profit was to be made an additional charge would have to be made to cover this item. The average overhead expense of a normal shop working at about full capacity would be from 80 per cent. to 100 per cent. In shops that are carrying a heavy initial investment, or have a large number of highly paid executives the overhead charges will be in excess of the 100 per cent. figure. Speaking plainly, the profit and loss on most jobs can be traced to the degree with which the real amount of overhead expenses have been incurred and calculated.

Source of Profit

The engineering of repair jobs of any size is a very important factor. Some jobs present little or no engineering problems, while others call forth a great deal of skill, in order that they may be successfully handled, and for exceptional skill if they are successfully handled at a profit. Thus in estimating time required for any particular job, the man entrusted with this work must be well versed in shop practice, have an excellent knowledge of the equipment available, and must also have a good grasp of the office end of the business. Usually there is a good margin of time allotted to a contract job, as incidentals will always creep in. Of course, if competition is keen and business rather quiet, the margin of time may be clipped to a very fine point, which is dangerous practice. It is customary for the shop superintendent to know the time alloted to each job and it is his business to keep the time below that figure.

A source of profit to a shop often occurs through the engineering staff devising a new and shorter method of executing the work. Thus in this case a reward is directly received for the intensive application of a man's brains. Profits also accrue from the use of material that has been salvaged from previous jobs and came into possession of the shop for little or nothing.

Profits are often sacrificed when some standard machine or article is placed in a shop for repairs, and an attempt is made to make all the special parts. These special parts on standard articles are practically always made in quantities on automatic and special machines and are sold at a fraction of the cost for which they could be produced in a repair shop. This idea can well be followed up in other ways, and if intelligently applied will become the source of considerable profit. Today, firms standardize and specialize on all sorts of taps, screws, pulleys, hangers, gears, and a multitude of other articles, which are sold at a figure much lower than that for which a repair shop could hope to produce the article. Then too a shop specializing in taps and dies can usually do a special job for a price much lower than that of a repair shop. Thus, to take advantage of all the opportunities offered by outside manufacturing establishments, the repair shop man has to read current

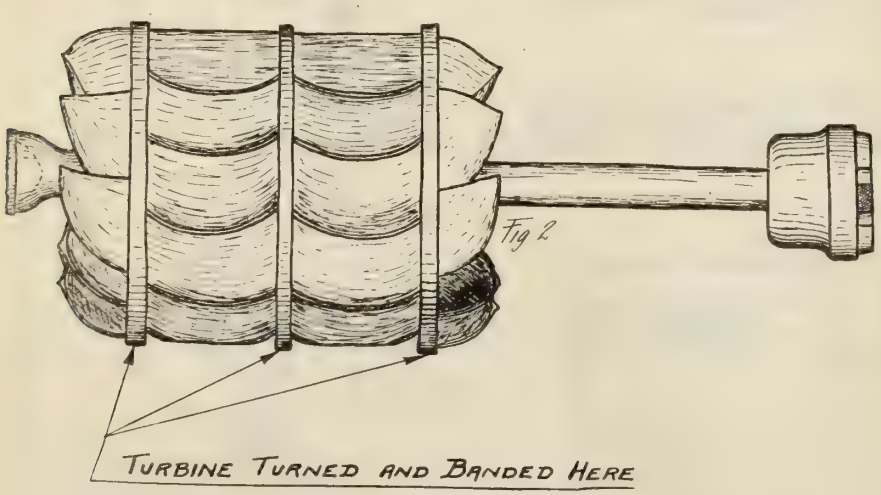


FIG. 2—Repairing a turbine water wheel.

mechanical literature to keep abreast of the times.

A New Practice

In some localities a new practice is becoming rather popular, but it is one that is hardly fair to the ingenious mechanical man at the head of a repair shop. It is the practice of quoting on a repair job on a straight time and material basis. When a job is an outside one such as reconditioning a factory, repairing a steamship, over-hauling a power plant, etc., the party for whom the work is being done, usually takes care of the time of the men composing the repair gang. This is often done by punching the clock in the factory or premises. Of course, time is also checked by a representative of the repair shop. This innovation eliminates any possible controversy as to the actual number of hours spent on a job, but does not enable the ingenious man to directly cash in on his ability, which would be the means of his accomplishing the work in a shorter period of time than some of his less practical friends, it rather tends to penalize him.

Some times financial risks are taken in attempting a short way and a man who carries such a risk ought to be recompensed in a direct manner, just as much as he should benefit financially for having completed a job in a shorter time than it would have required, had some other firm and methods been employed. Of course the indirect benefit the man would receive would be the good reputation he would build, and also the fact that he would be awarded contracts, which under other conditions might not have been received by him.

The time and material basis of handling repair jobs always nets the firm doing the work, a reasonable profit, if the overhead expense can be kept down to a point where the prevailing hourly charge for mechanics is greater than the actual wage paid plus this overhead. In every locality there is usually a standard scale of prices for the services of the mechanic. Thus it is that time and material contracts for repair jobs are never the source of any great profit to a shop.

If real profits are made in the repair business, they are made on jobs which are undertaken at a contract price. It must be borne in mind, however, that money is sometimes lost in this class of business. In large contracts, the various problems are so complex that it is beyond the scope of this article to treat upon them. Thus a few of the simpler examples will be taken up, which illustrate the principles involved in the larger work.

Repairing a Turbine Water Wheel

A manufacturer of a turbine water wheel was called upon to examine a small turbine, of his manufacture, and make an estimate of the cost of repairs. The wheel was examined and it was found to be 21 inches in diameter and was operating a small saw mill. The water was very low at this time of the year, (August) and the cut of the season had been completed some time before. Time did not enter in the proposition, and a thorough examination of the water wheel could be made easily. The wheel, without any accessories sold at about five hundred dollars. The shopman had estimated that repairs, which would make the turbine as good as new, could be made for one hundred and seventy-five dollars. This price was given with the understanding that the owner delivered the turbine to the shop and took delivery f. o. b. cars.

It was found that the turbine gates had been well protected from ice, sticks, and other foreign matter because of a very efficient head rack. The turbine case and runner were of cast iron and the design was of the vertical shaft type. The water wheel was set low in the wheel pit. The bearings, aligning the wheel in the case, were of lignum vitae wood and had been neglected. The result was that the wheel had been rubbing against the side of the case and had worn the bore of the case away almost a quarter of an inch. The diameter of the runner had also been reduced. The lignum vitae bearings were of course worn out. Power was delivered to a vertical shaft, an extension of the turbine shaft, through the medium of a pair of clutch or jaw couplings, no bolts being used. As the wheel wore, this pair of couplings acted as a universal joint. The bearings on the upright shaft were of the babbitted type as they were above water. These were found to be in good shape, as was practically all the other equipment in the mill. The turbine proper, being mostly under water, and out of sight in the wheel pit, had been neglected by careless attendants.

The wheel arrived at the shop. The case was put on a boring mill and was carefully centered and rebored, only enough metal being removed to make a true circle. The turbine runner was put in a lathe, still keyed to its shaft, and the runner was thus also trued up. (See Fig. 2.)

The journal on the top of the shaft was polished and the cup at the base of the shaft, which acted as a thrust bearing, was also trued up and polished. The runner diameter was then carefully calipered and three rings were made in the blacksmith shop from bar iron. These rings were shrunk on the runner. The bands increased the diameter to a dimension somewhat larger than the new bore of the case. Four small holes were drilled in each ring and through into the runner with a 21/64 inch drill. These holes were tapped with ⅜ inch taps and threaded pins inserted. These pins were peaned in place. Then the rings were turned down to fit the new bore of the runner. New lignum vitae bearings were fitted. The old half coupling was next taken off and a new standard half coupling keyed on the shaft. The other half of the coupling was shipped with the turbine, a rough key being provided.

The overhead in the shop in question was figured at 100%. The prevailing rates at the time were as follows; Machinists, 60c.; machinists' helpers, 40c.; laborers, 30c.. blacksmi hs, 55c.; fitters, 60c.; and painters, 50c.

The time and material was shown in the itemized bill which was rendered as follows:—

Time	Hours			
Machinists'...	32¼	at	$1.20	=$38.70
Helpers'.....	9½	at	.80	= 7.60
Blacksmiths' ...	10½	at	1.10	=11.55
Fitters'.....	5¼	at	1.20	= 6.30
Laboring.....	13½	at	.60	= 8.10
Painters'.....	5¾	at	1.00	= 5.75

17 ft.-0 in. bar iron 2¼ in. x ½ in., 8 ft.-6in. bar iron 1¼ in. x ½ in. = 74 pounds at 6 cents or $4.44

1 pair standard jaw couplings = $15.00

2 keys at $1.00 each ..... = 2.00

12 pounds lignum vitae at 35c. = 4.20

skidding..... = 4.00

$107.64

Very little equipment was tied up and only a small number of men thus the job did not interfere with progress on other work. The overhead at 100% was ample and there was a profit shown of approximately $67.36. Of course the jigs and

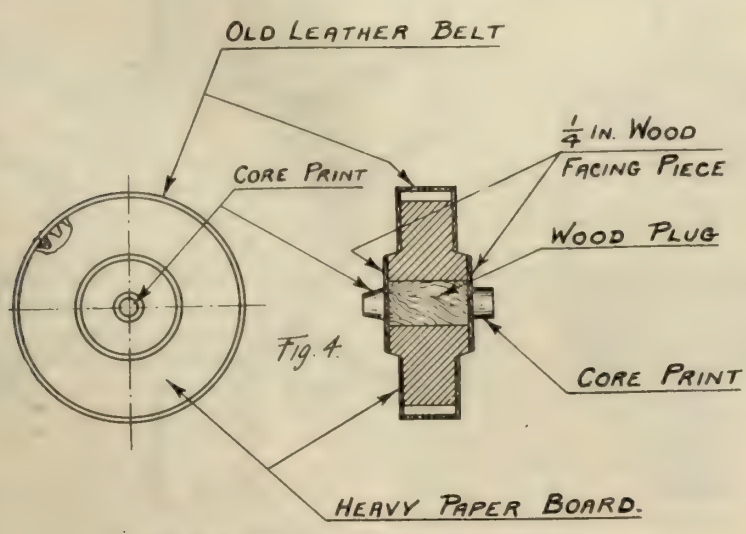


FIG. 4—A quick repair that proved satisfactory.

fixtures used were not charged up to this special job as same had been written off long before the work was undertaken. However, in the overhead expenses a charge for these jigs and fixtures was included, part of which would become profit, and part of which would be absorbed by the care and maintenance of this equipment.

Lathe Gear Repair

Another job, which, although small, was brought to the writer's attention, was a gear repair. This small gear on the back gear shaft of a lathe, had become stripped and rendered the machine useless, except for open belt work. The repair man was called in to see if some change could be quickly effected, as the small gear formed an integral part of the back gear shaft, and to replace it would entail the replacing of the whole shaft, the removing of the large gear from the old shaft, and the fitting of it on the new shaft, as well as fitting the new shaft to the machine. The difficulty was further increased by the fact that it would take ten days before shipment from the factory of the new piece could be made. The repair man made an offer to do the job in thirty-six hours or less. The offer was one which could be expressed as a labor charge of thirty hours. As time was a big factor the offer was accepted.

The back gear shaft was removed. At the repair shop this shaft was placed in a lathe and the remains of the small gear turned off leaving a diameter the same as the shaft. A small shallow key seat to one side of the location of the gear, was cut in the shaft, the work being done on a milling machine. Meanwhile a piece of steel, about one quarter inch larger in diameter than the outside diameter of the gear, was cut from a bar. The length was two inches longer than the face of the back gear teeth. The piece of steel was bored so as to be a driving fit on the back gear shaft and was then placed on a mandrel and turned over its whole face to the diameter of the outside of the teeth of the small back gear. The gear on the mandrel was next placed in a No. 1½ universal tool room miller and the teeth were cut. The shop had a miscellaneous supply of gear cutters and one very close to the proper form was found. A little touching up on the universal tool and cutter-grinder made it just what was required. The gear teeth were cut the proper width to mesh in the gear on lathe spindle.

There was not enough metal between the root of the teeth and the bore to permit of key-seating, so a key-seat was cut in the blank end extension. The gear was bored a few thousandths small so as to be a driving fit on the back gear shaft. Then it was heated and was driven on the shaft and key. (See Fig. 3). A Bristow set screw, on the quarter with the key, was inserted and the job was completed. Eighteen hours were consumed in the work, which was done in a few hours over twenty-four hours from the time the job entered the shop. No overtime was resorted to, and the material charge was small.

Emergency Repair to a Special Machine

During the shell business in Canada, a rather ingenious and quick repair was made to a special machine which was interesting because of its simplicity. A cast iron gear in a special purpose lathe was broken. It was 3.00 p. m. and too late to get another gear cast that day. Production was held up. The gear was of disc design with teeth cut in the rim. Of course the hub was also of somewhat greater depth than the face of the teeth. The gear was 2 inches face and had forty two teeth, ½ inch circular pitch. The outside diameter was thus, roughly 7 inches. The broken gear was removed, as shown in Fig. 4, and leather was wrapped around the outside of the teeth.

The bore was plugged with wood and facing pieces on the hub were nailed to the plug. Card-board discs were placed on the sides of the teeth and the patched up pattern rushed to a brass foundry. The part was moulded and cast just before six o'clock. At seven that evening it was in the shell shop and immediately bored, turned, and keyseated. A miller was put to work and at midnight the new brass gear was in place and the machine running. At seven o'clock the next morning the production for the 24 hours was almost up to normal. The casting of the brass gear blank was paid for by scrap brass accumulated from spoiled brass sockets which were used to some extent in shells. Quick work saved the firm quite a loss, although the circumstances under which this repair job was executed did not permit of the usual checking up as to the actual cost. The result of tieing up that machine for twenty-four hours to forty-eight hours would have run into several hundred dollars.

A repair job in a cement mill that was taken care of in the company's repair shop, by the repair gang of the company was a similar example of money saved. The pulley was of solid design 72 inches diameter, 13 inch face, and was keyed on a 6-15/16 inch shaft. The service to which the pulley was subjected was very severe and thus the design was unusually rugged. The hub, one day, was found to be cracked. The crack led from the corner of the key way. As the pulley was special and was not damaged in any other way it was decided to try to repair it. It was considered that the repair might be accomplished by welding but as there was no reliable welding concern within one hundred and fifty miles, a suggestion offered by the superintendent was made use of.

The pulley was placed on a boring mill and the hub turned on each side of the arms. Heavy steel rings were shrunk on the hub, as shown in Fig. 5, and the pulley returned to service. It ran for several years afterwards and was still in commission when last heard of. Here again is an example of quick action and ingenuity which enabled repairs to be made which kept a plant operating and saved large sums indirectly as well as being of a direct and immediate source of saving money.

Jaw Couplings As Universal Joint

A few years ago a rather peculiar job was undertaken by the writer. A small tramp barge had been purchased by a couple of men of limited means. The vessel was of wooden construction and bore unmistakable signs of age. She was drydocked and repaired, after a manner which was considered suitable for use on the minor inland waters. Difficulty arose in the shaft bearings. Bearings were continually heating and in one bolted coupling, bolts were always breaking. The shaft had been lined up several times and shortly the trouble appeared again. It was clear that with various

(Continued on page 26)

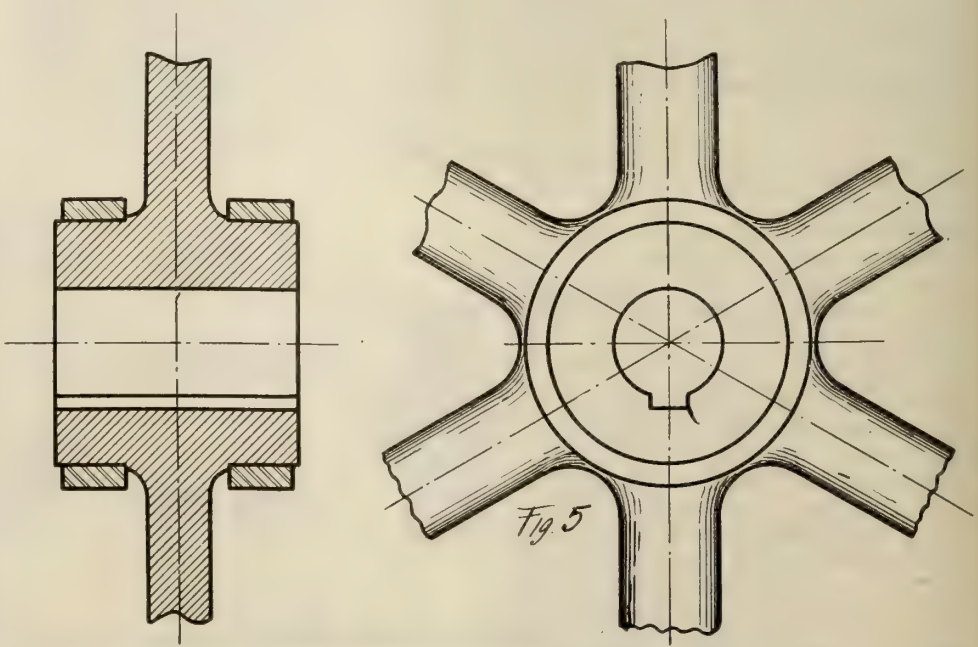


FIG. 5—Showing how pulley was repaired.

Salvaging Machine Shop Waste Important

Method of Segregating Chips, Turnings and Other Scraps Affects Value—Boxes and Packing Materials Can Often be Utilized in Plant—Lubricating Oil and Cutting Compound Should be Reclaimed

*By J. A. SMITH

THE TERM "salvaging" has become a world-wide slogan. Industrial managers are studying operating conditions as never before in the history of business, and among the various phases of the subject which relate to the reduction of operating expense, the salvage of factory wastes comes in for a large measure of attention.

First consider the question of salvaging metal wastes—for every factory in the country manufacturing a mechanical or semi-mechanical product produces metal scrap of one kind or another. It is essential a system be set up whereby the various grades of metal chips and turnings be kept separate in the shops during machine processes in order to save time and labor sorting and segregating in the scrap or salvage department. Non-ferrous metals should always be kept separate from steel and iron. When the parts machined consist of a non-ferrous metal with steel or iron, the chips should be run through magnetic separators.

In some of the larger industries, chips and turnings are pressed into briquets of suitable cupola size, but this practice has not become general throughout the country, and is carried on chiefly where the tonnage of chips and turnings is normally large. The process results not only in higher market value, but also in a material saving in transportation charges. Sheet-metal punching scrap, metal strips, trimmings, wire, etc., should always be put in bundle form and in cupola size before being loaded for shipment.

Miscellaneous Scrap

All the various classes of miscellaneous scrap metal, such as cuttings and trimmings from bar, rod, and heavy sheet stock, small castings, forgings, and solid pieces of every kind, should be accumulated in separate containers in the shop, for this class of scrap has a higher market rating than is obtained for chips and turnings.

Laboratory processes often are productive of valuable wastes in the form of metals such as tungsten, molybdenum, etc., or in various chemical residues which may through conversion or combination become the basic elements of new preparations and compounds.

There is a wide variety of miscellaneous wastes which require attention, and in this field a great amount of salvage work can be profitably done. Lumber, boxes, rope, rubber, fiber, cotton and woolen fabrics, cotton waste, paper insulation materials, chemicals, etc., constitute some of the items which can be salvaged with profit in modern industry. Incoming boxes can be repaired and put in shape for future use either for storing materials, or as tote boxes in the shop. When too large to be suitable for these purposes, the lumber can be utilized for repairing and making tote boxes, temporary platforms, stagings, concrete forms, etc.

The salvaging of lumber and making of boxes from this second-hand material in some of our large industries represents a saving of many thousands of dollars yearly in the purchase cost of new lumber. Even sawdust, usually considered of little value, can be used for the packing of porcelain and similar products, and the finer grades for the drying of metal parts in the dip shop. There is scarcely an item which can be named in the list of industrial wastes that has not some value either in its present state, or in the production of raw materials for the manufacturer's use. Even what is known as shop refuse may be burned in a destructor plant under boilers, and produce steam for heating and manufacturing.

Segregating Metals Is Important

A careful system of segregation is essential in the salvaging of metals, as well as of all other kinds of factory wastes, and this should be carried to the highest standard consistent with local conditions and without defeating the purpose of securing the highest market prices by undue expenditure for labor and equipment. It is well to have all scrap weighed and credited to departments for the two-fold purpose of correct accounting and inculcating an interest for salvage work in all department heads.

But salvage work must be carried into other branches of shop activity, such as maintenance of property, repairs to machinery and tools, handling of stocks, and upkeep of all the various classes of small tools, high-speed steels, etc., and here is where the expenditures begin to mount up to vast sums during the course of a year.

It is essential, therefore, that systems be set up whereby all these items of maintenance receive the most careful scrutiny and expenditures will be adequately limited and controlled. Systems must be set up governing the distribution and repairs of the various classes of small tools so that consumption of these will be regulated within certain defined limits of economy and efficient service, in accordance with production requirements in the shop.

It is good practice to make regular monthly inspections of machine tools and equipment, and make a record of the same, in order that repairs may be made promptly at a minimum of cost before the damage becomes more serious or breakdown ensues with increased repair expense and added delay to production. The record is valuable as showing the relative cost of maintenance and relative life of service of various makes of tools. It is often good economy to replace a tool showing high maintenance cost with a new tool of some other make and thus save expense and delays to production. In all cases of replacements and repairs, valuable parts should be salvaged and made use of on other jobs of repair work, wherever practicable.

Small Tools

In the supply of small tools to the shop much can be accomplished in the way of reducing expense by efficient methods of distribution and collection. A system of regular inspection of toolrooms, tool cupboards, benches, and areas around machine tools should be established. Tools not needed for immediate or current use should be cleared up promptly and returned to stock, and those needing repair put into shape. This is particularly important in the case of high-speed steel tools where the cost is relatively high by comparison, and a single idle tool may represent a good many dollars of tied-up capital.

Nearly all the various small shop tools, such as wrenches, vises, hammers, drills, cutters, pliers, files and numerous others can be repaired to good advantage and thus be made to give greatly lengthened service. By a properly organized system of distribution and collection the inventory of tool stocks carried may be greatly reduced, expenditures for new tools curtailed, and those in use in the shops kept more constantly in active service.

Lubrication of Tools

The subject of lubrication both of machine tools and of cutting tools affords opportunity for valuable reduction in the operating expense of the shop. With modern storage equipment and facilities for distribution to the shops, also proper feed pipes and oilers for regulating the supply to tools, a material saving in consumption of oils and cutting compounds can be made. Selection of oils is most important, and this should always be made with a view of reducing friction load on bearing surfaces and of keeping tools properly tooled and lubricated during the process of cutting, and not primarily in reference to cost.

*From a paper presented at the annual meeting of the American Society of Mechanical Engineers, New York. The author is general superintendent, General Electric Co., Schenectady, N. Y.

Valuable work has been done in recent years in the substitution of mineral oils and mineral lard oils for pure lard oil in a variety of processes where formerly pure lard oil was felt to be necessary. In fact, a heavy-body mineral oil of correct specifications will do the greater percentage of jobs commonly done with lard oil without any material increase in consumption, and with greatly reduced cost. A high-grade light-body mineral oil will also do many processes, such as turret-lathe work, milling high-carbon steels, etc. Soluble cutting compounds also have their place in machine-shop practice, and their use in a great variety of processes, such as drilling and milling, plain lathe work, cold cutting, etc., results in greater economy than can be secured with oil.

Attention needs to be given to the handling and distribution of oils in order to avoid waste. Machine tools should be equipped with proper tanks, drip pans, and aprons, in order that nothing may be lost. Reclaiming oil from reduction parts and from ships and turnings is a part of the salvage work of every up-to-date factory. Much talk is heard on the subject of reducing inventory, and it is essential that the work be carried forward intelligently and earnestly. The present is the time to make thorough investigations of every department and storage space, and to gather all surplus or idle materials and make effort to put them into service, or otherwise dispose of them to advantage. Analysis must be made of the methods of handling and distributing materials in order to establish improved systems, reduce labor, and avoid delay or damage.

Special attention should be given to cutting raw materials to required dimension or multiples of required dimension in order to save waste; and to the salvaging of all left-over pieces and parts for further use in some portion of the factory, wherever practicable. The central storehouse should act as a clearing house for this purpose and thus aid in the general work of salvaging.

The Human Element

The human element enters into salvage work, as into other industrial operations. If department heads and employees as well, can be interested in saving everything of inherent value, a valuable service in helping to re-establish industry will be performed. Not only industrial managers, but the public as well, are more interested in this most vital of human problems. One of the large industries salvages annually, in normal times, more than 80,000,000 pounds of factory wastes. The railroads also have caught the spirit of thrift and are establishing new practices which are showing greatly improved conditions as regards operating expense. The country at large in a recent year saved scrap, consisting of metals, papers, rags, wool waste, cotton fabrics, etc., aggregating more than $1,500,000,000.

In the next few years industry will be called upon to bear a large portion of the burden in the vast and arduous work of reconstruction. Engineers and managers should be strongly imbued with the vital principles of economy and thrift, and with the importance of greatly increased effort along the lines of salvage work. The question of profit must not always be a deciding factor, but a broader view of saving everything which may be of value to others in the production of raw materials or finished fabrics. The manufacture and supply of raw materials depends so often upon the supply of various kinds of scrap and waste that it is most essential consideration be given to the country's needs as a whole. Indirectly benefit will be derived through reduced cost of the raw stocks purchased.

Each Individual Can Help

No appeal to the manufacturer to save the waste products of industry can be made too forcible or too strong, nor can too much emphasis be laid upon the necessity for every individual joining earnestly in this work. Every pound of junk saved and turned over to the junk dealer in the end reaches the great melting pot, and finally the marts of trade, in the form of raw materials to be of definite value to some one; and that one, incidentally, may be any one engaged in the profitable manufacture of fabrics which serve a public need.

The nations of Europe, through the exigencies of the war, were forced to carry on the work of salvaging to its greatest limit in order to sustain the people at home and the armies in the field; and now, during the period of reconstruction, they appear to have doubled their efforts and to have gone beyond this limit in the struggle to rebuild government and business and industry on a stable and enduring basis. In America the people are gradually becoming more and more aroused to this big problem both in public and private life. The vital importance of practising the simple precepts of economy and thrift and of guiding all actions both in business and private life to that essential end is needed.

A permanent reclamation service, fostered and maintained by the national government as other public services, is needed. Through this office practical appeal could be made to the governors of states to mayors of cities and presidents of villages, and through these latter to the heads of boards of trade and to public-spirited citizens, to cooperate in the work of saving the nation's wastes.

Through this channel also could be disseminated much useful knowledge and instruction relating to the work of reclamation, which would thus reach in a helpful way not only the populous industrial centers but the outlying districts as well, and by this means bring about a widespread, concerted action for the public good. No one may attempt to predict the full extent of the value or the aggregate return of such a movement to the government and country at large.

Still another phase of salvage work which is distinct and apart from the field of salvaging metal scrap and other factory wastes, is saving of time and of human effort, the harboring of mental and physical energy, and the devoting of all efforts to highest purposes and highest aims. Profitable manufacturing requires the building up of organizations both in offices and in the factory with a view of concentrating directive effort, eliminating duplication of orders and instructions, establishing unity of purpose, system in method of procedure, and co-operative effort on the part of all employes, whether serving in official capacities or in the lower grades of mechanical and physical labor.

It is essential departmental forces be organized in such manner as will secure systematic control of all the functions of labor and consumption of materials, and the keeping of manufacturing expenses within the budget provided for conducting shop and office work. Organizations must be built with a view of attaining the highest standards possible, in order to re-establish business on the high plane of influence which it must always occupy in the successful upbuilding and support of the government and nation, and in the permanent establishment of the normal pursuits of industry and peace.

LARGE CRANK SHAFT

Something approaching a record in large crank shafts was recently achieved in a British engineering works. This shaft was constructed for a large marine engine. It measures nearly forty-three feet long and weighs fifty tons. Much more notable than its size, however, was the accuracy with which it was finished When the shaft was inspected the error in the total length was only eight one-thousandths of an inch, while the maximum error in all the bearings did not exceed twelve ten-thousandths of an inch.

HOURS TO MINUTES

What are you doing in your firm, to reduce hours to minutes?

This is one of the vital questions that measures your efficiency. Nearly all profits and high wages and low costs depend upon reducing hours to minutes.

For instance, a typewriter with a quick typist writing sixty words a minute, reduces an hour to twenty minutes.

A steam shovel reduces an hour to three minutes, as it does the work of twenty laborers.

A printing-press, continues Efficiency Magazine, reduces an hour to perhaps one-fortieth of a second, as it would take forty men one hour to write one copy of a ten-page newspaper which a press prints in a second.

In these days of high cost it is the time element that makes you or breaks you.

Our one main hope of success is in reducing hours to minutes—in getting more work done in less time.

The Problem of Efficient Power Transmission

Unfortunately This Important Production Factor Has Not Received the Attention it Deserves—Friction Causes Largest Percentage of Loss—Charts And Tables Showing Different Conditions

*By G. C. V. HEWSON

THE EFFICIENT transmission of power is a problem which, unfortunately, has received but scant attention in all but a very small percentage of the mills in Canada and the United States. Even in plants being laid out and built at the present time, the transmission question seems to be receiving no consideration, and engineer concerned apparently believes, that for this work, anything is good enough, and that if he can economize by buying second hand material so much the better.

It would appear, therefore, that the general engineering world has not made much progress in this regard in the last ten years, for the same state of affairs was deplored by Professor Unwin, one of the foremost authorities in machine design, in the last, or 1912 edition of his text book "The Elements of Machine Design," Part 1. On page 261 of this volume the following statement is made:

"In any large factory, the shafting, with its couplings, pulleys and gearings, forms a very important, costly, and power absorbing part of the machinery. Although great attention has been paid to the economical production of power, and its economical use in machines, the intermediate transmission is sometimes barbarous in arrangement and shows great neglect of any study of conditions of efficiency. In different machine shops it has been found that the power required to drive the shafting varies from 15 to 50 per cent. of the whole power employed."

That the loss of power through friction, in line, and other shafting, is of serious proportions has been amply demonstrated by various tests carried out from time to time. It has been stated that at Sir Christopher Furness, Westgarth and Co.'s Engine Works, Middlesborough, England, in one shop where two long lines of shafting and a comparatively small number of tools were used, the loss was 75.6 per cent. and that in two other shops it was 59 and 42 per cent. Truly a remarkable state of affairs.

No. of Installations Tested	Class of Industry	Max. H. P. per brg.	Min. H. P. per brg.	Average H. P. per brg.
6	Stone working	0.245	0.124	0.191
7	Wood working	0.318	0.015	0.117
25	Clothing mfg.	0.037	0.010	0.027
50	Machine shops	0.237	0.025	0.066
100	Various	0.321	0.015	0.119

Further light is thrown on the subject of transmission friction losses by the above table taken from an article "Friction of Line Shafting" by C. A.

* Engineer with S. K. F. Co., Toronto.

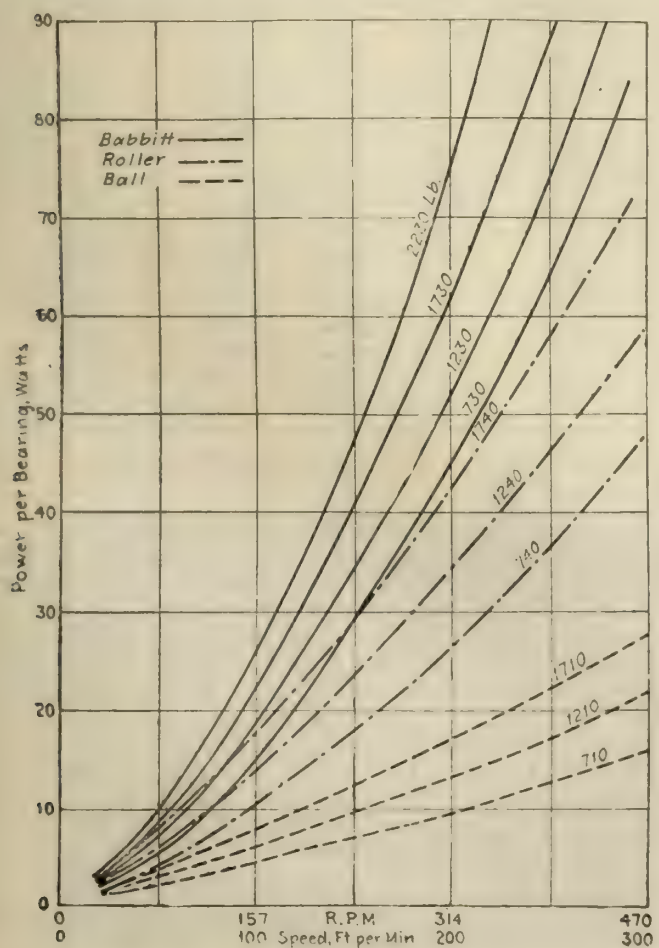


FIG. 1.

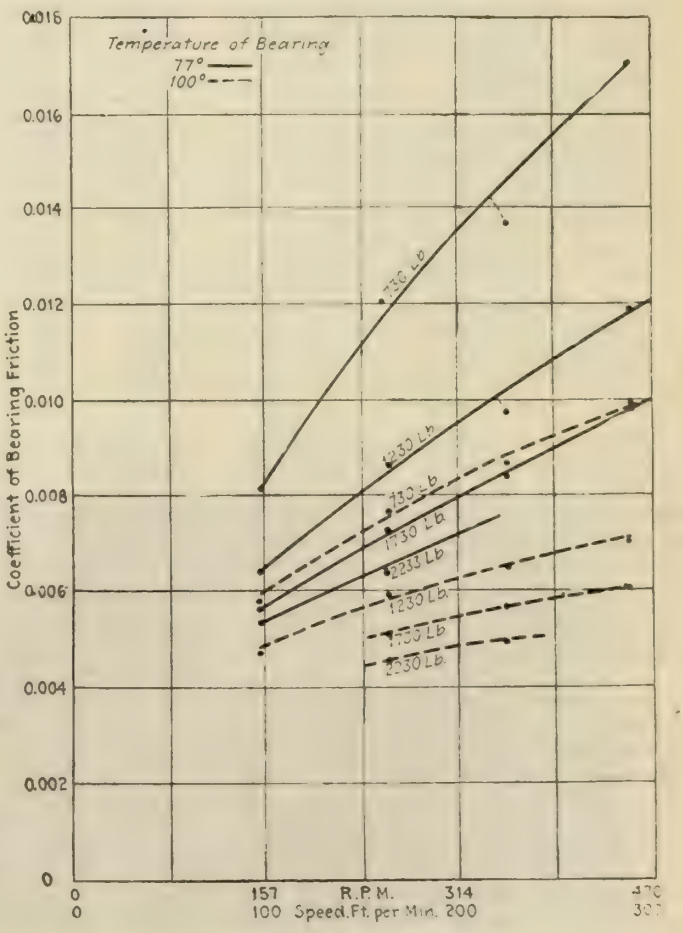


FIG. 4—Power Consumption Chart.

Graves, in "American Machinist," and giving the result of tests carried out on 188 installations.

Classified According to Industry

Classification according to size, the following table gives average h. p. per bearing:

No. of Bearings	Size of Shaft	Average R.P.M.	Max. H.P. per brg.	Min. H.P. per brg.	Average H.P. per brg.
66	15/16–1	428	0.052	0.010	0.036
706	1 – 1/8	382	0.079	0.016	0.033
37	1 – 1/4	425	0.119	0.040	0.062
492	1 – 1/2	392	0.193	0.035	0.089
155	1 – 3/4	218	0.113	0.029	0.078
409	2	242	0.300	0.028	0.133
21	2 – 1/4	264	0.321	0.124	0.257
83	2 – 1/2	243	0.300	0.085	0.255

While the above figures are of considerable interest as showing the conditions that obtain, they do not exemplify the true significance of the results as clearly as the following table covering the bearing losses in thirteen different industries and containing a column showing the percentage of total input power that is required to drive the shafting:

INDUSTRY	Line shaft in feet	R. P. M.	No. of Bearings	No. of Belts	No. of Counters	No. of Machines	H. P. to drive Machine	H. P. to drive Shafting	Percentage to drive shafting
Wire drawing and polishing	1130	170	115	89	69		243	157	39
Steel stamping and polishing	580	200	68	28	27	18	17	57	77
Boiler and machine work	1530	150	46	53	47	43	13	25	66
Bridge machinery	1460	110	142	92	79	69	11	48	81
Heavy machinery work	1130	190	110	141	96	68	48	64	47
Heavy machine work	1065	180	114	192	152	123	77	91	54
Light machine work	784	135	101	217	133	250	20	21	51
Manufacturers small tools	500	114	58	335	314	313	34	40	54
Manufacturers small tools	900	175	102	217	202	258	23	24	52
Sewing machines and bicycles	2490	150	274	521	403	454	82	108	57
Sewing machines	1470	160	184	484	435	179	33	74	70
Screw machines and screws	1800	180	180	486	392	428	127	114	48
Steel wood screws	674	175	96	131	89	392	100	17	15
Manufacturers' steel nails	988	200	74	187	175	184	50	46	50
Planing mill	165	267	19	45	40	53	11	28	73
Light machine work	275	175	27	48	27	30	4	4	49

Examination of the last column of the above table reveals the fact that from 15 to 81 per cent. of the total power required to operate the plant is absorbed in line shaft friction. The industries given, while by no means complete, are at the same time representative and indicate the ridiculous state of affairs existing in probably every line of manufacture.

For instance let us consider flour milling, a branch not covered by the above data. Taking the industry as a whole, it is safe to assert that more than one-half of the total power consumed is wasted in bearing friction and that of the energy delivered by the motor, less than 50 per cent. is available for converting the wheat into flour. Considering the type of mill, it is a matter of record that the minimum friction load is about 45 per cent. and the maximum about 65 per cent. of the total power consumed, with the mill running empty, and not taking into account the immeasurable friction that is added to the original friction load when the feed is turned on.

The absurdity of a condition, such as the one just outlined, must be apparent to every thinking man. Of what use is it to develop the efficiency of a prime mover to the really remarkable figures that have been obtained in recent years, for instance 93 per cent. in large water turbines, and to perfect the driven machine or machine tool to an efficiency close to 100 per cent., if the two are to be linked together by a transmission system whose efficiency may be as low as 15 per cent? Clearly a ridiculous idea. But worse than the ludicrous result is the pathetic fact that clever men can use so little logic in dealing with these matters.

Obviously, the only solution is an anti-friction bearing of maximum efficiency; and to fulfill this condition the ball bearing is most eminently suited. No more convincing evidence of this fact can be given than by outlining the results of a series of tests of the comparative friction of three types of lineshaft bearings, carried out at the University of Wisconsin, by Professor E. R. Maurer, (Professor of Mechanical Engineering) L. E. A. Kilso, (Instructor in Electrical Engineering,) and four senior students doing research work. These tests were made in order to ascertain definitely the relative and absolute amount of power required to drive a specially constructed lineshaft, carrying given loads at certain known speeds of revolution, when supported successively by three different types of shaft bearing, and to determine coefficients of friction for each type. The three types were tested, (a) a ball bearing, (b) a ring-oiled babbitt bearing of the following composition, lead 86.1 per cent., antimony 11.9 per cent, and tin 2 per cent. The last type tested was a roller bearing.

The coefficient of friction for ball and roller bearings was computed, just as for babbitt bearings, from the formula.

$$f = \frac{531 \text{ (watts per bearing)}}{\text{IIdn (load per bearing)}}$$

where "f" is the coefficient of friction, "d" the shaft diam. in inches, and "n" the revolutions per minute, one watt being equal to 44.26 x 12 or 531 inch. lbs. per minute. Figs. 1, 2 and 3 show the coefficient of friction speed-curves

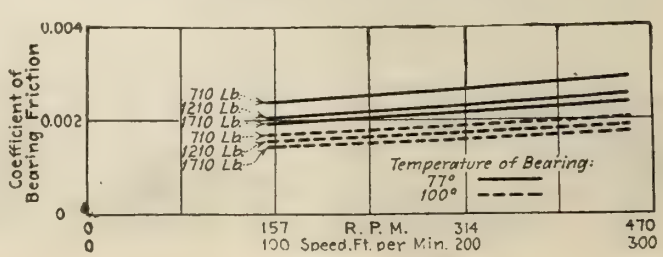


FIG. 3

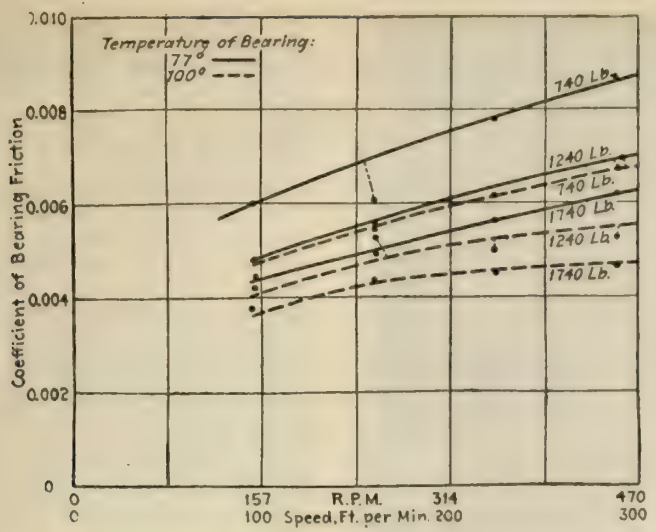


FIG. 2

for babbitt, roller and ball bearings respectively, at 77 degrees and 100 degrees temperature. Analysis of these curves reveals the fact that the coefficient of friction for a babbitt bearing at low speeds is about 30 per cent. higher than for a roller bearing, and 200 per cent. higher than for a ball bearing. The babbitt coefficient increases very rapidly with speed, especially on light loads. The roller bearing coefficient increases much more slowly, while the ball bearing coefficient is almost constant over the entire speed range. This last fact is of importance because it means that the friction load of ball bearing transmission is constant at all speeds.

An important point, not shown on these curves, because the first readings recorded were considerably above zero, namely 157 R.P.M., is the large coefficient of friction of a babbit bearing at the actual moment of starting, that is, between zero and ten r.p.m. This value is extremely high, due to the fact that the oil is squeezed from between the journal and box while the shaft is at rest, and the coefficient of friction is that of steel on babbit until a film of oil is formed between the surfaces. In a roller bearing, the coefficient has only a slightly higher value at the moment of starting than it has after the shaft has commenced revolving, while in a ball bearing the co-efficient is practically the same at starting as at any time later. This point is of the utmost significance since it means that a smaller motor can be used to start a shaft equipped with ball bearings than to start a shaft carrying the same load in babbitt boxes.

Fig. 4. compares the power consumed by friction in the babbitt, roller and ball bearings at 77 degrees Fah. Each curve gives the power required per bearing, of the kind indicated, to run the shaft under the load and at the speed specified. The figure shows that the power for the babbitt is higher than for the other bearings, and that the power for rollers, is higher than for balls. The excess of power for babbitt over rollers and rollers over balls increases with an increase in speed for all loads. The following table shows the relative amounts of power consumed in friction by the three kinds of bearings at the speeds and temperatures indicated. The relative numbers are based in each case on the average power for three loads: 710, 1210 and 1710 lb. for ball bearings; 740,1240 and 1740 per roller bearings; and 730, 1230 and 1730 for babbitt bearings.

This table is not intended to give more than a few figures, taken from the curve, so as to present a general idea of the relative power consumption of the three types of bearings.

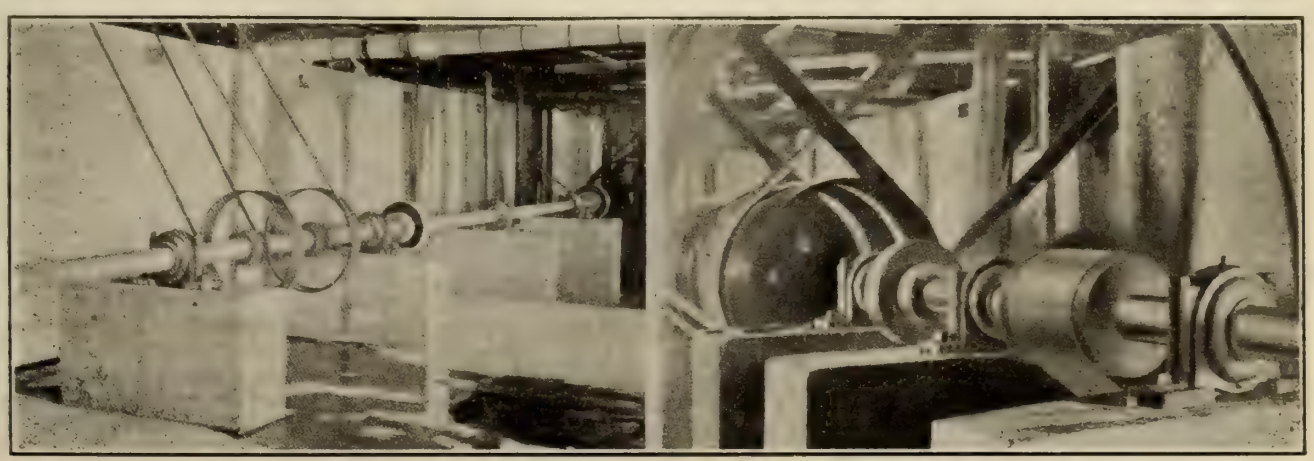
From the above it is readily seen that two important results are obtained by the use of ball bearing transmission. The actual frictional load is reduced to a minimum at all speeds of operation, and the size of the motor necessary to start any given load is decreased. There are however, other features which, while though not so important as the two just mentioned, have a decided effect on the general operating efficiency of the plant.

A ball bearing equipped line shaft can be operated at speeds far in excess of a shaft on plain bearings. By directly connecting the shaft can be run at motor speed. In a woodworking plant, the advantages of such a drive are obvious. High speed countershafts are eliminated and with them is eliminated one of the most frequent sources of trouble. Also, the smaller the number of countershafts, the fewer the belts required, with the consequent reduction in first cost and maintenance. Such a drive is illustrated in the drawing Fig 5. A practical example is shown in Fig. 6, which is a photograph of a heavy roll stand drive direct connected to a large motor in the plant of the Quaker Oats Co. at Peterborough.

If the speed of the line shaft is increased to two or three times what it formerly was, the size of the pulleys may be correspondingly reduced so as to give the same rim speed as before. For instance a 10 inch pulley at 650 r.p.m. has the same circumferential

Relative Amounts of Power Consumed In Friction

Bearings	100 feet per minute		300 feet per minute	
	77 Deg.	100 Deg.	77 Deg.	100 Deg.
Ball	1	1	1	1
Roller	2.2	2.5	2.7	3
Babbitt	3	3.6	4.5	4



FIGS. 7 and 8—For reference to these photographs see text.



FIG. 6—Heavy roll drive direct connected to 450 h.p. motor

speed as a 25 inch pulley at 260 r.p.m. A considerable saving in the cost of pulleys can thus be effected. Or, when operating at increased shaft speed, by keeping the main line pulleys close to their former diameters (thereby increasing the rim speed,) narrower and lighter belts can be used.

The advantages of applying ball bearings to countershafts are quite as great as those obtained by applying them to main line shafts. There is probably no piece of mechanism, of the same size and cost, in the machine shop which causes as much trouble as the average counter. This trouble can be completely eliminated by the use of ball bearings regardless of the speed at which the shaft is operated. The belts can be run slacker, due to the small friction load, resulting in a decreased maintenance cost. The remarkable saving that can be effected under certain conditions was brought to the writer's attention about a year ago. A certain firm in Toronto had a reversible countershaft, which destroyed, on the average, three sets of belts per year. They equipped this counter with ball bearings which cost them $72.00. At the time of the writer's visit, which was two years after the ball bearing installation had been made, they were still using the same set of belts they had put on at the time the bearing change over was made, and were in perfect condition. As the belts cost them $38.00 a set, and they had been using three sets a year, they saved the cost of the ball bearing equipment in less than the first year.

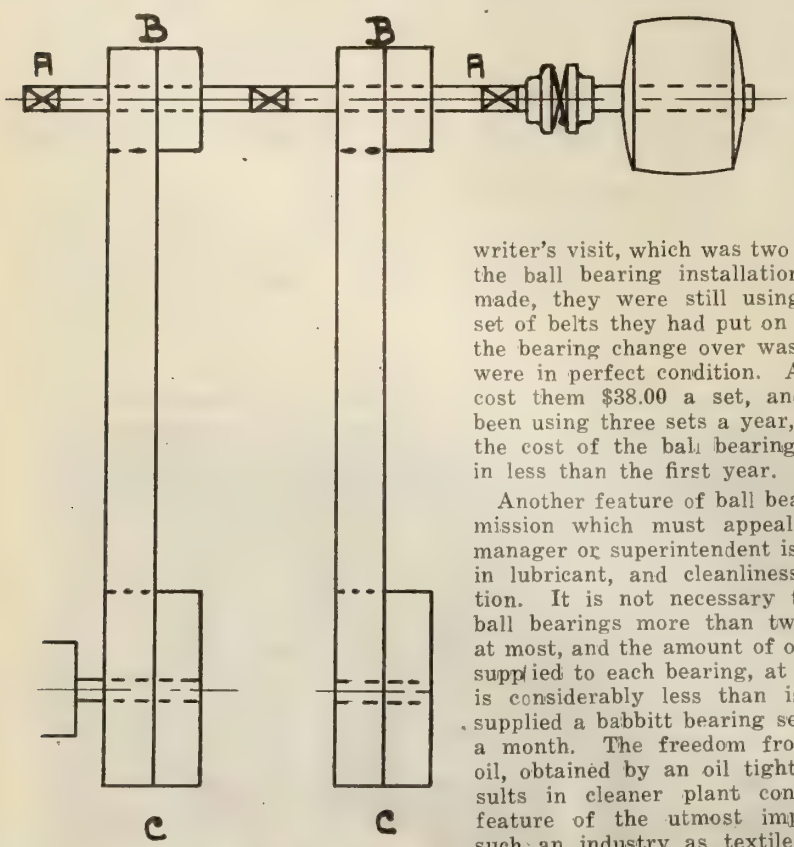


FIG. 5—A direct connected shaft

Another feature of ball bearing transmission which must appeal to every manager or superintendent is the saving in lubricant, and cleanliness of operation. It is not necessary to lubricate ball bearings more than twice a year, at most, and the amount of oil or grease supplied to each bearing, at such times, is considerably less than is generally supplied a babbitt bearing several times a month. The freedom from dripping oil, obtained by an oil tight casing results in cleaner plant conditions (a feature of the utmost importance in such an industry as textiles,) and reduces the fire hazard.

Owing to the fact that the bearing is enclosed in a dust proof housing, it can be operated satisfactorily in plants where dust and grit conditions in the atmosphere are such as to quickly bring about the destruction of the unprotected plain bearing.

Before leaving the subject the writer would like to correct an erroneous impression still held by many users of power, namely, that ball bearings cannot be used on heavy drives. Figs. 7 and 8 are photographs showing a 5 15/16 inch line shaft, 100 feet long, mounted on ball bearings. This shaft is driven by a 28 inch belt and transmits 375 horse power. In spite of the great weight of the shaft with its pulleys, when the belts are off, the entire length can easily be turned by one man. Further comment is unnecessary.

REPAIR WORK

(Continued from page 20)

types of cargo, and with varying quantities of the same, the boat strained sufficiently to throw the shaft out of line. One thing was certain, a rigid bolted coupling would never do. The trouble was reduced a great deal by simply substituting a pair of jaw couplings of heavy design for the flanged and bolted couplings. This was done at a moderate cost and gave the engine on the old craft a fresh lease on life. The thrust was taken care of in such a way that this expedient did not interefere with it.

Another job that was somewhat unusual and yet simply disposed of was the case of a large 60 inch x 60 inch planer. The shop in which this planer was located did quite a flourishing business in cast iron foundry flasks which were used in an up-to-date factory for moulding bath tubs. The copes, cheeks, and drags, had to be planed square and to thicknesses within a few thousandths. This, the planer would not do. It was practically impossible to place a cope piece on a drag and avoid a slight rocking. It was only a few thousandths but was great enough to permit of the rejection of the pieces. It was found when the machine was checked over that internal strains in the castings were blamed as well as the theory that the parts had been clamped in a manner so as to distort them. These theories were investigated and were found wanting. The trouble still remained. The firm offered a premium to anyone discovering the trouble.

The man who received the premium discovered that the machine had recently been reset and that when checking up the setting only ordinary levels and measuring instruments had been used. Thus he felt sure that had precision instruments been used it would have been found that the machine was not set properly. He used these instruments and found the extreme end of the bed had settled slightly. He introduced thin shims under the supporting pads and re-planed the table and the trouble had disappeared. His work took only a few hours and it netted him a nice profit.

The Prevention of Freight Loss and Damage

Railways Have Recently Taken More Progressive Steps to Prevent Losses to Goods in Transit—Loss and Robbery Are Two Important Factors—Men Can Accomplish Much by Holding Experience Meetings

*By JOSEPH MARSHALL

PRACTICALLY all railways have taken more or less progressive steps to prevent loss to goods in transit with splendid results. However, the individual departments have not been able to check loss in goods which, in order to reach their various destinations, have to be routed over several lines. In order to attack the problem from this angle the association with which I am connected was formed, and we are securing the support and co-operation of practically every road in the U. S. A. and Canada. Figures tabulated by our association show that $125,836,948.00 was paid in claims by the Canadian and American roads during 1920.

The average man would hardly believe that a sum equal to what it costs the railroad to secure its traffic is paid out for mishandling after it is secured.

Loss and damage exceeds account of the superintendence in transportation. It exceeds the cost of dispatching trains and all station supplies and expenses. It will more than pay the wages of all yard enginemen. It will almost pay the fuel bill for the yard locomotive. It will pay the yard enginehouse expense, plus the yardmasters and all the clerks.

It costs twice what bureaus, advertising and law expense cost during 1919 and half as much as the bill for ties. It would more than pay the cost of supervision of maintenance of ways and structures and maintenance of equipment combined. It will almost pay the bill for rails. It will come within a half million dollars of paying the tax bill. It will pay the insurance bill for every general department, and you could add the entire stationery and printing bill for all departments of every railroad in the Dominion and still have over a million dollars left as waste.

Loss and Robbery

The largest single item is loss of entire packages. Add to this robbery and you have about 20% of the total claim payments. In nearly every case a lost package is nothing more than a lost record. If the record shows what happened to the box the package is not lost. So, to find lost packages, find where the record stopped.

The largest item is unlocated damage. This is a damage not explained by investigation. Freight going into car in good condition and coming out at destination damaged, specific cause unknown, but influenced by the following: strength of package or crate, method of stowing in car, weight of load in car, mechanical condition of car, position; length of time car en route, the degree of handling car receives in the train and in the yards.

This subject can probably be hooked up with rough handling of cars, which is the next largest item. We know from what we see out in the field that a large portion of our damage is due to the quality of the handling the car receives. Opinions differ on what constitutes rough handling.

We find that freight train car repairs stand at $29,938,025. This is 8% of the total operating expenses. It is certain that claim prevention will have an important bearing upon reducing this item, and every operating, transportation and mechanical man is interested in making that reduction. At the last annual meeting of the Freight Claim Division, Mr. J.A. Pilcher,mechanical engineer of the Norfolk & Western, delivered a talk on this subject, the burden of which was, that cars equipped with spring draft gears must not be brought together at a speed greater than two miles per hour at time of impact. He chose spring draft gears on the theory that we must bring the force of our handling down to meet the strength of the weakest link and then he suggested we cannot continually make heavier cars to meet heavier handling, and that men must learn to ease up and not hit cars just because they look like they will stand it—repeated drops of water will wear away granite.

To answer a thought which may arise in the minds of some, I want to draw a distinction between switching at two miles per hour and coupling at two miles per hour—two different things. If an engine foreman can switch fast and not damage the scenery, he is a good man. If he can so line up the work that every member of the crew understands what the other fellow is trying to do, and between them they have their speed down to two miles per hour when the cars come together, he is a good prevention man. It is worth study in every yard as shown in the claim accounts and the car repair bill.

Unfit Equipment

The next largest item is defective or unfit equipment to which we can add wrecks. Over 50% of any activity directed to any of the four items just mentioned will influence for good each of the remaining three items. You can readily see why it is so—all of them together account for about 40% of the total claim expenditures. With this we can keep in mind that maintenance of equipment, taking 23% of the total op- [illegible] ind reduction in proportion to the effort devoted to reducing transportation account insofar as relates to unlocated damage, rough handling, defective equipment and wrecks, or derailments as the operating man likes to call it.

Therefore, we have rough handling causing damage to freight, damage to equipment, which results in leaky roofs, sides, etc., impairs the running gear or

placement. What can we do about this? My first thought brings me back to the committee arrangement where the men can find occasion to discuss better methods: where one switchman can talk "turkey" to another switchman about his signalling methods and bring about a better understanding, and the art of giving a signal so the other fellow will understand it and not come down for three car lengths when he had but two to do; where a conductor can tell an engineer what happened on the rear end and not start to fight about it. You could not put one engineer in the cab to show something to the other fellow, but he could do it at meetings and get away with it and thus be of help to the travelling engineer, trainmaster or road foreman of engineers, if one is on the road.

Train and yard men can tell the car men about bad hand brakes, and the car men need not hesitate to tell the switchmen about pulling air hose with the engine and what that leads to. These meetings are the greatest kind of help to superintendents, trainmasters, yardmaster, or other staff officials in keeping abreast of things that create claims and enlisting the help of the rank and file in getting right things done in the right way, and at the right time.

Here are some of the things for discussion with the idea of using them with variations to suit the conditions in each yard:—Restrictions as to commodities that will be sent over humps. Restricting the number of cars that will be handled in one cut; some restrict to 15 cars, others 20.

Discussing signalling methods to avoid misunderstanding and to learn the best method for each particular yard. The man on the engine knows the num-

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ber and weight of cars, but he does not always know how far he is going. Shall the engineer take signals from the engine foreman only? What does a man going from one yard to another know about the interpretations applied to the terms used by switchmen? When it is used, is the wash-out signal a quick stop or a slow sign?

What is behind the failure of couplings to make? Plenty of room for discussion here. What is the best brake equipment for switch engines, straight air or automatic? To what extent are trains classified to reduce switching en route? Do enginemen know the effect of releasing brakes on long trains when running at low speed? Many frightful angles to the brake question and a wide field for discussion.

Trouble With Brakes

Brake pipe leakage causing trouble with air brakes—much of this results from pulling air hose apart with the engine. Every trainman ought to uncouple the hose and not simply allow the engine to pull the coupling apart. A live committee in any terminal will soon put a stop to that practice.

Stopping trains by applying air at the rear end, either by opening conductor valve, angle cock, or tail hose is another practice that would be discouraged.

How much time should be allowed for the inspection of train after being made up? Is enough time being allowed in any particular yard? It is said stretching trains entering or leaving terminals is a great help to car inspectors and enables them to test the air in the least possible length of time. The question of the proper place in trains for old and weak equipment is a live subject which should be kept in the minds of yard men at all times. Reporting bad brakes and hand brakes, and long brake chains, for proper corrective measures will help the rough handling account, also checking yard delays to reduce the extent of handling and opening merchandise cars for inspection of condition of load before or after lined up for road.

Yard air testing plants connected up with freight houses, team tracks, etc., where practicable, will be of help. With this goes the question of triple valve cleaning, oiling, ring adjusting, etc. Among the aids to supervision in this work can be mentioned:—

The flood lighting of yards, conductor's air-brake cord, report of draw-bar failures, report of knocked down drawheads, and report of yard damage. These to be followed up with a view of correcting the underlying causes.

Out on the road we have a wide field for educational work with train and engine men on such subjects as:—Negotiating grades, the control of slack action, uncoupling engine before making water tank stops, bunching slack and stopping trains before entering switches, the general subject of starting and stopping, the reporting of train line leaks, supplying suggestion cards for use of train men in reporting prevention matters.

The Instruction Car

Then there is the matter of getting the men to visit the air brake instruction car, where one is used. At stations we have the matter of methods of pulling and setting house and team tracks, especially where partly unloaded cars are involved and the problem of watching the traffic volume to provide as many set out cars as possible to reduce merchandise handling — the less handling, the less claims.

The above are a few things having a bearing on unlocated damage and rough handling, some of the matters which must be gone into, if we are to talk rough handling to the men in the field, because it is necessary to neutralize the excuses which are afforded to explain such failures, thus clearing the way for an intensive campaign among train and yard men.

A good plan, where it can be worked, is to choose certain engineers who are willing to place their minds on the subject, to study train handling; make a write-up of their observations and circulate this to employees. The same can be done with respect to other employees writing from their standpoint, such as conductors, yard foremen, car foremen, etc.

Claim prevention calls for education and co-operation. We must educate ourselves and the other fellow. There are conflicting opinions as to what constitutes education for the purpose of preventing claims, but we can call it education in good service—it is nothing more. What we do to prevent rough handling will, of course, reduce the number of derailments and reduce the money. After an accident does occur, the big thing is to salvage as much freight as possible. To this end, wreck outfits should be equipped with tarpaulins and cooperage supplies to take care of any situation, and as the car department usually looks after picking up wrecks, the wreck master should be a member of some committee, at least he should be kept posted on claim prevention matters, so he will be interested, and will never fail to open a car which is lying on its side, get his men inside and re-arrange the freight in such a manner as to cause the least damage when car is righted. He should know exactly what the car contains before taking hold of it with the big hook. It may burst open. If the freight inside the car is arranged for such a contingency, or shifted in position for the proper righting of a car, a lot of money can be saved.

Safety Department

The safety department of a railroad can consider freight claim prevention along with its safety work. I do not suggest that the work can be mixed, but simply want to show how they are interested because we, as railroad men, ought not to allow a bad practice or condition to go unnoticed, particularly when we can reinforce our argument from two standpoints.

Here are some examples:—

A defective running board or apron over which freight is trucked might go off under a truck; if so, personal injury is possible, plus damage to freight. Leaking tank cars cause loss of oil and danger of fire, explosion and personal injury. Dragging arch bars, or brake beams, can be talked from both standpoints; so can overloading of coal on tender or coal cars; so can holes in freight platforms. Also bad breaks and methods of signalling in yards. These are just a few to show the wide range of overlap in the work of men who may be looking after safety first as well as those who may have sole charge of doing things to prevent freight claims.

All work to eliminate rough handling in transit and defective equipment combines safety first with safety to freight. It will be observed that delay is another large item. The rule should be to keep freight moving—it is the slow drag that keeps moving that gets freight over the road. The remedy lies in terminals, a good daily yard check and a live prevention committee will solve the problem. Other causes such as hot boxes, resulting in set outs en route, is a matter of proper journal packing to be looked after by the car department.

A Large Item

In talking about delay, we must not overlook the dispatcher. Keep him posted on claim expenditures, particularly the truck dispatcher. He is the man who puts the stuff over the road. Another point to be considered is that anything which reduces delay will reduce per diem. Many disputed points on claims would be decided in favor of the freight claim agent, were it not for some delay along the route. Delay means increased hazards of all kinds. Any road with an agricultural department may get them interested in crop conditions and field diseases in connection with fruit and vegetable loss and damage. Big opportunities await the railroads in this field of possible prevention activity.

It will be observed that defective and unfit equipment is one of the large items. In presenting this problem to you, I can do no better than state it as it appears in a report the freight claim division has just drawn up for the consideration of the mechanical division, as follows:—

For seven months ending March 31, 1921, defective and unfit equipment account summed $5,876,056, or 9.9 per cent. of the total payments, divided as follows:

Car Load	$5,322,770
Less than Car Load	553,286
Total	$5,876,056

against total payments divided as follows:

Car Load	$32,573,286
Less than Car Load	26,996,110
Total	$59,569,396

It may interest readers to know the principal commodities represented by defective equipment payments:

	Car Load	Less Car Load
Grain	$1,765,462	$53,202
Coal and Coke	1,076,387	17,250
Flour and Mill Products	901,923	95,397
Sugar	394,652	33,170
Fresh Fruits and Vegetables	103,672	8,388
Cement, Lime, Sewer Pipe, etc.	74,985	8,456
Live Stock	56,228	1,220
	$4,373,363	$217,083
	217,083	
Grand Total	$4,590,446	

As a matter of information, we show the percentage of defective equipment payments charged to specific causes, as taken from figures compiled at different times by individual roads as a guide in determining the relative importance of the subjects detailed in what is to follow:—Defective equipment sums 9.9 per cent. of the total payments, or on basis of $10,464,000 per year at the present rate of payment of $5,876,056 in seven months. Wet through the door, will account for 5 per cent. and up to the above figures, depending upon the rainfall and the kind and nature of storm encountered, as such damage results from wind blown rain only. Leaky roofs will take care of 30 to 60 per cent., depending upon the territory and the weather. Nails and bolts will account for 4 to 6 per cent.

About 1 per cent. of the above payments can be charged to dirty floors. The average for six selected years on two roads was .859 per cent. In discussing defective equipment losses as applied to grain and coal, we must consider the item of "Unlocated Loss." This is a loss the specific cause of which was not determined by the investigation. This item is influenced by defective equipment.

The payments on grain for the seven months were as follows:

Defective Equipment	$1,765,462
Unlocated Loss	573,053
Total	$2,338,515

Under the method described above, this sum will roughly divide as follows: 25 to 35 per cent., scale discrepancies, 5 to 14 per cent., defective lining or siding, 5 to 6 per cent, defective grain and other doors. The percentage varies on different roads, depending upon the conditions.

In these days of double loading, it is difficult to accurately determine how much of our so-called rough handling, unlocated damage, and unfit equipment, damage to carload sacked goods, is due to the many obstructions now appearing on the inside of box cars, or how much might be saved by building cars with smooth interiors, such as is provided in refrigerator cars. The loss and damage on carload flour, mill products, sugar and cement, summing about $300,000 per month, gives an indication of the value to be derived from a study of the question as applying to these and other commodities—bulk grain, for example.

During the seven months $444,229 was paid account damage to live stock. The physical condition of stock cars has an important bearing on this item, particularly with reference to horses and mules. As a sidelight on horse and mule damage, it may be mentioned that bruised eyes result from striking obstructions in the roof, resulting from the habit such animals have of throwing up their heads.

Defective Equipment

One phase of defective equipment affecting claims concerns the transfer of bad order loads. One large road making a check for a 30-day period reports 500 such cars transferred at a labor cost of $11,000 in adidtion to the claim hazard. This cause, of course, is influenced by unfair handling, yard damage, etc. On the theory that the less handling freight receives, the less damage will occur, it is thought that car foremen could well give consideration to the matter of reducing this handling by an inspection to determine methods of running a car without transfer, taking into consideration:—The nature of the load, the condition of the load, the length of the haul to destination, and the possibility of temporary repairs.

On Prevention Day (May 18, 1921) during our 1921 annual session, the following action was taken in connection with consideration of the above subject:

"That report be made to the Mechanical Division of the A. R. A. that it is felt that losses due to defective equipment are of such extent as to merit consideration by that division with respect (1) to agitation for extensive repair of equipment; (2) need for drastic regulations as to selection of equipment for grain, flour, mill products and coal; and (3) enforcement of rule for stenciling of bad-order, leaky-roof cars." Every railroad man should be interested in making the railroad successful. He should do what he can to prevent waste of railroad revenue in satisfying loss and damage resulting from failures in transportation.

All of this expenditure is not preventable in the ordinary sense of the term, but the claim man, paying this money day after day, sees so much that he thinks and much which he knows can be prevented, that the freight claim division of the American Railway Association is placing this subject before those who we are sure will be able, from their own knowledge of what is right in this particular field, to reduce this waste after the claim man points out the causes with his idea of the remedy available.

I have touched upon methods of interesting the rank and file, but they cannot be expected to go any further in this work than their opportunities will permit. To produce this opportunity the supervising heads of all divisions of each general department of railroading must be interested. Previous remarks have taken care of the important features of the operating and mechanical departments. There are a few, additional, however, of equal importance, and I shall attempt to show how they are interested in this question and how they can help by encouraging their men to watch those features of their work, the wrong handling of which spells claims.

The car department can do much to prevent the use of cars unfit for the class of freight to be loaded. Equipment may be scarce, but a good system of carding cars, showing class of freight they are fit to carry, and a proper interest by yard men, will always produce the few good cars to be found in every yard to load the few high-grade commodities loaded from that place every day. In theory, when a merchandise house is set for the day, every car is one fit to carry merchandise. Any cars found unfit must be used as they stand set out, or fixed up. We know it doesn't pay to break up a house setting, so the tendency is to use the car. This car, if used, will be loaded to some freight house at some other place, perhaps a small place where the house foreman must make his own empties. In any event wherever it goes, it likely will be unloaded at a point where it at once becomes another merchandise car, and this may go on for weeks and months until finally the car gets out of the merchandise channel and is set for the loading of mill products or other commodities.

Puts Cars In Shape

The point here is that a car once in merchandise service is likely to remain in that particular channel for a long period of time carrying a new load each few days. If the condition of that car is such as to produce claims, it is of more than passing importance that it be put in shape before it starts out. The car department can do much to get this car in shape even if by use of temporary repairs. The car may show daylight. Temporary repairs to missing sheathing will save damage. Perhaps it will be possible to draw from doorposts protruding nails left for bracing previous loads. Perhaps they can replace bad hasps or locks, as a car in that condition is a standing invitation to be robbed each time it is loaded. This can be done on all cars which reach the rip trace for any purpose. Card leaky roofs so they will not be used for high-grade commodities.

The Purchase and Storage Department can help when buying new equipment by following the Mechanical Division's recommendation and help get money-saving devices into effect. They could have car builders cut off bolt ends where they protrude beyond the nut on inside of cars.

They can have their men represented on prevention committees so they can learn the many ways of co-operating

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WHAT OUR READERS THINK AND DO



ANSWER TO QUESTIONS

By I. N. BRIGHAM

Replying to "Can you answer these questions?" in the December 22nd issue of Canadian Machinery, I hope the following will help the questioner somewhat at least.

Regarding the query as to the variations in the reading on the Scleroscope on the different size balls. The enclosed sketch shows the right and wrong way to test balls. Fig. 1 shows the wrong way to support the ball as in a conical depression, while Fig. 2 is the right way to support small balls. "A" shows that the ball must be struck in the center, to avoid the side glance of the drop hammer, as at "B" and "C" and vibration at "D." If the balls are ground flat and parallel, and struck directly above the point of support, the reading will be correct. If your correspondent will read the Shore Scleroscope; its Application to the Arts, he will find out the reason he got so much variation in the readings. It is sent free on application. The writer used the Scope for testing gauges, cutting-tools, etc., during the War, and found it very reliable when properly applied.

Replying to query as to how threads are cut in scroll chuck jaws; this is done on a scroll lathe designed specially for cutting scrolls used for operating the jaws of scroll chucks.

The part to be operated on is held either in a chuck or special fixture attached to the spindle of the lathe. The scroll lathe built by the Automatic Machine Co., Bridgeport, Conn., has two tools held on slides, which, in turn, are mounted on a carriage. This carriage travels forward and backward along a bed located at right angle with the axis of the work-spindle. There are no idle movements because one tool is cutting while the other tool is returning. The tool-slides withdraw for the return movement, and, when the tool reaches the starting point, it is automatically fed in to a predetermined depth for the next successive cut. When the cut is finished and the tool, after being withdrawn, is on the return movement, the tool in the opposite slide is taking a cut. When the spiral groove has been cut to the required depth, the feeding of the tool is automatically discontinued. The travel of the carriage and the position of the bed relative to the work are adjustable. The lead of the spiral is varied by means of change-gears which impart motion to the lead screw, and either a right-or left-hand spiral may be cut. After the grooves in the jaws are cut, they are relieved for the travel of the jaw.

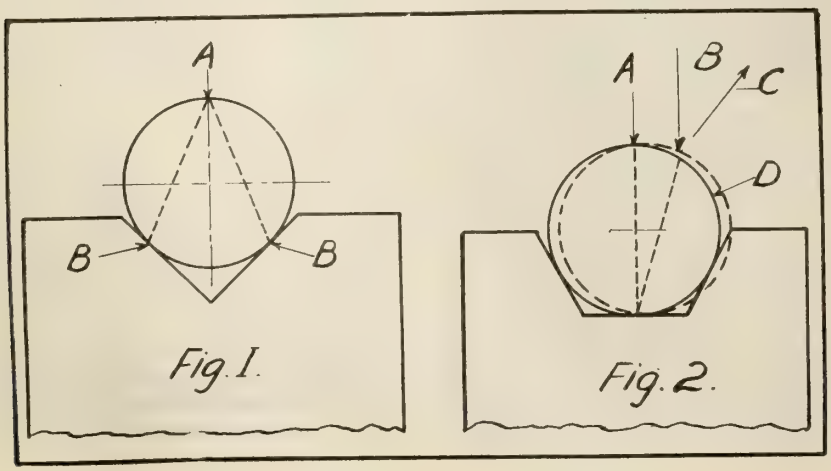
NOTHING NEW UNDER THE SUN

By WALTER ROWLANDS

Some time ago an article appeared in a mechanical journal under the heading "A new idea in upsetting," and went on to say that a very large automobile manufacturer had built and equipped at considerable expense an upsetting dept. to make gears and other parts off the bar, thereby eliminating considerable waste caused by drilling the holes. The idea was to upset the piece in one or more impressions in the dies, and then in another impression to punch the hole. The bar would then be separated from the piece required and when reheated would go through the same procedure again.

A few years previous to the above article appearing in print the writer had charge of an upsetting department in connection with a forge, and had occasion to get out as soon as possible a considerable quantity of hexagon nuts of large diameter, which were required to be rather more than standard size across the face. Fortunately I had an old pair of dies that suited the job, and after taking a light cut over the face I turned them over and put the impressions on the backs. The job cost very little money and in a very short time we were ready for the job of turning out hexagon nuts in exactly the same way as the supposed new idea.

By heading, and then punching the holes which released the bar, and by having several pieces in the furnace, the job of making the nuts was fairly fast. The same thing happened to the writer some years later in another firm where the purchasing agent had neglected to order some square nut blanks, (not threaded), and as the time was limited in which they would be required it was impossible to obtain them. Our nut machines were too small for the job so we made bolt heads and punched the bar out and the nut dropped in the floor. The strange thing about this job was that the purchasing agent omitted to order the blank nuts the following year although he was told the first time that making the size blank by this method was too slow and costly and was only done in the first instance to enable shipments to be made on schedule time.



NEW HAND TOOL

The breast drill is one of the most familiar of small hand tools in engineering shops, and a new tool in a novel form has been brought out by a British firm. This tool provides four separate speeds. The usual toothed crown wheel is replaced by a disc with four concentric circles of conical holes. On the drill spindle there is a pinion which meshes with one circle of these holes. In order to change the speed of the drill the pinion is moved from one circle of holes to another. At all speeds the gearing is said to run smoothly yet rigidly. The tool is also noted for its lightness.



DEVELOPMENTS IN SHOP EQUIPMENT



EXTERNAL AND INTERNAL LAPS

The R. & C. Lap Company, Davenport, Iowa, has recently placed on the market a line of standardized external and internal laps. These have been designed and developed with idea of producing a lap that can be used in production manufacturing in the shop, as heretofore lapping has been almost universally confined to the tool room. The laps can be used with excellent results by labor that has not had previous experience in lapping operations. All laps are provided with interchangeable shells which are, of course, replaceable. Two grades of shells are provided, the use of which depends upon the speed of cutting desired and the type of work. These laps are made in sizes from one quarter inch up. The laps consist of a floating type shank, and an expanding device for adjusting the size, and also to take up wear of the soft metal shell which is charged with abrasive. This adjustment precludes any chance of a lap sticking in internal lapping operations, and always allows the lap to be removed from a piece of work when lapping is completed.

Although the lap can be contracted in the work after the operation is completed, it cannot be made to expand beyond the original micrometer setting, which maximum diameter limit is secured by a lock nut adjustment of the expanding mechanism. It is claimed that the expanding mechanism is so constructed that a constant diameter is maintained from end to end of the lap, which fact, of course, produces work of constant diameter. The laps are fitted with standard shanks and may be used in a lathe, drill press, or by hand. The lap may be expanded to the proper size by means of the adjusting nut, and this setting may be maintained by means of a locknut. The abrasive is then applied, and the work is lapped in the usual way.

REAMING AND CHAMFERING MACHINE

The Murchey Machine & Tool Co., Detroit, Mich., has recently developed and placed on the market, a machine which is intended for reaming and chamfering pipe nipples and other pipe fittings. The pipe nipple, or whatever piece of work is to be machined, is held in a central vise which is opened by pressure on a foot treadle and is closed automatically when the pressure of the foot is released. There are two spindles which carry the tools. These spindles are mounted on opposite ends of the machine, thus both ends of a piece of work are machined simultaneously. Both these spindles are operated through one capstan wheel placed at the right hand end of the machine.

When a nipple has been reamed and chamfered it is knocked out by the insertion of the next nipple and drops into a receptacle which is regularly provided as an integral part of the machine. The jaws of the vise are hardened and ground. Wide bearings are provided for the slide on which the vise operates. Provision is made so that the work in the vise centers itself as the tools start cutting. A countershaft is provided on which are two drive pulleys of different diameters which give two independent ranges of speed to the machine.

In addition to this a four-step cone pulley is provided. The capacity of the machine is for nipples from ½ to 2 inch pipe and lengths up to 12 inches can be accommodated. The machine under test recently produced six hundred and fifty ¾ in. nipples per hour and another test showed that the machine was capable of machining three hundred and seventy 1½ in. nipples per hour. The approximate weight is 1,200 lbs. and the floor space required is 8 x 2 ft. An oil lamp is included in the regular equipment which furnishes cutting lubricants to the tools. Although primarily designed for reaming and chamfering the machine can be equipped with dies for threading but in this case the capacity is for fittings from ⅛ in. pipe to ¾ in. pipe sides. Tees, valves, studs and other work that requires threading on both ends can be easily taken care of in this machine.

RENEWABLE PLUG GAUGES

Several sets of plug gauges, on which the gauging ends are renewable, have been placed on the market in wooden cases by the Coats Machine Tool Co., Inc., New York. The design is intended to make replacements possible with a minimum of cost. The gauges are made of hardened steel and are ground within an accuracy of 0.0001 of an inch.

There are two principal sets of gauges supplied in cases. Set No. 1 comprises fourteen sizes from ¼ inch to 1¼ inches in diameter, the sizes increasing by 1/16 of an inch, up to 1 inch, and by ⅛ inch from 1 inch to 1¼ inches. The four smaller sizes are made solid with the handle. Set No. 2 includes sizes from 1⅜ inches to 2¼ inches in diameter increasing by increments of ⅛ of an inch. In addition to these standards, renewable limit plug gauges are also manufactured and supplied by the same concern from stock. Each gauge of the limit type, consists essentially of three parts, a "Go" end, a "No Go" end, and a handle. The handles are interchangeable and one size will fit a range of plug sizes. Both English and metric measurements are carried.

QUICK-CHANGE DRILL CHUCK

The "Save-All" Tool Co., Waltham, Mass., has recently placed on the market a positive, safety, quick-change, chuck for drills or other tools with taper shanks. The tool is held in a collet which may be slipped into the chuck when the sleeve on the latter is raised. When the sleeve is lowered jaws engage the taper end of the collet and hold it in place. A safety device, in the form of a pin that shears, prevents the breaking or burning of tools. The pin is held in place by a pointed screw which seats in a groove in the pin. After a pin has been sheared it is readily removed by loosening the screw.

It is claimed that the construction of the collet is such that members do not stick when tools are changed. A special feature is a compensating collet lock which automatically takes up wear and eliminates end motion while a Bristol set screw prevents the tool from pulling out. Tools can be changed while the chuck is revolving. Release is obtained by tapping an ejector on the small end of the collet. One of the standard chucks accommodates drills having Nos. 1, 2, 3 and 4 Morse type shanks. Other types accommodate an equally wide range. All parts are hardened except the shearing pin.

THREAD-LEAD GAUGE

The Toledo Tap and Die Co., Toledo, Ohio, have placed on the market a Thread-Lead Gauge, which is designed to quickly and accurately check the lead of all taps and accurately threaded studs. The gauge has an arm 8 inches long that is pivoted on adjustable angle bearings and carries at its outer end a hardened and ground conical point.

The arm also has a hardened button which comes in contact with the plunger of a dial gauge, on which is positively registered any variations between a master thread gauge and the work being inspected. A second hardened and ground conical point is mounted on a slide which may be operated horizontally, so as to vary the distance between this point and the pivoted arm. The distance between these two points can be varied from ½ to 2 inches.

In using the device the master thread gauge is first placed in the proper position and the instrument adjusted to it. Then the dial gauge is set at zero, and after removing the master gauge, the specimen to be inspected is inserted in the machine and any variation in lead, from that of the master thread gauge, is read directly from the dial gauge.

The dial may be furnished to read either in thousandths or ten thousandths of an inch. The arm and pivot points are fully enclosed so that they are not accessible to curious operators who may wish to tamper with, and adjust them. For the same reason they are practically free from harm due to abuse of the instrument.

ELEVATING TRUCK

The Western Tool and Manufacturing Co., Springfield, Ohio, has placed on the market an elevating truck. The construction is entirely of iron and steel, many of the parts being hand forged. Two front wheels, placed only a few inches apart, swivel on thrust ball bearings. The whole four wheels are provided with cage roller bearings. The truck has a lift of 1½ inches, and it is capable of handling weights up to one ton through the efforts of one man. The turning radius of truck is its own length. The dimensions over-all are, length 46 inches, width 26 inches. The standard platform dimensions, with the over-all dimensions given above, are, length 38 inches, width 23 inches. However, special platforms of greater length can be provided on special order.

CLEANING MACHINERY

A cleaning machine designed for cleaning small parts such as roller bearings, gears, ball bearings, drills, milling cutters, motor and generator parts and other small tools has recently been placed on the market by the Black & Decker Mfg. Co., Baltimore, Md. The machine consists of a cast iron pedestal, at the top of which, a bowl is mounted. The bowl is 13 inches in diameter and 12 inches deep. It has a fine mesh brass screen supported about 5 inches from the bottom. The housing of a plunger pump is cast integral with the bowl. The bowl has a safety cover so arranged that it cannot be left open. The cover is lifted by means of a convenient handle that operates the pump.

A gallon of kerosene, gasoline, or any other desirable cleaning liquid is poured into the bowl, and the operation of the pump forces a stream of this fluid toward the center of bowl from the side. The parts to be cleaned are held under the stream so that all dirt and chips are washed away and deposited on the screen below. The fluid passes through the screen and on to the pump to be used again.

PORTABLE WELDING OUTFIT

There has recently been placed on the market a welding outfit that is contained in a fibre case to facilitate the transporting to a job. This outfit has been brought out by the Davis-Bournonville Co., Jersey City, N. J. The various units in the case include: a torch, three extension tubes, five welding tips, decarbonizing tube, oxygen regulator, twelve feet of oxygen hose and connections, twelve feet of acetylene hose and connections, spark lighter, pair of colored glasses, and torch and regulator wrenches. The copper extension tubes can be furnished in any length desired. The tubes are flexible thus making welding possible in inaccessible places. It is claimed that the outfit is suitable for any welding job.

QUICK CHANGE DRILL CHUCK

The Collis Company, Clinton, Iowa, has designed a quick-change drill chuck. It can be used in the spindles of lathes, drilling machines, screw machines and other types of machines including those having rapidly revolving spindles. The chuck can be operated by one hand and collets inserted or released when it is revolving at speeds up to 1,500 revolutions per minute. The ease with which a tool can be replaced adapts the chuck for use where several operations are performed on one spindle without removing the work.

The collets have taper shanks and may be used in either a vertical or horizontal position. Different collets can be used to accommodate the various tapers or straight shanks of drills and taps. A special type known as the "Use-Em-Up" enables drills with twisted or broken shanks to be used. In such cases it is only necessary to grind a flat on the remaining portion of the shank. The chuck is manufactured in six sizes.

PORTABLE ELECTRIC DRILL

The United States Electric Tool Co., Cincinnati, Ohio, has developed a small portable electric drill having a capacity for drilling holes up to 5/16 inch diameter in metal. The drill has an aluminum alloy housing, weighs about 5½ pounds, and has an over-all length of 9 inches. Hardened chrome nickel steel gears, running in grease, are provided. The electric switch is located in the handle so as to be conveniently controlled by the thumb at all times. The motor is of the universal type, air cooled, and operates on 110 or 220 volt circuits. When used on alternating current circuits it can take care of current from 25 to 60 cycles single phase. It is capable of being used on direct current if the voltage is correct. Connection is made to any lamp socket. The drill is particularly suitable to corner drilling

VERTICAL BROACHING PRESS

The Lucas Machine Tool Co., Cleveland, Ohio, have recently placed on the market a vertical broaching press the ram of which is driven from a train of gears having as a prime mover an electric motor. The application of the machine is for the operation of push-broaches, requiring only short broaches, allowing the work to rest in the horizontal position, permitting of easy lubrication, and providing a convenient means of operation for the workman. The drive between the motor and the gear train is through the medium of a leather belt. The motion of the train is controlled by a friction clutch in this pulley which engages a wormwheel. The length of the stroke can be regulated automatically by a dog which can be set at any desired point and will reverse the motion of the ram. A gauge is mounted on the ram, so as to register the pressure that is exerted.

The machine is built in two sizes, the smaller requiring a 7½ horse power motor, the larger a 10 horse power size. A pump supplying cutting lubricant can be included, although this is not part of the regular equipment. The large machine exerts a pressure of 30 tons and the smaller a pressure of 15 tons. The speed of the ram on the large size is 9 ft. per minute and on the small machine is 6 ft. per minute, while the return speeds are 21 and 15 ft. per minute respectively. The maximum distance from the base to the ram in its top position is 48 inches for both sizes, although a high-pattern type of machine can be furnished to special order with a height of 60 or 72 inches. The distance between the housings is 25 inches for the small machine, and 30¼ for the large. The speed of the driving pulley for both machines is 500 r.p.m. The net weights are 2,900 lbs. and 3,800 lbs. respectively.

MOTOR DRIVEN ROAD ROLLER

The use of steam for driving road rollers has been the universal practice for so long that the change to the internal combustion engine strikes one with a peculiar degree of surprise. At a recent transport exhibition in London, a British firm showed a type of motor road roller weighing eight tons. It is a three wheel machine driven by a 20 horse power engine running at 1,000 revolutions per minute. Petrol is used for starting, and afterwards the engine runs on crude oil. A single lever effects all speed changes, giving three speeds—two and a half, one, and one half miles per hour—forward or backward. Ample power is afforded for hill climbing as the engine runs at full speed when the roller is going at its lowest speed.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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There Is Profit In It—If

ON ANOTHER page of this issue appears an article on "Repair Work and How It Can Be Made Profitable." Everyone should make it a point to read this article for it contains many hints of value. Some people imagine that a repair shop is a glorified wood shed into which has been placed some old-fashioned, second-hand machinery. The proprietor is sometimes pictured as an overalled member of the gang, dirty in appearance, and a rapid tobacco chewer, but why go further with this very much misunderstood personality.

The modern repair shop is just as carefully housed and laid out as any manufacturing plant. True, there still exists the type of small shop which is content to putter away in some back alley, but these places are not to be classed as genuine repair concerns. You might as well compare an up-to-date garage with the little shed out in the country that has a whitewash sign proclaiming the fact that ANY make of car can be repaired there while you wait.

The size of repair shops differ. The style of plant may vary, but look inside. The equipment and general appearance tell the story. One can readily tell whether high-grade work can be expected or not. While many mechanics can turn out a better job on a fairly good machine, than others can on the best tool available, still we cannot dismiss the necessity of first-class equipment on these grounds. All the more reason why the capable worker should be given the best machine possible.

Another point of importance, and one which unfortunately does not receive the attention it deserves, is that of keeping track of costs. Many repair shop owners are content to give a price on a job which they believe to be high enough, secure the order, then think they have made money, when in reality they haven't. Usually, it takes a few years before this type of man finds he cannot pay his bills, and we soon see a sign "For Rent" on his premises.

There is good profit in the repair business IF certain factors are continually kept in mind. The business should be handled in a regular, and not in a haphazard manner. A proper, but simple, cost system should be adopted, overstocking of material should be carefully avoided, and only the best type of mechanic should be employed. There is an erroneous impression existent that any old mechanic is good enough for the repair business. This viewpoint is ridiculous, for the better the workman the quicker he will complete the repair, and the greater the profit to the owner. Last, but perhaps most important of all. The foreman, or owner, as the case may be, should see that he is always dressed in such a manner that he will create a spirit of confidence in the minds of his customers. He should be able to leave the shop in charge of some competent employee, and devote his activities to the securing of orders and otherwise building up the business. Many an order has been lost, because owners, or foremen, of repair shops, have been too busy (?) to give proper attention to prospective purchasers.

A Year For Energetic Men

READERS of Canadian Machinery may approach the present New Year in either of two moods. They can feel dispirited, pessimistic, hesitant, finding many arguments to support their attitude, or they can resolve to encourage optimism, enterprise, and more business. Each individual exercises an influence on those around him. That influence may be buoyant or heavy. A community is a collection of individuals and what communities think and do becomes public opinion. Public opinion is one of the greatest of human forces.

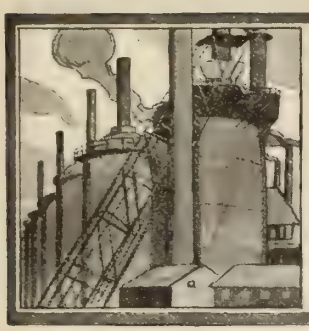
The most casual observer knows, of course, that there has been a period of depression. That it would come, as certain as evening follows day, was anticipated by all who took the trouble to read lessons from the past. History repeats itself with faithfulness. During every war of magnitude there has been a period of lavish expenditure, inflated prices. Always it has been followed by a cycle of contraction and readjustment. The pendulum of time has always swung in one direction as certainly as it swung in the other.

For a couple of years Canada, in common with other post-belligerent countries, has been balancing the two sides of its ledger. It has been taking stock, counting its elusive dollars against heavy obligations, clearing over-loaded shelves and settling back to sound economic principles of production and marketing. Every one has recognized that it is necessary to go through the valley before you can begin to ascend the hill on the other side. The question which thoughtful men, who have responsibilities on their shoulders, are now asking, is, whether the corner of the road has been turned?

Without suggesting that caution and shrewdness should not still be boon companions in every person's office or shop, at the same time no one who thinks it worth while to carry on business should forget that 1922 will see a considerable volume of business done. The world does not stop moving. It doesn't even sit down by the roadside to rest, but jogs along, pulling and complaining, laughing and grumbling much as it has done for centuries.

The note that Canadian Machinery wants to pass on is that a bright day is always more inspiring, more prosperous, than a dull, gloomy one. The business man who sees nothing but clouds around him will scarcely expect his colleagues, his staff, his salesmen or his business creators to look through brighter glasses. On the other hand, the man who makes up his mind to do things, generally finds a way to do them and the initiative hustle, aggressiveness of one person unconsciously radiates to others. 1922 may not be made a big year, but the story it will have written across it will be the story of busy, enterprising men. Dollards and pessimists rarely write anything.

Alberta coal is estimated to form 15 per cent. of the world's supply.



MARKET DEVELOPMENTS



Business Conditions Show Decided Improvement

Figures From Steel Mills Encouraging and Prices on Various Products Remain Firm—Channels of Demand Are Discussed—Ice Breaker Controversy Continues—Small Tool Market Improves.

THERE IS AN optimistic note in the various market reports this week which augurs well for future business. Although very early in the new year, various lines show considerable improvement already. The steel trade is holding up remarkably well, and prices remain firm. One concern reports an increase in business of 136 per cent. since our last market summary. This same firm also expects the present week to be still better.

Other dealers in steel goods report an even better volume of business than was expected this month. Several good orders have been closed and dealers are well satisfied.

The small tool market is picking up. Several concerns are replenishing their stock of drills, reamers, etc., and from now on dealers in this line expect a gradual improvement.

The scrap metal market has improved slightly and things are expected to be still better as time goes on. Machine tools are not very active, although enquiries are coming in all the time. When this business breaks, it will be in good volume.

The controversy in Montreal regarding the purchase of an ice breaker for the Government continues. No decision has been arrived at, the counter proposal being to buy a second-hand vessel.

American mills expect to keep the January rate of production up to the October-November, 1921, figure, and from present outlook they will be successful.

Furnace coke has stiffened in the spot market and weakened in the contract market. Recently this commodity could be quoted down to $2.75, but now $3.00 is about the average price. Contract coke has dropped from $3.50 and $3.25 to $3.10 so that both spot and furnace are now close together.

STEADINESS IN STEEL PRICES CONTINUES—CHANNELS OF DEMAND

PITTSBURGH, January 17th.—The point as to how much slowing down there was in steel demand and production towards the close of the old year is now settled by the appearance of the monthly report of the American Iron and Steel Institute for December. While the report gives the production only of 30 steel companies, there is information whereby the report can be interpreted, and an estimate made for the industry as a whole. The rate of steel ingot production in October was 23,000,000 gross tons a year, against scarcely over 10,000,000 tons at the middle of July, the low point, and a rate of 42,000,000 tons in the first nine months of 1920, when there was heavy pressure for deiveries, but when output was at only 80 per cent. of capacity because there were physical restrictions, particularly an insufficiency of train transportation accommodations.

In November the rate was about the same, a trifle over 23,000,000 tons. Now it turns out that the average rate in December was about 20,000,000 tons. Probably the rate was about 22,000,000 tons December 1st, tapering off sharply in the last week or two to about 19,000,000 tons, possibly a trifle less.

Average for Industry

An interesting point in connection with mill operations in December is that the Steel Corporation operated to much better advantage than the independents, doing about 48 per cent. of capacity, while the independents did about 30 per cent. This made an average for the whole industry of between 37 and 38 per cent. Frequently, and particularly in 1921, the corporation has had this advantage, not because it undersells the independents, since usually it is the other way, but because they get the preference from many buyers on account of the steadiness of its prices and the regularity of its deliveries. In the high pressure period of 1920, when independents were securing much higher prices than the corporation, the percentage rates of operation were practically even.

The slowing down in production towards January 1st does not indicate any change in fundamental conditions of trade affecting the demand for steel, being simply a reflection of the time of year. Frequently the mills are sold up so well ahead that the natural decrease in demand in the winter, and the withholding of orders just prior to the inventory period, does not materially affect the production, but this time there was a condition of buyers having been ordering from hand to mouth, makin a sensitive condition whereby the rate of production reflected the time of year

It is to be expected, therefore, that production will increase, and a rate of say 23,000,000 tons, the October-November rate, be attained again by the end of January. To the regular requirements of the trade that harmonize with present industrial and financial conditions generally there may easily be added an extra demand through buyers replenishing their stocks, which are far below normal. They are unlikely to restore stocks to what they have hitherto considered normal, but they are likely, now that steel prices are quite steady, to restore them to say 50 or 70 per cent. of normal.

Steel Prices Steady

The steadiness in steel prices noted recently becomes more impressive as time passes. Since the reduction of the American Steel & Wire Company on December 21st, caused by independents having shaded the prices previously held by the leading interest there has been no appreciable change in the general market price of any important steel commodity. Thus, there is steadiness in point of time, and there is also steadiness in point of tonnage, for nowadays large and small orders go at almost the same prices. Last August there was a big difference in some commodities between carloads of 2,500 or 10,000 tons.

The market remains quotable as follows: Bars, shapes and plates 1.50c; hoops, bands and hot rolled strip, 2.00c; standard steel pipe, 71 per cent. basing

discount; plain wire, 2.25c; galvanized wire, 2.75c; wire nails, $2.50; cement coated nails, $2.00 to $2.10; blue annealed sheets, 2.25c; black sheets, 3.00c; galvanized sheets, 4.00c; tin plate, $4.75. Blue annealed sheets are properly quotable at 2.25c, base. This applies to the lighter gauges. The heavier gauges do not sell now in blue annealed to any extent as plate mills are glad to take such business now, and sell on a plate mill basis, which makes a considerably lower basis than the jobbing mills would sell at. While hot rolled strips are quotable generally at 2.00c the same as hoops, the strip mills will shade the price much more readily than the hoop mills.

Channel of Demand

There is such a widespread popular misapprehension about the quantity of steel used by the automobile trade that it may be well to set down some facts. Leonard P. Ayres, who is an authority on this subject, forecasts the 1922 production of passenger vehicles at 1,100,000 Ford, and 700,000 all other types, representing a considerable increase over 1921 production. The production of trucks in 1921 is stated by another authority to have been 145,000. A fair estimate is that in such production about 700,000 gross tons of steel is involved. Those who think of the automobile industry using large quantities of steel probably overlook the oil industry, which has been using about 1,000,000 gross tons a year of steel tubular goods alone, besides steel of other descriptions, as in tanks, for instance. The actual steel consumption of the automobile industry can be given another interesting comparison, for the apparently insignificant commodity tin plate is likely to show a production in 1922 of 1,500,000 gross tons, i.e., twice as much steel tonnage in tin plate as in passenger automobiles and trucks. Another overrated consumer is the railroads. Rail orders for 1922 are now estimated to total 500,000 tons.

Pig Iron and Coke

W. P. Snyder & Company have sold 1,500 tons of Bessemer pig iron to an Ohio manufacturer at $19.50, valley furnace. For several weeks previous the market had been quotable nominal at $20, valley. Basic remains quotable at $18.25, valley, and foundry at $19.50. There was a fair movement in foundry iron in December in small lots for January shipment, while thus far this month the market has naturally been quiet.

Any amount of figuring can be done on pig iron costs and selling prices without any plain conclusion being reached. Selling prices in general are below the recent or present cost of production, and the really important question is whether they are below the prospective cost since the furnaces must perforce recognize what is coming. Thus, the furnaces still have large quantities of Lake Superior iron ore brought down in 1920, while prices for the 1921 season were reduced $1 a ton, and for the 1922 season they will be down 50c to $1 more, depending on how freight rates come out, both the rail rates from mine to lake water and the vessel rate down the lakes, since prices are named at Lake Erie docks.

Connellsville furnace coke has stiffened in the spot market and weakened in the contract market. Recently furnace coke could be quoted down to $2.75, there being odd lots pressing for sale. There seems to have been quite a clean-up, and one could hardly buy a lot of ten car-loads now at less than $3.00. On the other hand, first quarter contracts were made early in December at as high as $3.40 or $3.50, and late December at $3.25, while the latest contract now reported is at $3.10. Spot and contract are close together now, as they should be.

POINTS IN WEEK'S MARKETING NOTES

The Toronto market shows considerable improvement. The steel market is stronger, the small tool business has improved, and while machine tools are not selling rapidly, enquiries are coming in nicely. One steel concern showed a 136 per cent. increase in business during the past week, and expects to do even better this week.

The figures showing steel production for the closing months of 1921 are now out, and show a tapering off in December. This slowing down in production does not show any change in fundamental conditions of the trade, being simply a reflection of the time of year. It is expected that the October-November rate will be attained again by the end of January.

Steel prices remain firm, and several important commodities are listed in this week's Pittsburgh letter. Several comparisons showing the quantity of steel used by the various trades are given. The oil industry shows some remarkable figures, having used about 1,000,000 gross tons of steel tubular goods alone during the past year. The railroads are overrated consumers; they do not use up as much steel as some imagine.

Montreal reports an improvement in business this week. Although only slight, it is considered the start of still better things, as buyers' stocks are known to be very low.

Whether a new ice breaker will be ordered or an old one purchased by the new government remains an open question. Particulars of this controversy are given in the Montreal letter.

The Canadian Pacific Railway have brought down their annual budget and the claims of Western Canada will come first.

LOCAL CONDITIONS ARE MUCH IMPROVED

TORONTO, January 18th:—As far as the local market is concerned, the new year has ushered in quite a bit of improvement. Take for example the steel trade. January is never looked upon as a good business month for steel men, but here is how one dealer sums up the present situation.

"In the first week we sold a fair amount, but the following seven days we showed an increase of 136 per cent. So far, we feel we are going to pass the figures of last week, as orders are coming in nicely. The automotive industry is largely responsible for the influx of orders."

Another dealer in steel reports a good volume of business for this time of the year. Buyers are still placing their orders carefully, but as this merchant says, "I would much prefer to see orders coming to us in such a manner, than without sign of care or reasoning. It denotes a healthy atmosphere and shows that buyers have got both feet on the ground so to speak." The time when men ordered ridiculous amounts of steel is gone. The wise man to-day orders what he requires, not too short, but just sufficient. When he does so, both he and the dealer are satisfied.

To attempt to place your finger on a feature in the steel market is futile. Demand is general, with an occasional surprise. For example, quite unexpectedly, a dealer received a good sized order for stair treads this week. True, he had been working on this business for about a year, but it broke when least expected. However, he has the order, and seasonal or not, he is mighty glad to mark it down on the right side of the ledger.

We have been preaching for some time past that business can be secured, if one goes after it hard enough. A steel dealer voiced our belief word for word this week, when he remarked that he was searching every cranny in search of business. The result is that his firm is experiencing remarkably good business.

Small Tools and Supplies

The small tool dealer is in very good spirits this week, for business has improved considerably during the last seven days. Drills seem to be the feature, and as we predicted last week, these orders are the result of what inventory sheets throughout the country showed at the end of the year.

"The supply business is a funny one, and in it you meet many funny people," remarked one dealer to Canadian Machinery. "This is especially true of the automotive line," he continued, "and worst of all is the salesman trying to sell you some brand new specialty. He starts out by speaking about MY company, and from then on you hear nothing except the personal pronoun throughout his voluminous talk on WHY we should buy HIS product."

"Apart from the types we meet, the supply game is a funny one in other ways. Without notice, we will have a squint on some particular line. For instance, last week it was grinding wheels. We sold more of these wheels than was ever expected, and now this week we find plumbers' tools and supplies are in demand. Two or three weeks ago chain blocks were in the spot light, and so it goes.

"For the past week or two we have been receiving regular floods of literature pointing out the fact that NOW is the time to buy. There is no question but what it may help business, but that remains to be seen. Taking the supply business as a whole, we have no reason to complain," concluded our informant.

The Machine Tool Market

Things are still very quiet in this line. Evidently manufacturers are playing a waiting game, and refuse to buy until they absolutely need to. A few enquiries are coming in, but whether these will develop into orders depends upon the aggressiveness of the dealers themselves. They now have to convince manufacturers beyond a doubt that they require their particular tool. Competition is keen and is likely to remain so for some time to come.

The Scrap Market

A slight improvement is making itself felt in the scrap metal market. This is so slight however, that no importance is attached to it except that it is perhaps a start of much better things. The chief point of interest in all markets this week is the optimistic note prevailing. Everybody feels the turn has been definitely reached, and while hard plugging will be necessary for some, those in touch with the situation feel assured better business is not far away.

BUSINESS SHOWS IMPROVEMENT ICE BREAKER CONTROVERSY STILL ON

MONTREAL, Jan. 17th:—The volume of business passing during the last week has been a slight improvement over that of the past two weeks. However conditions are far from being satisfactory. Many things have occurred during the past week that would tend to cause matters to improve in the near future. At the same time the final figures for 1921 show in spite of all the talk of depression, the amount of business closed was such that it compared very favorably with the years immediately preceding the war. Yet behind all the reports of quiet conditions, there exists unquestionably a more optimistic spirt. In the Pittsburgh district reports show that the mills are operating at a better rate than was expected.

In Canada, buyer's stocks are low and purchasing is expected to be a little more active. American mills confidently look forward to being able to operate at about 70 per cent. capacity in the near future. The American Steel and Wire Company as noted last week reduced the price on cold rolled strip steel from $3.75 to $3.50, which shows a slight weakness still exists in some lines of steel business, and this tendency will no doubt be reflected to a certain extent in Canada. Connellsville coke is a little softer owing to the very poor demand existing since the middle of December.

The opinion expressed by Sir James McKechnie of Edinburgh, Scotland, a director of Vickers' Ltd., England, and of Canadian Vickers', is that "the Washington Conference is arresting the recovery of business, staying normal activities and developments, and until the industrial world knows just what is going to be done, whether fleets will be scrapped and ships destroyed, or a go-ahead building program decided upon, there will not be much progress made in restoring stability." These sentiments were voiced by Sir James while staying in Montreal this past week.

At a recent meeting of the board of directors of the British Empire Steel Corporation, the vice-president D. H. McDougall, said that "the corporation was facing the process of deflation in wages and until this was acomplished activities in both the steel and coal divisions, would not be very brisk. Until wages were reduced," he continued, "it was considered impossible to regain the St. Lawrence market for coal, or to compete with European and American prices in steel. The rolling of steel rails at the company's plants supplied a fair amount of employment at the present time, and coal is being mined for current requirements."

There still remains a certain amount of unemployment in the coal fields at Sydney, in spite of Mr. McDougall's statements, and it is sufficiently acute to warrant a special session of the Nova Scotia Legislature to deal with the situation in the Sydney and Cape Breton coal fields. It is feared that grave danger of trouble exists unless something is done, as some sections are destitute.

The Ice Breaker

The cancellation of the contract for the ice breaker which the late Meighen Government placed with Canadian Vickers's Ltd., has aroused a great deal of interest, and in some quarters, a storm of protest. No authentic report of what the outcome will be, is available at the moment. Official deputations from the company, and official representatives of the workmen interested, have visited Ottawa and have kept in communication with that city for several days. Diversified reports have been received. It appears that the ice breaker, "John D. Hazen," originally constructed by the Vickers' Co., in 1914 for the St. Lawrence work, can be repurchased for a sum in the neighborhood of a half million dollars. The present government have decided to investigate the offer with the idea in view of ascertaining which would be the cheaper, to build a new ice breaker, or to purchase the old one and repair it.

After these statements were issued in a more or less official manner from an apparently reliable source, a report comes from representatives of the late Meighen Government, that they had investigated the offer to purchase the old ice breaker and had concluded that it would be better business to build a new one, particularly in view of the unemployment existing in Canada at present. The report further states that the "John D. Hazen" has been sunk twice and has been subjected to very severe usage, that could be better termed as abuse. Bad as this seems to be, as it represents an unknown repair bill which might offset the original advantage gained by the low purchase price, the steamer is at present at Cherbourg, France, and the French government claim to own the boat. As the Russian Soviet government also claim to own the boat complications from the quarter are bound to arise. Thus, the saving that might be made is of a very uncertain amount. It is claimed by some that contract to build will be re-awarded to the Vickers' concern after a few minor changes in design have been made. Other reports have it that purchase of the old ice breaker will be made, and with the saving (?) effected several patrol boats will be built and employment given in that way. As it is, the whole affair is very uncertain, and no one can say at the moment with any degree of authority just what will be done. As it stands the contract is only held up, not finally cancelled. The purchase of the old ice breaker, on the other hand, is not an accomplished fact.

West Comes First

On the 12th inst. the Canadian Pacific Railway brought down their annual budget. This called for appropriations of 25 million dollars, but it was thought that when accepted this amount would be reduced to about 20 millions. The money is to be spent in road extensions and improvements. The claims of Western Canada are to be taken up first, and the Eastern demands will be dealt with later. It is a foregone conclusion that there will be little or no line extension in Eastern territory. As far as local construction is concerned, it has again been decided that work on the proposed line from Place Viger to l'Epiphanie which was started in 1912 and abandoned temporarily, will again be held over.

The original difficulty was with the then independent city of Maisonneuve, which would not come to satisfactory arrangements regarding street crossings. The line was to have cost several millions and would have materially reduced the distance between Place Viger station and Longue Pointe, providing a more economical coal route, as well

as speedier general service. The company is keeping the viaducts in shape for the eventual completion of the cut-off, but declared that the work would not be resumed until traffic conditions justify the outlay. The company's general program for the year is scheduled for confinement to actual necessities pending the announcement of the new government policy with respect to the railway situation in general, and in relation to encouragement of immigration in particular. In the event of the government not interesting itself in immigration the C. P. R. has already under way its own scheme for taking care of the problem. In this endeavor the company has approached the British government and has assurances of its support. It has been figured that if the government interests itself in immigration for agricultural settlers it will probably work in close conjunction with the Canadian National Railway System.

Additional Orders

The Algoma Steel Corporation report that their mills at Sault St. Marie have secured an order for 6000 tons of rails from the T. & N. O. and that with this, along with a number of other small orders they will be able to operate a single shift for two months. It is felt that by that time the railways and industrial plants will have started to place their orders for 1922 requirements, and business will be a bit more free. The Canadian Brakeshoe Co. Ltd., of Sherbrooke, report a very satisfactory condition of affairs, and state that the outlook for the coming year is good.

Steel sales in general have not amounted to a great deal this week. Prices remain fairly steady and some quarters show signs of weakening. Pig iron sales are conspicuous by their absence. The past week has been one of the dullest on record. Prices remain unchanged. The outlook is brighter this week and an improvement in the near future is looked for.

Machine tool sales are as dull as ever. There is nothing new to report in this line. An improvement is looked for in the spring but there is no immediate change of conditions anticipated.

The small tool and supply business is picking up a little, and promises to rapidly improve to a point where it was early in December, when it was noticed to fall off as shops commenced to close for the Christmas recess.

The non-ferrous metal market is very dull indeed. No activity is noted in any line. Aluminum continues to drop a little in price each week. In summing up, conditions are not as bad as they have been painted, and in a few months a much better tone will exist.

The Beaver Machine Shop, 1110 Center St., Calgary, Alta., are anxious to purchase a lathe and gear cutter. Particulars as to size, type, etc. can be secured by writing the above mentioned firm.

WERE WELL PLEASED WITH ANNUAL NUMBER

HAS our annual review number been the success we hoped for? Will it appeal to others as strongly as it did to us? Have we succeeded in preparing an issue that we can feel justly proud of?

These and many other similar thoughts came to our editorial mind after the presses had completed their work, and postmen all over the world were delivering our efforts in magazine form.

Naturally we were interested, for without an interest in one's daily task, nothing of importance can be accomplished. Fortunately our readers did not keep us long in doubt, for a regular avalanche of letters poured in congratulating us on the results attained. Lest we be accused of tooting our own horn, let a few of our friends blow it for us.

Edward Beck, secretary of the Canadian Pulp and Paper Association, says that he wishes to congratulate us on the very excellent number. He remarks that it is the best of its kind he has seen in a long time, and that it certainly reflects credit upon everybody who has had a hand in its production.

"I want to congratulate you on the excellent get-up of your issue," says A. E. LaBelle, vice-president of the St. Lawrence Flour Mills Co, and he goes on to remark that it is one of the finest trade magazines he has seen for a very long time.

H. S. Van Scoyoc, manager of publicity for the Canada Cement Co., says that we have certainly succeeded in making our number a very interesting one. "The varied information it contains," he continues, "should lead to its being preserved and frequently consulted during the year."

Frank Kennedy, manager of the Toronto section of the Bell Telephone Co., congratulates us on the number, and says that it has been perused by a number of their officials who are unanimous in their praise.

Thos. W. Gibson, deputy minister of mines for Ontario, says that our issue is a highly creditable one and must have entailed an immense amount of labor.

T. R. Deacon, president of the Manitoba Bridge and Iron Works, congratulates us on our enterprise, and says that the number is highly creditable and distinctly useful as it gives the viewpoint of so many men from so many different angles.

A. T. Enlow, president of the Dominion Sheet Metal Corporation, compliments us on what he terms the magnificent issue, and hopes that the returns will be sufficient to justify us in keeping up the pace which we have set during the last few years.

R. M. Hamilton, works manager of the Canada Machinery Corporation, congratulates us on the contents, and also makes mention of the cover design which he thinks excellent. We thoroughly concur with his views in this respect and the John Bertram Co., are to be congratulated on their aggressiveness and vision in presenting to the trade such an artistic cover. In fact, Mr. Hamilton says it is almost nice enough to frame.

L. T. Rutledge, professor of Queen's University, Kingston, congratulates us on the number and says he has been hearing compliments on all sides regarding the fine articles on economics and economical conditions.

Norman S. Rankine, special publicity agent for the Canadian Pacific Railway says that our special number is handsomely displayed and full of very interesting information. "I know from experience what a lot of trouble you must have gone through, in order to secure all the contributions from different writers of prominence," concludes Mr. Rankine.

Several managers of the different chambers of commerce, boards of trade, etc., in the various cities write in to say that the number appeals to them very much. W. R. Landon, of Chatham says that from an artistic and business standpoint the issue is a complete success. We could go on quoting what our many friends have told us, but sufficient has been recorded to show readers, and to convince us, that our efforts to please have most decidedly been appreciated. We can go on through the year 1922 with a firm determination to achieve still greater things, so that when 1923 rolls round we will be receiving fresh notes of appreciation on the progress made.

PERCENTAGE OF INDUSTRIAL BLIND

The American Engineering council have investigated the subject of eye accidents as a source of avoidable waste, and have found that the total number of industrial blind in the U. S. is 15,000 or 13.5 per cent. of the total blind population.

The eye it is declared is involved in 10.6 per cent. of all permanently disabling accidents. According to the report, eye accidents have been reduced 85 per cent. in some plants by the use of goggles. Sub-normal vision and faulty lighting are claimed to be responsible for the defects.

An examination of 10,000 employees in factories and commercial companies found 53 per cent with uncorrected faulty vision. Of 675 employees in a typewriter factory, 58 per cent. were found to need glasses. One estimate placed the loss due to faulty conditions above the entire cost of illumination. From 446 plants studied only 8.7 per cent. were in excellent condition, and the others were graded as follows: 32 per cent. good, 29.1 per cent. fair, 18.8 per cent. poor, 3.5 per cent. very poor, 7.8 per cent partly good and partly fair.

Improved lighting was said to increase output 2 per cent. in steel plants and 10 per cent in plants where the operations are on smaller pieces.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$22 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	21 00
Basic, Valley furnace	26 00
Toronto price:—	
Silicon, 2.25% to 2.75%	29.15

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 60
Tank plates, Pittsburgh mill price	1 60
Structural shapes, Pittsburgh mill prices	1 60
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Gross Montreal	Gross Toronto
Lake copper	$17 75	$17 50
Electric copper	17 50	17 50
Castings, copper	17 25	18 00
Tin	37 50	38 50
Spelter	7 25	7 50
Lead	6 50	6 75
Antimony	6 75	8 25
Aluminum	25 00	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT
Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.08	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C
Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.59	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and less	55
Coch and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, fl. and rd. hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	$1.25
Nuts, hex., tapped off net list	75c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 90
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	0 87
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	15 to 20 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	57
Class B	22	32
Class C	14	22

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 75
Sheets, blue ann., No. 10	4 00	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	8.50	....
Apollo brand, 10¾ oz., galvanized	....	....
Queen's Head, 28 B. W. G.	7 75	....
Flerur-de-Lis, 28 B.W.G.	7 25	....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	....
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz.	650	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60 0/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 25
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 75
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	4 00

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

WASTE

XXX Extra	16½	Atlas	18
Peerless	21	X Empire	13
XX Grand	15½	Ideal	18
Superior	20	X Press	11½
X L C R	14½		

Colored

Lion	12	Popular	9
Standard	10½	Keen	7½
No. 1	13	Fancy	13½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored. 13
Mixed colored. 14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

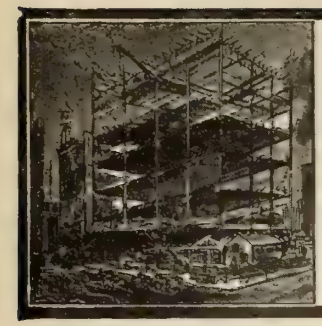
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



Mr. C. Lovatt, 1537 St. Denis St., Montreal, Quebec, is in the market for one 25 h.p. steam boiler.

The Mount Royal Arena, Montreal, Quebec, is in the market for equipment for an artificial ice plant.

The Union Natural Gas Co., Chatham, Ont., are in the market for piping, tools, and drilling equipment for drilling wells.

Mr. J. Grey, Maple Street, Collingwood, Ontario, is in the market for equipment for a proposed steel spring and steel specialty factory.

The operation of the marking act has been postponed until after the next session of parliament, according to a report from Ottawa.

A Windsor, Ont., press report states that a city freight shed and steam truck are to be built there at an approximate cost of $250,000.

The Hamilton Tar and Ammonia Co., Lees Avenue, Ottawa, Ont., are in the market for tar stills, tanks and all machinery equipment for proposed tar and ammonia factory.

W. Ward & Son, 19 King St., London, Ontario, are in the market for machinery cutters' special equipment for the manufacture of cigars, to replace that which was destroyed by fire, estimated loss being $25,000.

The Rod Mills at the Sydney Steel plant, Sydney, N. S., will re-open the first part of next week, and the Wire Mill will start about the same time, according to the general manager of the Dominion Steel Corporation.

Grant Smith & Co., and MacDonell, Ltd. of Vancouver, have been awarded the contract for the construction of the extension of the T. & N. O. Railway from Cochrane 70 miles northward. The total cost of construction, including bridges, will not be less than $3,500,000.

The London division of the Canadian National Railways states that about 80 miles of track in this division will be re-laid with 100 lb. rails and that a considerable amount of other maintenance is planned for this year.

We are officially advised that the Grand Trunk Railway has ordered from the Algoma Steel Corporation, 30,829 gross tons of 100 lb open hearth steal rails. This is in addition to the 15,243 tons ordered from the Dominion Iron and Steel Company. The T. & N. O. Railway has ordered 6,000 tons of 80 lbs. open hearth steel rails from the Algoma Corporation.

The value of Canada's products of all forms for the year 1920 reached a grand total of $5,716,247,141, according to a report prepared by the Dominion Bureau of Statistics.

Authorized capital of $778,173,149 is represented by new companies in Canada, incorporated in the first eleven months of 1921, according to the Monetary Times. There were only six incorporations with a capital of $10,000,000 or over, against twenty during the first eleven months of 1920.

An Edmonton, Alberta, press report states that the Alberta government is negotiating regarding a market for Alberta coal, and that the Vancouver Harbor Commissioners are considering the construction of an extensive dock an which to store the coal for bunkering steamships, and that a similar scheme is proposed for Prince Rupert.

After being closed for over a year, the factory of the Central Spring Co., Oshawa, Ontario, started on January 9th, to get their factory in shape to resume operations as soon as possible. They will employ 20 men at the outset and expect in the very near future to have a full complement of 70 men working.

A further indication of gradual improvement in industrial conditions is contained in an announcemet that the Holmes Foundry Co., Sarnia, Ont., has taken back about 50 employees since the plant re-opened on January 1st. The superintendent stated that operations have been resumed, but that construction work on new units would not be carried on at present.

By the end of January it is understood that the island plant (Fort William) of the Canada Starch Co., will again be operating at full capacity and employing a full staff of 220 employees. As is usual during the months of December and January, the plant is closed for general repairs and stock taking but it is stated that orders are plentiful and when the plant starts next month it will be operated without interruption.

The Federation of British Industries with headquarters in London, England, has applied for space at the Canadian National Exhibition, Toronto, next summer. The Federation is an organization similar to the Canadian Manufacturers' Association in this country. It is affiliated with the Canadian body. The Federation has a membership of about $20,000,000,000 of capital engaged in British industries.

The ratepayers of Stratford, Ontario, have passed a by-law to spend $52,000 for a new wing to the General Hospital, and $47,000 for the Isolation Hospital.

Among the plants resuming operations at Hamilton, Ont., is the Burlington Steel Company. Mr. H. V. Hamilton announced that it would operate for the rest of the month at about 50 per cent capacity. Over 100 men have been given employment.

Preparatory to the commencement of building operations on the new five million dollar plant for the Western University, London, Ont., the board of governors have arranged for the enlargement of the new campus by the purchase of 30 acres of adjoining property. The site thus grows to 230 acres.

Power to spend $60,000,000 on roads will be adopted by the Minister of Highways of the Province of Quebec, at the present session of the legislature. Already the province has spent $30,000,000, but the additional amount is to be used to maintain existing highways and to build new ones.

The establishment of a chain of hospitals for crippled children throughout Canada and United States is projected by Rameses Temple, Mystic Shriners. This will involve an expenditure running into millions of dollars. A contract has already been let for the erection of a hospital in Montreal, which will cost $250,000.

A draft agreement with respect to the erection of a Union Station in Peterborough, Ontario, was reported on December 10th, to have been forwarded to the city council by the C. P. R. The proposed site of the station that has been agreed upon by the C. P. R., the C. N. Railways and the city council, is practically in the centre of the business section.

Official statistics just published show that whilst in Canada in 1919 there was one automobile to every twenty-five persons, there was one to every eighteen in 1920. The automobile industry employed 12,139 hands in 1919, turned out over 60,000 cars, and had an invested capital of $57,000,000. In the year 1915 Canada exported automobiles to the value of $3,000,000; during the year ended March 31st, 1921, the export value had risen to nearly twenty millions. Australia and New Zealand are said to be the best markets for Canadian made cars, although shipments are made to South Africa, India and the Dutch East Indies.

Sawyer-Massey plant at Hamilton have taken on 100 or more employees since January 1st.

The Toronto Carpet Co., according to Capt. S. J. Cragg, is finding business very good. The mill is working overtime.

Milton brick manufacturers this week announced a drop in their prices. The reductions run from three to four dollars per thousand. This should have a stimulating effect on the building prospects for 1922.

Persons desiring a copy of the form of certificate of origin required in the Bahama Islands for entry of goods under the preferential tariff as provided for in the Canada-West Indies Trade Agreement may obtain it on application to the Director, Commercial Intelligence Service, Ottawa.

A. W. Jackson, formerly with the Ontario Wind Engine and Pump Co., recently joined the traveling staff of the Steel Trough and Machine Co., Tweed, as their Ontario representative. Two other appointments: Robt. L. Welch for Montreal and Quebec, and C. B. Clarke for the Maritimes, have been made this year.

Preston & Schwartz, manufacturers of small tools, Galt, are adding to their line, drill press sleeves for Morse standard taper shank drills, also a range of combination centre drills. These are of tool steel with the relief ground after hardening. The firm claim to have perfected a machine for production of these tools.

R. J. Durley, secretary of the Canadian Engineering Standards Association tells us he has at his office, Room 112, West Block, Ottawa, the following publications which may interest our readers. Standard specifications for steel railway bridges, separate reprint of material specifications for above, requirements for distribution type transformers, also specifications for galvanized telegraph and telephone wire.

Charles Barber & Sons, manufacturers of turbines and power plant equipment, Meaford, Ont., have been sending their friends in the trade a very neat calendar for the New Year. The illustration is a reproduction of the famous picture of Canada's first parliament under Confederation and is most appropriate in that the Barber firm began business in this notable year, 1867.

The A. B. Jardine Co., Hespeler, are placing on the market a complete repair equipment outfit for garage purposes. It will include engine stand, floor and wrecking cranes, garage press, grinder, hand and power forges, and garage sets of taps and dies. The equipment, in whole or section, takes into practical consideration the varied requirements of the modern garage with the idea of improved practice and efficiency in view.

According to Business Administrator Pearce, the building programme of the board of Education for the city of Toronto, for the year, which in preliminary estimates calls for the expenditure of $2,711,700, will include $695,000 for High Schools. The total of nearly $3,000,000 required, also includes $1,338,000 to provide 92 grade class-rooms and $532,000 for the sites. Schools already under construction call for $56,700, and the High School of Commerce will have to be completed at the cost of $60,000.

The Holden Co., of Montreal, Toronto, Winnipeg and Vancouver announce that they have assumed control of the Canadian Brake-Shoe Co., Sherbrooke, Que., manufacturers of Electric Steel Castings. All business pertaining to the Canadian Brake-Shoe Co., will be transacted at the head office of the Holden Co., 354 St. James Street, Montreal, Que.

Prospects of Canadian export trade are more hopeful, as indicated by the marked increase in the number of trade inquiries published in the Commercial Intelligence Journal. In the current number no less than 65 inquiries for Canadian products—18 for food stuffs, 17 for hardware, machinery and metals, 19 for pulp, paper and timber and manufacturers thereof, and the balance for miscellaneous produce.

The output of coal from Canadian mines during the first nine months of 1921 was ten and three quarter million tons as compared with slightly over twelve million tons the corresponding period of 1920, according to a statement issued by the Dominion bureau of statistics. While the production was less than the previous year, it was greater than 1919, when the output of nine months period was 14 per cent less.

A large increase in customs received in Oshawa, has been recorded during the month of December, the figures showing them to be $236,050.83 as against $176,678.27 in November. This apparently shows that business in Oshawa is much better and more active than for many months past. With industrial conditions growing steadier and continuing to improve it is reasonable to expect that the receipts each month will soon equal the records of two years ago.

The International Malleable Iron Co., Guelph, are making a feature of their Imaco detachable maleable chain and attachments. The chain is described as being simple in construction, detachable at every link, interchangeable with all standard sprocket wheels, adaptable to elevating and conveying equipment, as well as agricultural and mechanical appliances. The range also includes a complete line of standard riveted drive chain, and elevator buckets for all kinds of work.

That many Canadian buyers will visit the eighth annual British Industries Fair, to be held in London and Birmingham from 27th February to 10th March, was the statement made in an interview by the British Trade Commissioner in this district. Buyers believe, said the commissioner, that a renewal of their overseas purchasing visits is due. This fair is Britain's annual display of her manufactures and industries and the trade buyers' opportunity of selecting goods for the ensuing season's trade.

Western Ontario is assured the construction of another plant by a United States firm. Dodd and Struthers, manufacturers of copper cable, have arranged for the early erection of a modern plant, the location for which has already been selected. Former Canadian exporters for the company were at Sherbrooke, Quebec, but in view of fast growing imports to this district the company opened a small branch at Walkerville in 1916. Increased Canadian business has proved to the company that a larger plant is needed.

The Newfoundland Government is negotiating with the Armstrong-Whitworth Co., of England and the Reid Newfoundland Railway Co., with regard to the previously announced project to create a water power development totalling 235,000 h.p. on the west coast of Newfoundland. This would be utilized for the establishment of a paper mill with a capacity of 400 tons of newsprint daily; a factory for smelting aluminum with a capacity of 15,000 tons yearly, and other industries.

Discussing the outlook of the New Year with The Montreal Standard, Mr. E. A. Robert, President of the Montreal Tramways Company, expressed confidence in Canada's ability to continue upon normal lines of development, in respect to industrial, financial and agricultural affairs. He foresees no reason for pessimism, on the contrary, he believes that the Dominion has come through a year of unprecedented world difficulties with considerable credit. "Immigration, curtailment of unnecessary imports, and American capital," said Mr. Robert, "are the essentials requisite to a further enhancement of our national development along sound lines."

The Premier and the Minister of Public Works for the Province of Ontario, will decide next week regarding the T. & N. O. extension. Between two thousand and three thousand men will, in all likelihood, be employed on this project and already a staff of about 100 are on the job above Cochrane. Thirty-five were sent up this past week to work on the survey. It is expected that when the contract is let and operations begun on a larger scale, the extension will be instrumental in relieving the unemployment situation in Ontario to a great extent. Another interesting item is to the effect that nearly 200 of the T. & N. O. employees who were laid off on Friday previous to Christmas for a general stock-taking have returned to work. to be completed at the cost of $60,000.

Large export outlet for motor cars of Canadian manufacture opens up a promising field for the motor industry in this country. Export business in automobiles, as well as in other lines, is coming back gradually after the collapse of the international trade in 1920. In the past five years Canada has advanced rapidly as an exporter of motor vehicles. It is not necessary to delve into specific details, suffice to say that the value of cars exported in the year 1921 totalled approximately $33,000,000. The total

amount of cars exported in the year 1915 did not exceed $5,000,000. A visit to the General Motors Corporation plant at Oshawa makes it apparent that a healthy amount of business is existent. Some departments are working on double shift. Over 1,700 men are employed at Oshawa. Close to 800 men are employed at Walkerville. The number of plants are kept busy supplying materials and parts. The total investment in plant, inventory, etc., of the corporation's plants in Canada approximates $20,000,000.

The industrial development in Sherbrooke, Que., has been satisfactory from many points of view. The completion of the new plant of the Canadian Connecticut Cotton Mills, manufacturers of tire cotton fabrics, represents an investment of over $5,000,000 and in normal times will give employment to over 2,000 employees. The new plant of Julius Kayser and Company, was completed in 1921, and their production consists of high grade silk gloves, hosiery and underwear represents an investment of over $3,000,000, giving employment to about 1,000 employees. The Super-Heater Co., manufacturers of Super heaters for locomotives, marine and stationary boilers; number of employees 160, cost of plant $260,000. The extension of the Sherbrooke Machinery Co., manufacturers of pulp and paper machinery was erected at a cost of $100,000 and will enable this concern to double its production, number of employees 100. The new plant of the Pressure Proof Rings, Ltd., manufacturers of piston rings, was also completed in the year 1921, at a cost of $25,000, number of employees 25. Within a short time there will be another new industry in Sherbrooke, the Canadian Vesta Battery Co., manufacturers of automobile batteries, this being an additional link in making Sherbrooke an automobile centre. At the present time they have large factories manufacturing automobile tires, tire cotton fabrics, rubber accessories and piston rings. The above mentioned firms are only a few of an extensive list which has been published in Sherbrooke daily papers.

THE PREVENTION OF FREIGHT LOSS AND DAMAGE

(Continued from Page 27)

with the freight claim agents, particularly on roads having supply train service and reclamation or testing plants.

They can use their scrap material, empty corrugated, and other containers at large stations which need it for coopering purposes. If they have a treating plant, they can see that treated ties are not loaded in good box cars.

They may be able to induce manufacturers to discontinue nailing the floors of four-wheel warehouse freight trucks. If these floors were bolted, freight would not be damaged by nails which work up in service. They could look into the seal question to be sure that agents do not carry too large a stock of seals. If an agent has much more than thirty days' supply, there is a big chance for misuse. The telegraph department can help by watching advance notices on stock, rush car orders concerning live stock and perishable, and in the matter of mailing diversion or stop orders, if, through error, that is done. They can check against errors in transmission of consists, icing reports, diversion orders, etc.

They can help educate operators to keep dispatchers posted in detail when a train is being delayed at their station. They can help educate operators to be on the look-out for dragging brake rigging, or hot boxes on passing trains. The traffic department can help educate shippers to keep posted on car loading rules and classification requirements. Anything they can do to induce large receivers of freight to maintain a written record of all freight delivered to them without regular billing so the claim agent can check against this record in handling claims for short packages, will go a long way to reduce short package losses.

Get Shippers Interested

They can help shippers get interested in existing laboratories for the study of proper box construction. Many shippers do not know that the average box fails first at the nailing points—that a few more nails in the right place make a stronger box. They can encourage shippers to study the causes for their claims, recording them by causes and specific articles, by having customers or salesmen report conditions as determined at destination with apparent cause, so they can learn what may be necessary to ride it safely—the railroad will help in this.

They can get the chambers of commerce interested in spreading the gospel of careful marking and packing, and in the study of how the shipper and carrier can handle freight without damage. They can advertise claim prevention along with passenger and other advertising, because claim prevention means good service, and the claim account which represents failure in service sums as much as the entire expense of the traffic department as just shown.

The police department, of course, is engaged in property protection, but I often wonder if they are intensively pushing the matter of correct seals and seal records, bad doors and door hasps. Their influence will go a long way to keep this situation in the clear. They can't do business without a good seal record and a proper facility upon which to apply the seal. If there is a scale department on the railroad, anything they can do to help keep country wagon scales in proper shape, by educating owners in their use and upkeep and by doing the same thing with elevator people and other users of scales, will be of great help. Careless weighing and scale maintenance is the crime of modern business. In the general work to reduce costs, both the railroad and express employees have found they must work together to get the bests results. An express man should be on every local prevention committee.

In many instances, the same problems must be overcome; for example: —On ventilation and refrigeration—on hand freight or express—short packages—it is just as important to police express resting on a truck as it is to police freight resting on a platform. It is just as important to keep express trucks from contact with trains at station as it is to watch baggage trucks. Express must be protected from the weather the same as baggage and freight. Delay problems apply to both. The same study of classification requirements is necessary. Packing, marking and billing have many points of similarity.

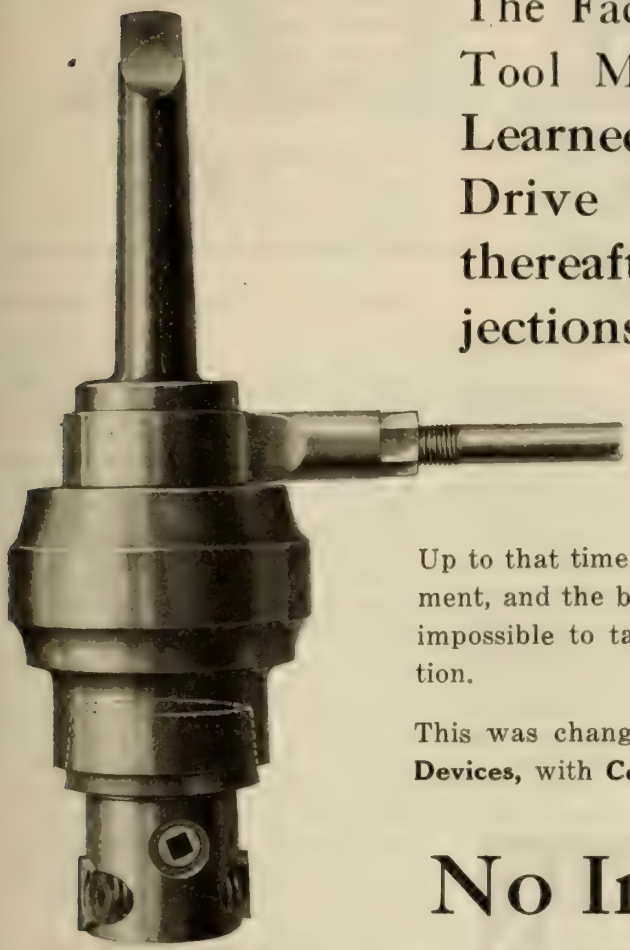
Yardmasters and engine foremen are as interested in switching express cars as freight cars, and for the same reason—to avoid delay and rough handling. The car department is interested in defective express equipment the same as freight cars. And an express car can be set out en route the same as a freight car for the same reasons—defective running gear, hot box or other bad order condition. The baggage department is in on this, because often one car is used for both express and baggage, and the same general troubles encountered by baggage are with express. Good containers are of importance to both branches of the service.

Particularly can the two branches co-operate on the question of preventing pilferage and robbery. By all means, express and railroad men should work together locally and nationally in the effort now being made to reduce transportation expenses, and every branch in transportation service get busy with all the means at their command to produce the best service possible at the least cost.

SIMPLE HYDROHOIST

One of the simplest forms of pump consists of an endless chain in the links of which, owing to their peculiar shape, the water is trapped and raised. The mechanism, in fact, operates as a water hoist. In order to make it more efficient a British firm has introduced a very ingenious modification. A wire rope is used, and on this rope are threaded a series of small steel cups, each with a thimble at its centre to keep it at the right distance from its neighbors. When the rope runs at 600 feet per minute this hoist will deliver 3,500 gallons per hour. Curiously enough this delivery represents more than a solid column of water of the diameter of the cups. The cups rise full of water, and there is in addition a large quantity carried on the outside. No fixing is needed beyond the casing at the wellhead, and on this and the grounds of simplicity and ease in maintenance the "hydrohoist," as it is called, appeals particularly to agriculturalists.

Worked Like Magic



Note the dotted lines illustrating position and size of friction Cone.

The Factory Manager of a large Tool Manufacturing Concern **Learned of the Jarvis Friction Drive Tapping Device and thereafter there were no rejections.**

Up to that time they had been using regular standard equipment, and the bottoming taps did not bottom. It was almost impossible to tap the holes so that they would pass inspection.

This was changed like magic when the 20 **Jarvis Tapping Devices,** with **Cone Friction Drive,** were installed.

No Inspection Needed

The Jarvis Friction Tapping Device taps the holes to bottom, and then runs in a second time to do its own inspecting, and, when it finishes, every hole is thoroughly cleaned out to bottom.

Very little pressure is needed to drive the Device.

The Drive is controlled by pressure on the machine spindle.

Stripped threads are unknown.

Holes tapped in toughest metal with little tap breakage.

Standard Chuck.

No special taps required.

The Tap is freely started and stopped while rotating.

Adaptable to Drilling Machine or Speed Lathe.

Ask us about the Jarvis High Speed Tapping Devices, which act without clinching or binding.

And the Jarvis Quick Change Chucks and Collets, for Drilling, Counterboring, Tapping and Stud Setting.

We Are Sole Distributors

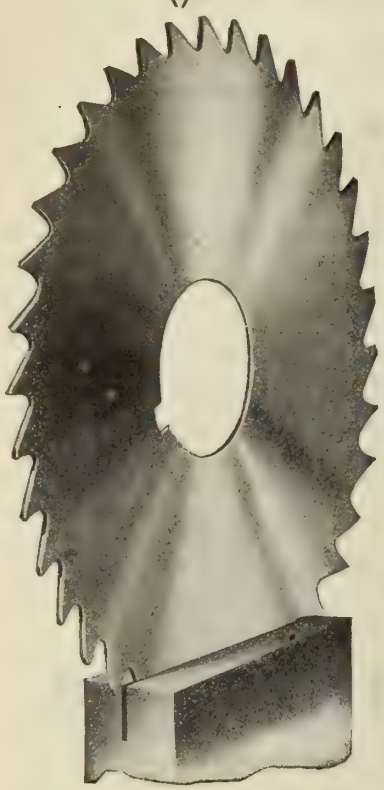
The Geometric Tool Company

New Haven, Conn., U.S.A.

Canadian Agents:

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S., Vancouver, B.C.

SIMONDS



Metal Slitters

In many Machine Shops and Metal Working Industries the Simonds Metal Slitter is used as a universal saw. It is a high-grade saw, made of exceptionally tough steel, hardened and tempered to the proper degree for efficient cutting.

Write for catalog and prices.

Simonds Canada Saw Co. Ltd.

"The Saw Makers"

Montreal, Que.

St. John, N.B. Vancouver, B.C.

LEADING ARTICLES IN THIS ISSUE

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BUSINESS PAPERS EXTREMELY VALUABLE

IT WAS the reading of a business publication that inspired Henry Ford to quit the farm and seek employment which would help him to build a "horseless carriage" such as he then read about. It was by reading a business publication that George Eastman got the idea of establishing what has become by far the greatest establishment of its kind in the world. It was the reading and studying of business writings that started Frank A. Vanderlip on a career which landed him in the presidency of the largest national bank in America. Edison reads more business periodicals and books than perhaps any other man in America; he assured me that he couldn't afford not to.

Cyrus H. K. Curtis once told me, continues an editorial in Forbes Magazine, that he first conceived the idea of creating the Saturday Evening Post when, as a youth, he read a story about a young man who achieved dazzling success in business. It was reading and studying the business achievements of John D. Rockefeller that fired James B. Duke with ambition to become in tobacco what Rockefeller had become in the oil industry.

Only the other day a salesman of one of the many business "courses" now in vogue, told with great gusto that he had just sold his "course" to the president of a very large railroad, Daniel Willard, of the Baltimore & Ohio. J. Kindleberger, the famous paper manufacturer, tells how the reading of a business book caused him to organize what became a very successful enterprise.

Recognizing the infinite value of business books, "Forbes" has decided to open a new department to encourage the reading and studying of them by those who are ambitious to make headway in the world. As one means of emphasizing the benefits which can be derived from business books, they are offering $250 in prizes for letters answering the question, "Which Business Books Have Helped You Most, and How?"

It has become not uncommon, concludes the article, for employers to get a line on the kind of reading done by employees being considered for promotion. I once heard of an employer who made an excuse to visit the home of an employee whom he was thinking of promoting, but when the only reading matter within sight was a popular weekly and second-rate fiction, the employer concluded that he had better promote someone who devoted at least part of his spare time to reading periodicals and books calculated to widen his knowledge of his business and broaden his mentality.

The man who reads this story is to be congratulated, because he too is a reader of a business paper, and is thus building upon a solid foundation.

PATENTS

Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada. Booklet Free.

Rubber Mill MACHINERY

BERTRAMS LIMITED
SCIENNES EDINBURGH

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BLACK DIAMOND OVENS

"OVENS"

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co. Ltd.
Brantford, Canada

BLACK DIAMOND OVENS

ATKINS METAL CUTTING SAWS

Present Conditions

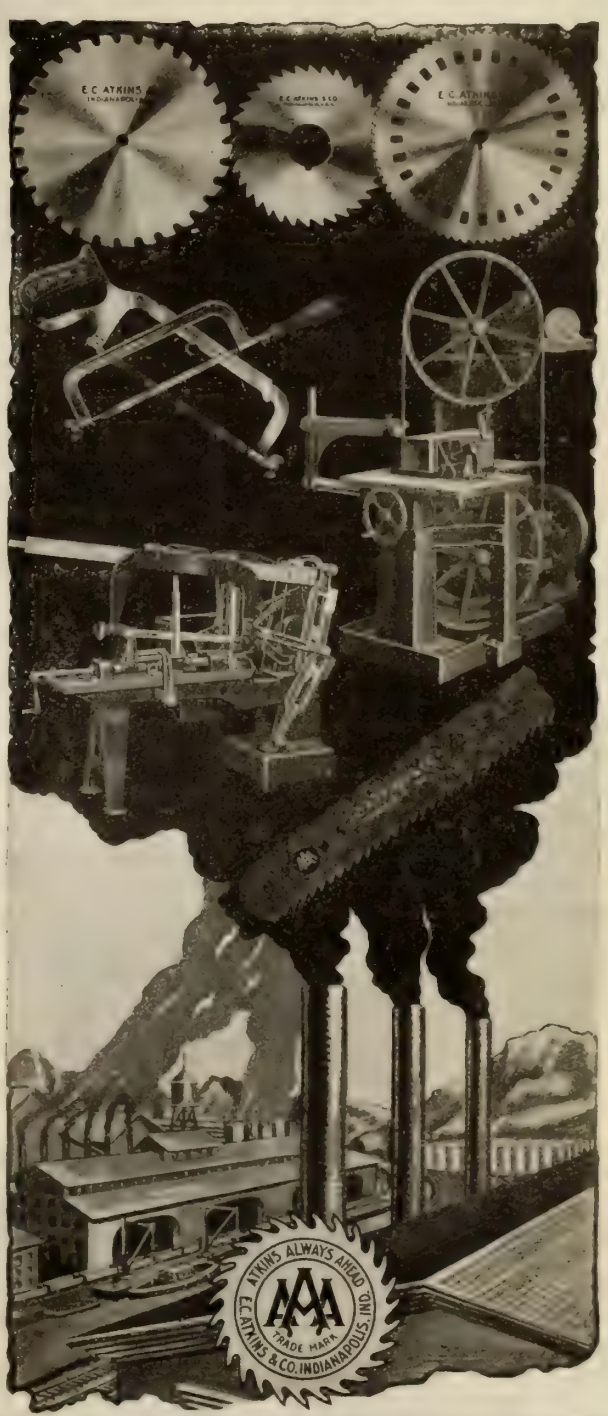
Don't let present-day conditions worry you; everything is fundamentally sound. More economy is being called for, use

Atkins Metal Cutting Saws

Conditions are such that quality and quantity production is essential. The use of Atkins AAA Non-Breakable Hack Saw Blade and Frames, Circular Metal and Slitting Saws, Hot Saws, Cold Saws, Kwik-Kut Hack Saw Machines and Blades and Metal Band Saw Machines, will assure you of efficient economical operation and give you quality and quantity production.

Write for descriptive literature and prices on any of the above.

"A Better Saw for Every Use"



E. C. ATKINS & CO.

Est. 1857 "The Sterling Quality Saw People"

Home Office and Factory, Indianapolis, Indiana

Canadian Factory, HAMILTON, Ontario

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Classified Opportunities

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern Work. Our advice and estimates will save you money. Semi-finishing operations on Lathe or Grill on Castings supplied if required.

ASK US.

THE KATIE FOUNDRY, GALT, ONT.

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WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

FOR SALE

FOR SALE — FORTY HORSE-POWER VERtical Boiler 120-lb., steam, Ontario inspection, 129-2" tubes 5' 9" long, 74 of them new. Complete with grates, smoke stack and cast iron base. $500.00 F.O.B. Port Arthur.

Return Tubular Boiler 72" x 18' for 115-lb. steam, Ontario inspection, 84-3½" tubes, straight seams, triple rivetted butt joint. This boiler with full flush front and doors, arch-plates, soot doors but no grates or fittings, for $900.00 F.O.B. Port Arthur. Port Arthur Boiler Works. (c2m)

FACTORIES FOR SALE — TWO DESIRABLE plants; one at Mount Forest, constructed of brick, floorage over 40,000 square feet, formerly operated by Weir Wardrobe Co.; and the other at Guelph, stone floorage over 50,000 squar ft., formerly operated by Dominion Casket Co. Apply Box 777G, Canadian Machinery.

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

REGO
WELDING
and
CUTTING
APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 152
(TF)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

POSITIONS WANTED

MECHANICAL DRAFTSMAN DESIRES A change; age 30; married. Experienced in tool, jig and machine design. If you are looking for a young man who by practical shop experience, knows his job from the drafting office to the shipping platform, arrange interview, at your convenience. Box 798, Canadian Machinery. (c4m)

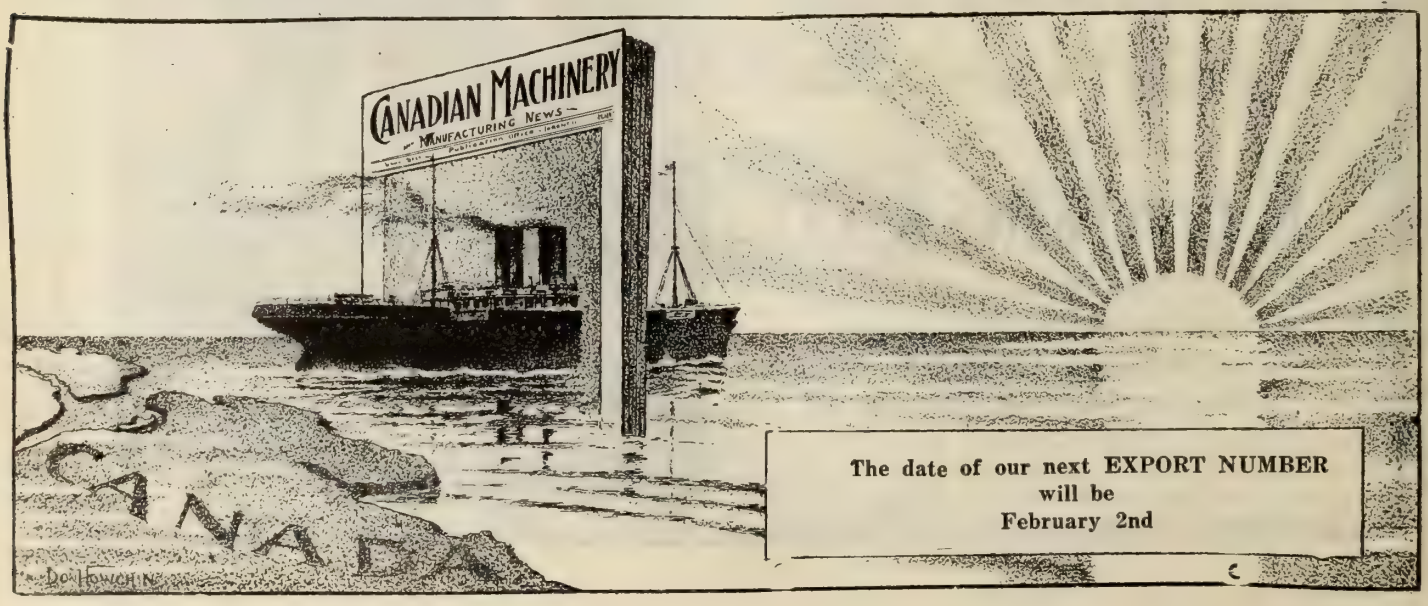
MECHANICAL ENGINEER, COLLEGE GRADuate, twelve years' practical experience, able executive, thoroughly experienced in modern methods of production and management. Desires position as works manager or general superintendent with moderate sized concern where concentrated effort and ability would be appreciated. Moderate salary with percentage. Location immaterial. Box No. 800, Canadian Machinery.

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W.H. Sumbling Machinery Co., Toronto. (etfm)

RATE FOR CLASSIFIED ADVERTISING

Rates (payable in advance.): Two cents per word. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.



The date of our next EXPORT NUMBER will be February 2nd

Belting That Has Endurance

Belts are expensive. The item of Belt replacements might run into good sized figures in some factories. The time lost in factory idleness while poor Belts are being repaired or replaced is worth more than the Belts. Buy the *Best* — because they *Last* longest and save *Time* as well as *Money*

GUTTA PERCHA & RUBBER, LIMITED
TRADE P.M.S MARK
TORONTO, CANADA

The Brand That Stands For Quality

"P. M. S" BELTING

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Gutta Percha & Rubber, Limited

Head Offices and Factory: TORONTO

Branches in all Leading Cities of Canada

PARTIAL LIST OF NEW AND USED
METAL WORKING MACHINES ON HAND

1—Briggs' Miller, Type A, 22-in. traverse,
1—18x11½x8 Gas Furnace,
1—Edlund No. 2-B High Speed Drill,
Racine High Speed Hack Saw Blades,
3—Davis 24-in. Turret Lathes,
1—36x18 Putnam Engine Lathe,
1—18x8 Rae Engine Lathe,
1—16-in. Bardons & Oliver Turret Lathe,
1—18-in. Oliver Turret Lathe,
1—McKechnie-Bertram 20x12 Engine Lathe,
1—Racine No. 10 Hack Saw,
1—16x6 Lathe,
4—Woodward & Rogers Four Spindle Drills,
1—Canadian Allis-Chalmers 5 H.P. Motor,
1—Roots No. 1 Pressure Blower,
1—Perfect No. 3 Hack Saw,
1—12-in. Dividing Head for Ford-Smith Miller,
1—Plain Vise for Ford-Smith Miller,
1—Buffalo No. 3 Blower,
1—Champion 20-in. Drill,
1—Grant No. 80-B Riveter,
1—12-in. Three Jaw Universal Chuck,
1—Burke No. 1 Bench Drill,
1—Smart-Turner 4½x2¾x6-in. Pump,
1—Goldie-McCulloch Pump,
1—Greenerd No. 3½ Arbor Press, with Stand,
1—Landis 12x42 Plain Grinder,
1—Greenerd No. 3½ Arbor Press, without Stand,
1—Bellevue Double Oil Furnace,
1—Silver Three Spindle Gang Drill,
1—Silver 20-in. Drill,
1—Canadian Allis-Chalmers 5 H.P. Motor,
4—Speed Lathe Beds,
1—Air Compressor Stand,
1—No. 190 Brown-Boggs Press,
Chain Hoists,
Motors, varied H.P. and Current,
1—30-in. Straightening Roll,
1—30-in. Bending Roll,
I.R. Air Compressor with Tank,
Lot of Friction Rolls, Log Chains, Shafting, etc.
1—36-in. Back Geared Drill Press,
1—American 14x6 Double Back Geared Lathe,
1—16-in. Ohio Shaper,
1—Acetylene Welding Outfit on Truck, Portable,
1—Cataract No. 3 Bench Lathe,
No. 20 Rich Drills of various sizes.

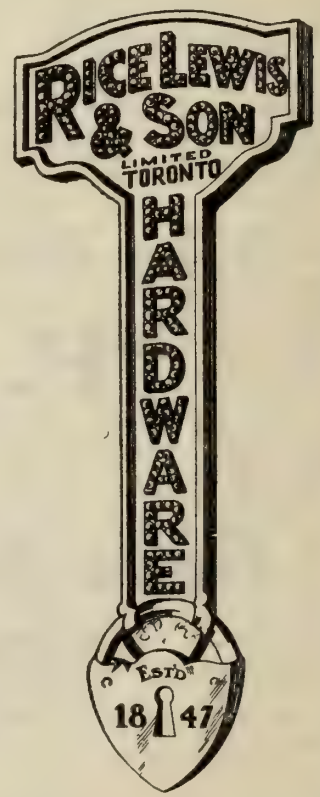
If you don't see what you need here—write us—
We Desire to Serve You in Every Way Possible

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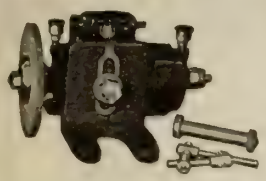
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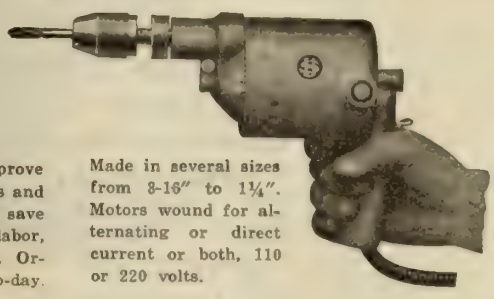


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U. S. ELECTRIC
Drills and Grinders
Can be Attached to any Lamp Socket



For drilling in metal these drills are the superior of every other kind of portable drill. Their operating cost is only half that of air drills. And they can be attached to any lamp socket.

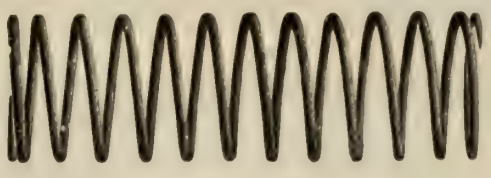


A trial will prove that our drills and grinders will save you time, labor, and expense. Order a few to-day.

Made in several sizes from 3-16" to 1¼". Motors wound for alternating or direct current or both, 110 or 220 volts.

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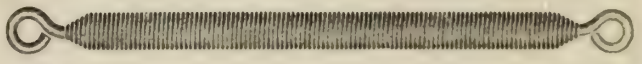
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Our excellent facilities for the production and heat treating of Springs insure accuracy and durability.

Write for catalogue, also free engineering service on your spring problems.

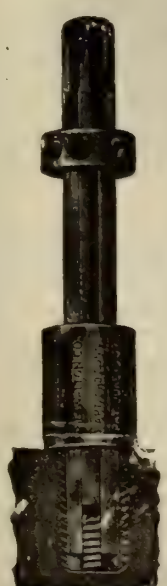
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Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

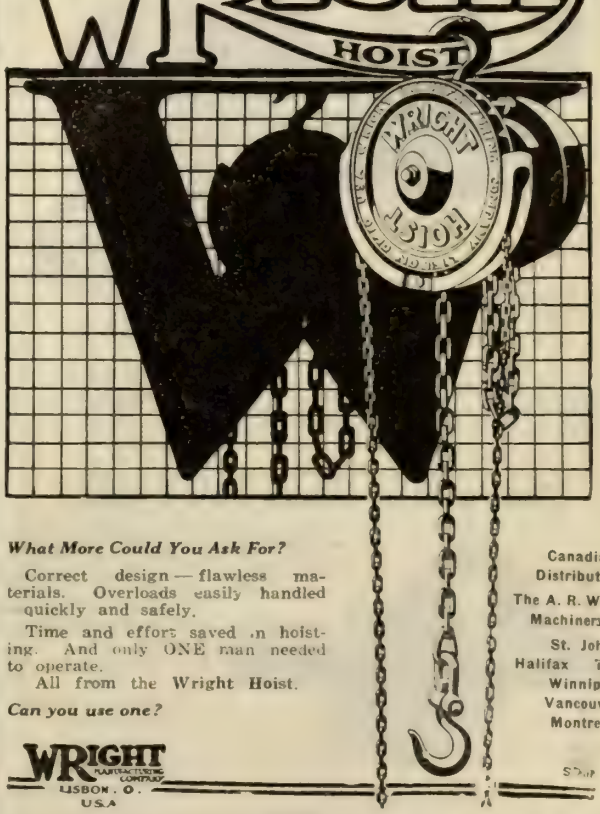
And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

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Correct design — flawless materials. Overloads easily handled quickly and safely.

Time and effort saved in hoisting. And only ONE man needed to operate.

All from the Wright Hoist.

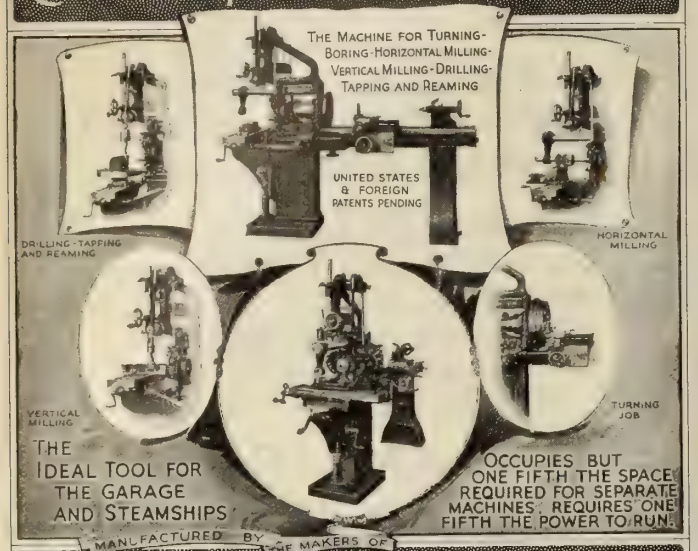
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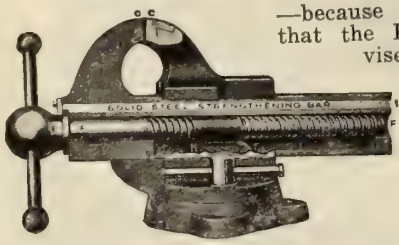


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Eighty years of vise making has solidly convinced us that, after all, nothing stands the heavy strain of daily use like vise castings of the right mixture of Bessemer steel and grey iron.

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That's Why They Sell Easily



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One of the "70"

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DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. This necessarily widened the scope of our Directory, but it would be impracticable to list all the lines handled by all the dealers. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS AND METAL WORKING EQUIPMENT

Chas. P. Archibald & Co., Montreal.
Bertram & Sons, Ltd., John, Dundas, Ont.
The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
R. S. Holly, Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
A. R. Williams Machinery Co., Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.
Wilson-McGovern Limited, Toronto Ont.
Yeates Machinery Co., London, Ont.

MACHINE SHOP AND FACTORY SUPPLIES

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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont
The Standard Equipment & Tool Co., Montreal, Que.
Chas. A. Strelinger Co. of Canada, Limited, Windsor, Ont.
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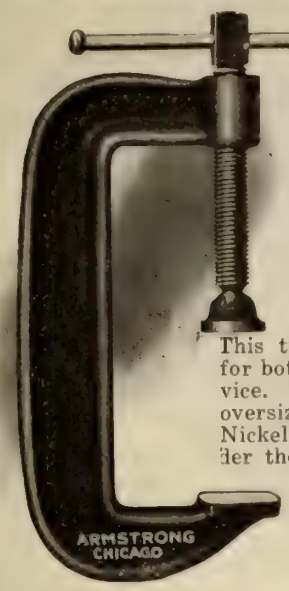
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MacGovern & Co., Montreal, Que.
H. W. Petrie Limited, Toronto, Ont.
The Standard Equipment & Tool Co Montreal, Que.
Wilson-McGovern Limited, Toronto, Ont.
A. R. Williams Machinery Co., Montreal, Que.

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The Canadian Fairbanks-Morse Co., Montreal, Que.
The Garlock-Walker Machinery Co., Toronto, Ont.
Herbert Ltd., Alfred, Toronto, Ont.
R. S. Holly, Toronto, Ont.
H. W. Petrie Limited, Toronto, Ont.
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"THE TOOL HOLDER PEOPLE"
306 N. FRANCISCO AVE. CHICAGO, U.S.A.

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Better Springs!

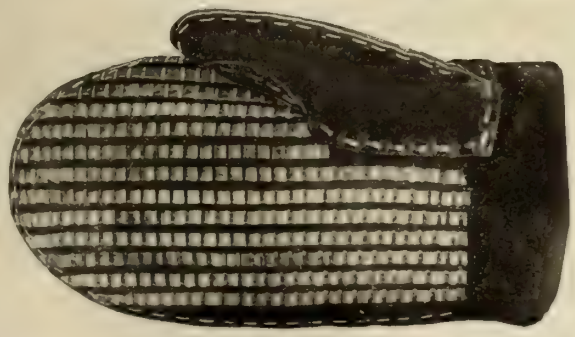
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Means Better Work



Mitten StyleNo. 681

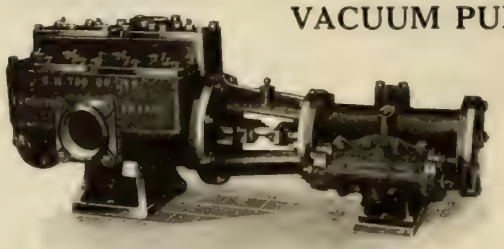
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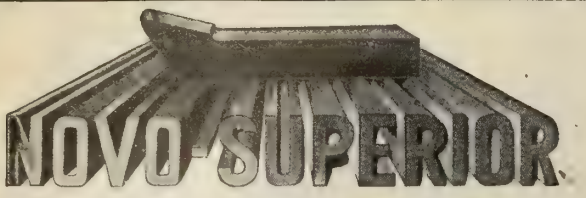
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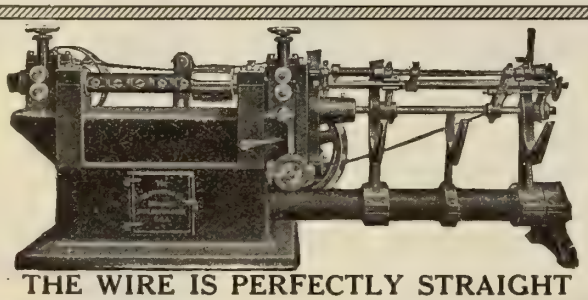
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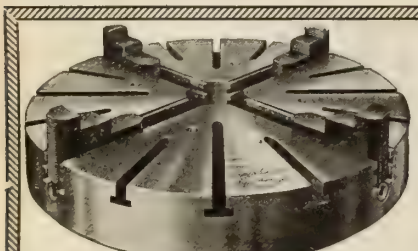
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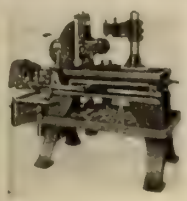
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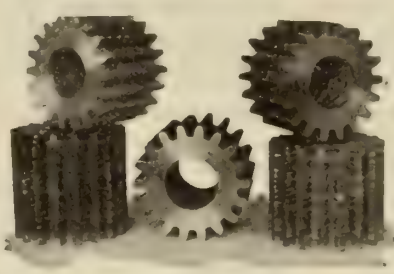
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Can. Fairbanks-Morse Co., Ltd., Montreal.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can Link-Belt Co., Toronto, Ont.
Fittings, Ltd., Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd, Montreal, Que.

Belting, Fabric
Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. H., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Ltd., Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Machines, Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Prybil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Prybil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Grey Iron
Fittings Ltd., Oshawa, Ont.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Fittings Ltd., Oshawa, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Prybil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Can. Mathews Gravity Carrier Co., Port Hope, Ont.
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drill Press Sleeves.
Preston & Schwartz, Galt, Ont.

BUYERS' DIRECTORY

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Williams Machinery & Supply Co., A. R., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont
Fittings Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johansson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Atkins & Co., Inc., E. C., Indianapolis
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg Co., Providence, R.I
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que
Morse Chain Co., Ithaca, N.Y
Can Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec

Gears, Worm
Dom. Steel Products Co., Brantford, Ont
Hamilton Gear & Machine Co., Toronto, Ontario

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont
Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario
Petrie, Ltd., H. W., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co. Racine Wis

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto,

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal, Q

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Im.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont
Kearney & Trecker Co., Milwaukee, Wis
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis
Can. Fairbanks-Morse Co., Ltd., Montreal
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Sherford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd Montreal Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co. Kalamazoo, Mich
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Patterns, Wood and Metal
Crescent Machine Co. Ltd Montreal, Q
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co. Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.

BUYERS' DIRECTORY

Williams Machinery Co., A. R., Toronto.

ipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

ipe Fittings
Fittings, Ltd., Oshawa, Ont.

ipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

ipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

ipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

ister-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

laning Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

laning Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

late Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

lates, Boiler and Shi.
Beardmore & Co., Ltd., Wm., Montreal, Que.

neumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

olishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Prybil Machine Co., New York, N.Y.

ressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

resses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

resses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

resses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

resses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont

resses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

resses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

rofiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

rotractors
Brown & Sharpe Mfg. Co., Providence, R.I.

ropellers
Kennedy & Sons, Wm., Owen Sound, Ont.

ulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

ulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited. Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

ulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que

umps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

umps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

umps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

umps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Goods, Ordinary Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Prybil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal. Q

Screens
Can Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd, Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Rogelefson Machine & Tool Co., Toronto,
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Prybil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O
Steele Ltd James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence R.I.

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Dr. C. K. Clarke, noted Canadian alienist, says that not more than twenty per cent. of Canadian children have more than average intelligence. Is your child one of the average sixty per cent.? one of the twenty per cent. above this line? or one of the twenty per cent. below? How do you rank yourself?

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This remarkably timely article appears in

MacLean's Magazine *for* JANUARY 15

The West Is Still There!

***By* Charles Christopher Jenkins**

A staff writer of MACLEAN'S MAGAZINE was sent West a few weeks ago to find out what there is to these 'blue ruin' stories. He returns with a huge grist of facts, and reports that, although hard hit in many ways, the West is, as everyone who knows it would expect, breathing the virile and vigorous spirit of constructive optimism.

Included in this article are striking and timely messages to the readers of MACLEAN'S from Hon. T. C. Norris, Premier of Manitoba; Hon. W. M. Martin, Premier of Saskatchewan; and Hon. Herbert Greenfield, Premier of Alberta.

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Parmenter & Bulloch Co., Gananoque, Ont.

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Diamond Saw & Stamping Works, Buffalo, N.Y.

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British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

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Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
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Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
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Atkins & Co., Ltd., Wm., Sheffield, Eng.
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Pilot Steel & Tool Co., Montreal, Que.
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Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I

Switches, Railway
Can Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Alkenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Wheel Truing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Bans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
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Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
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Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres,
Beardmore & Co., Ltd., Wm., Mon

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont

Valves
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Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Supplies
Carter Welding Co Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

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American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wiping Cloths
The Levi's, Toronto, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
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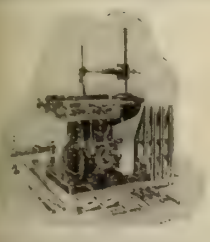
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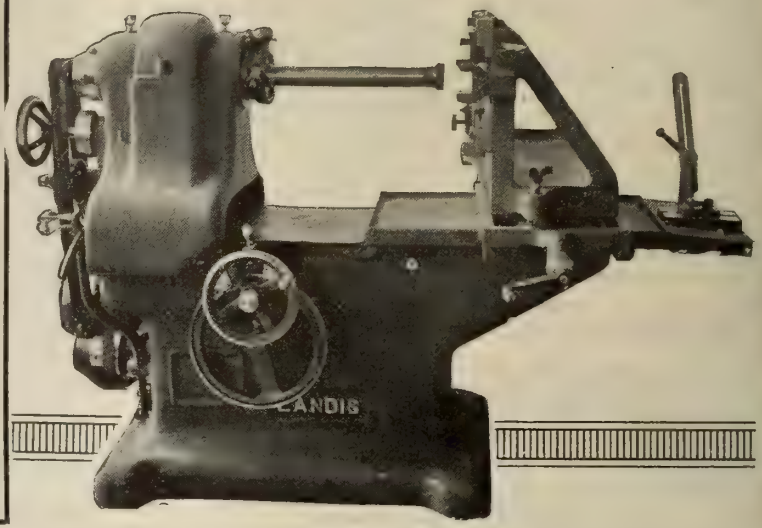
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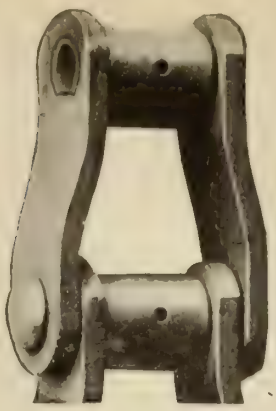
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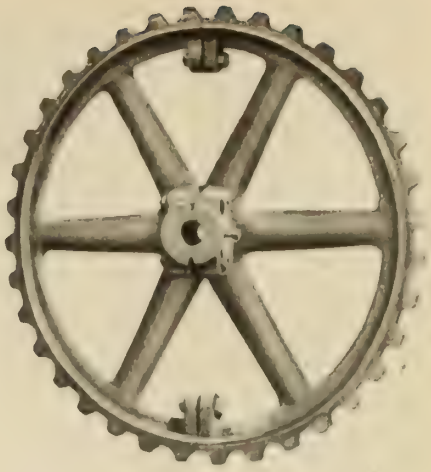
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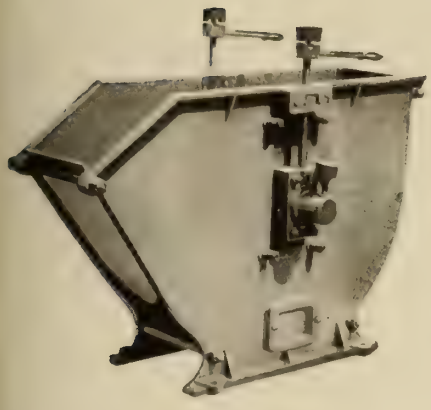
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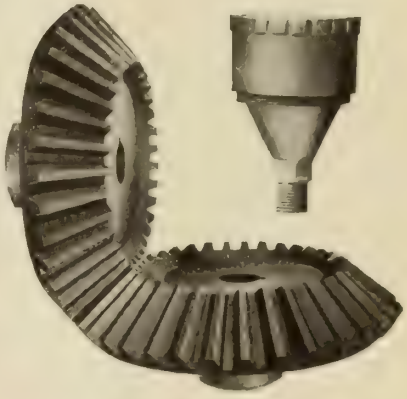
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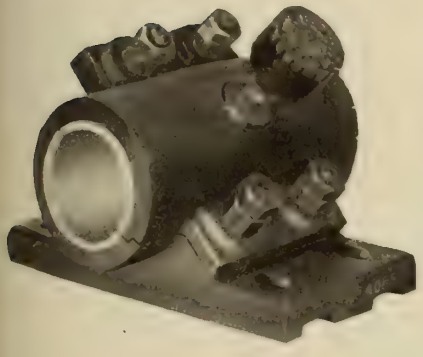


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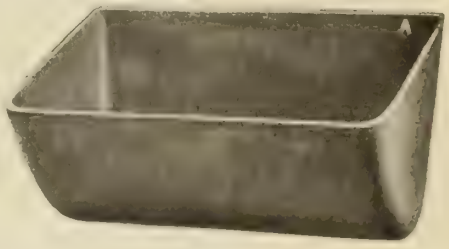
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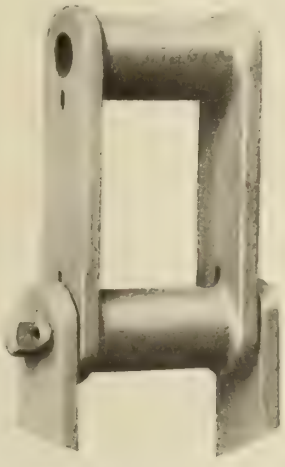
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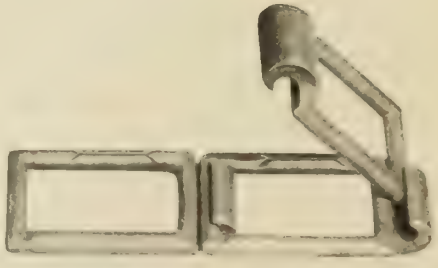


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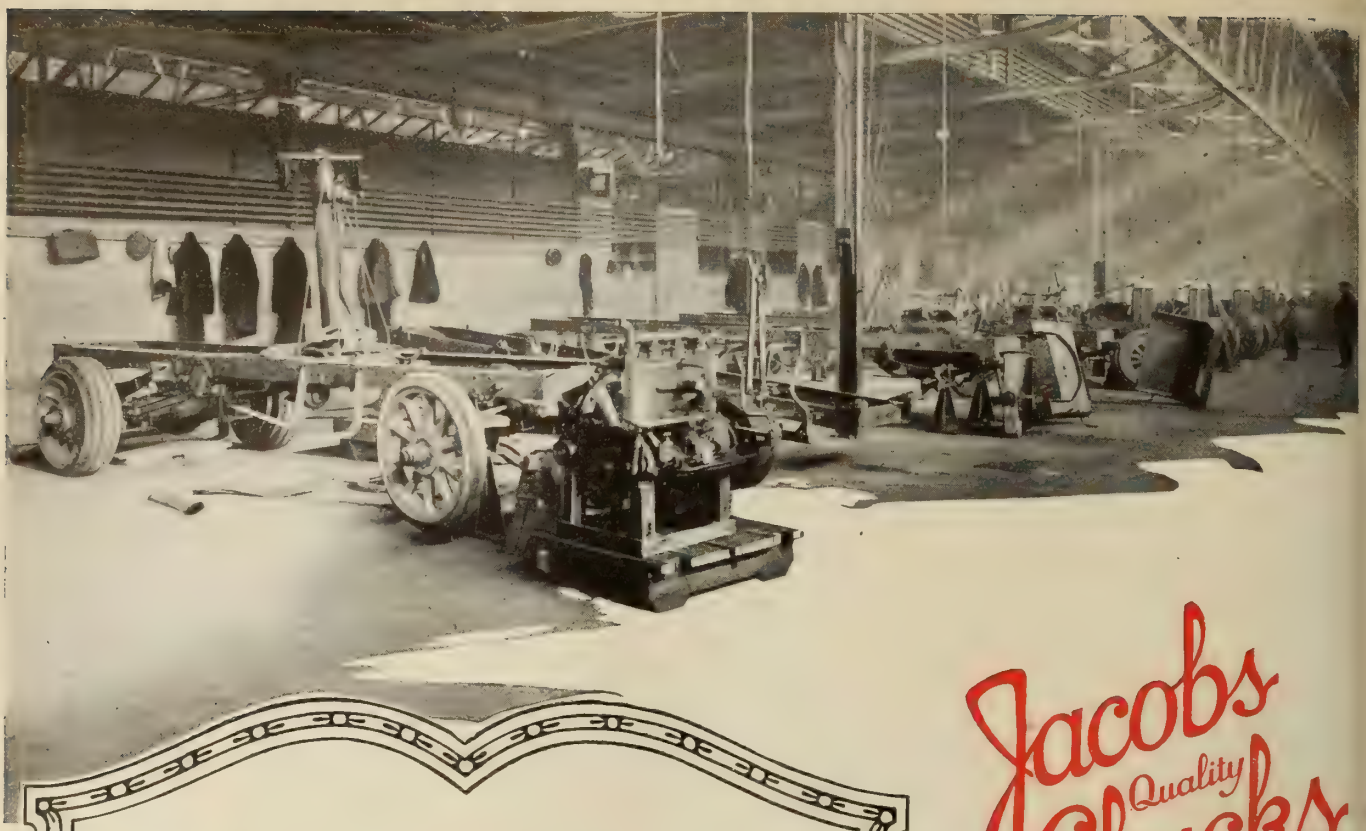








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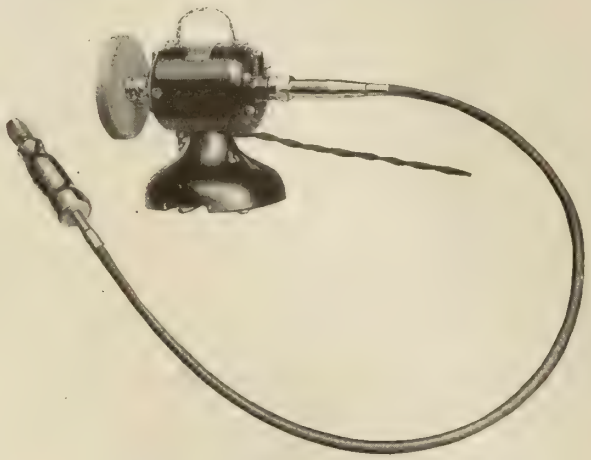


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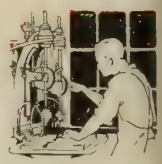
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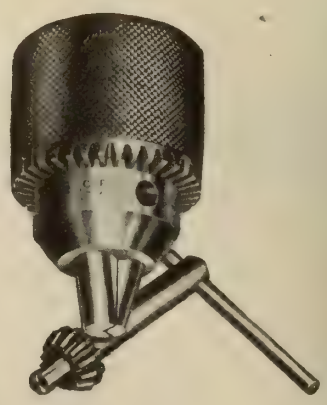
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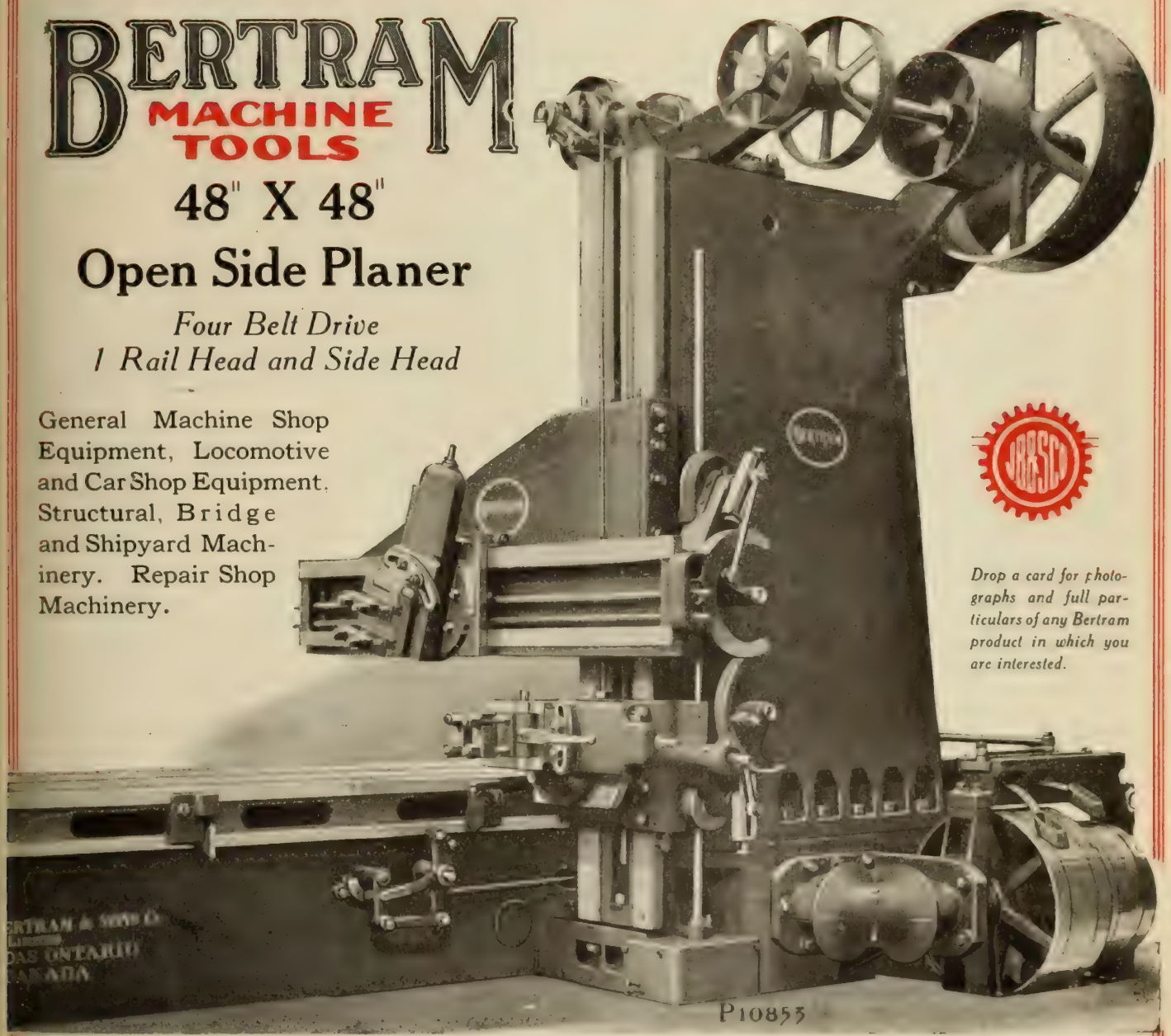
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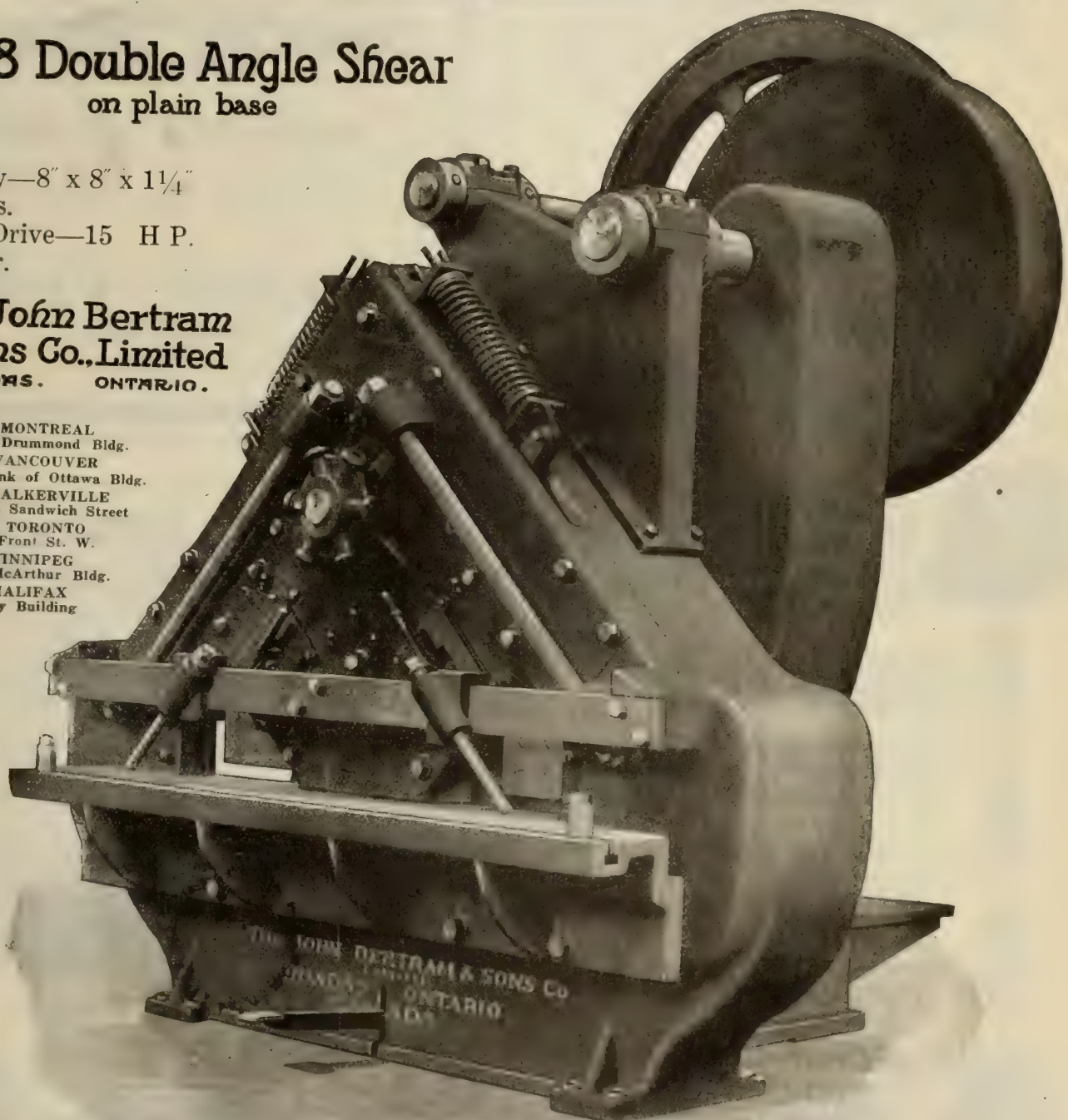
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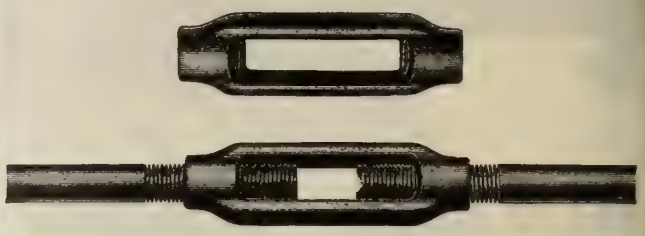
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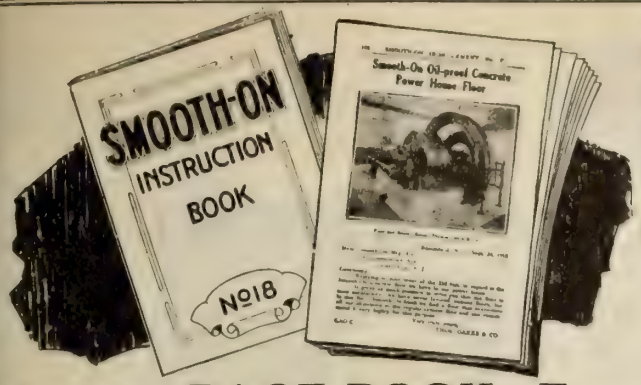
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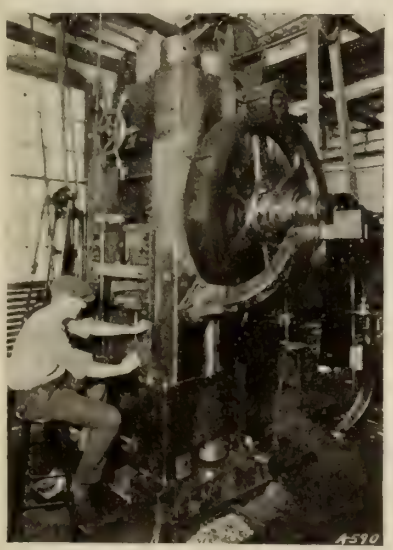
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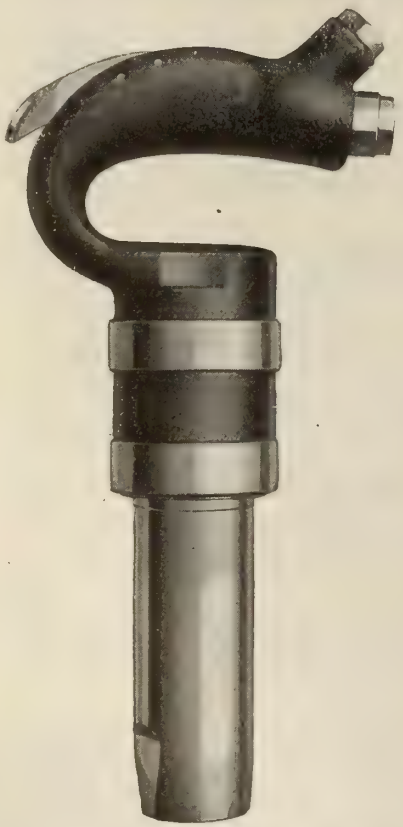
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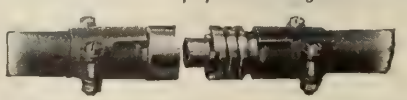
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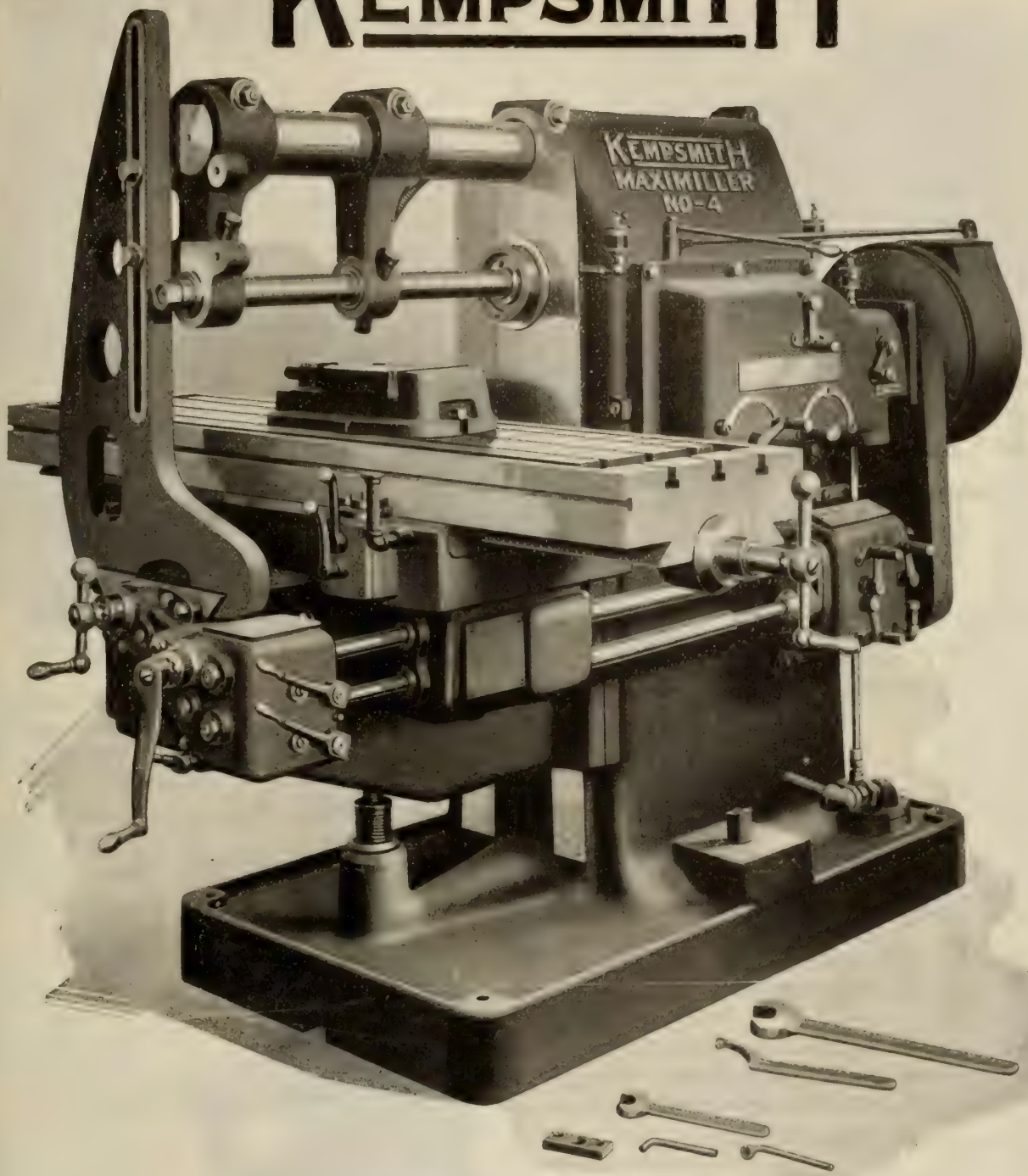
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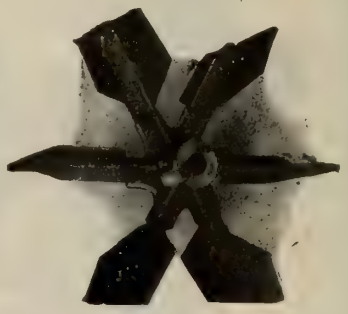
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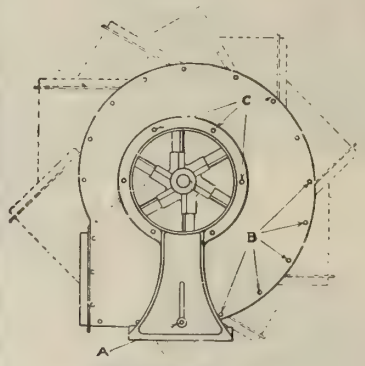
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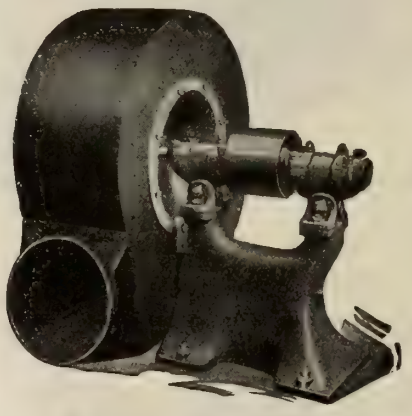
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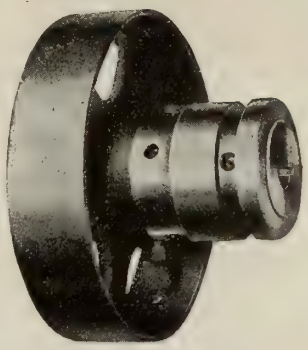
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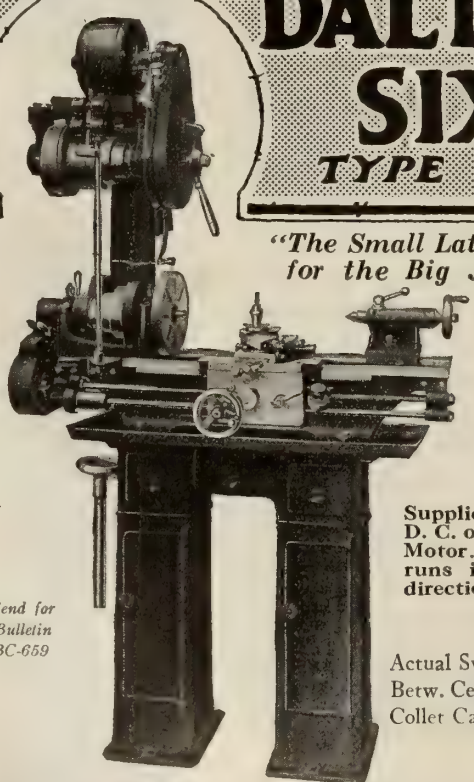
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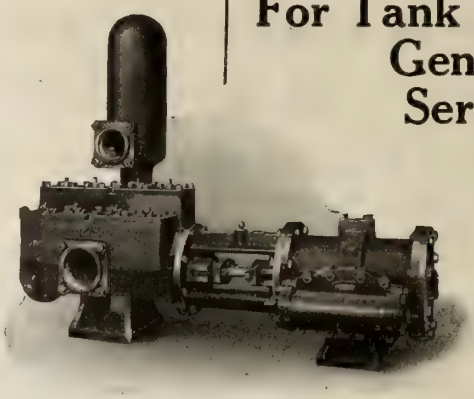
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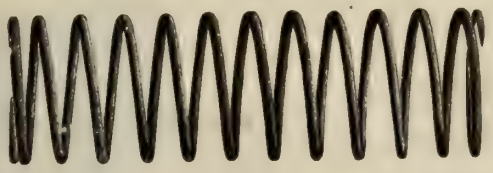
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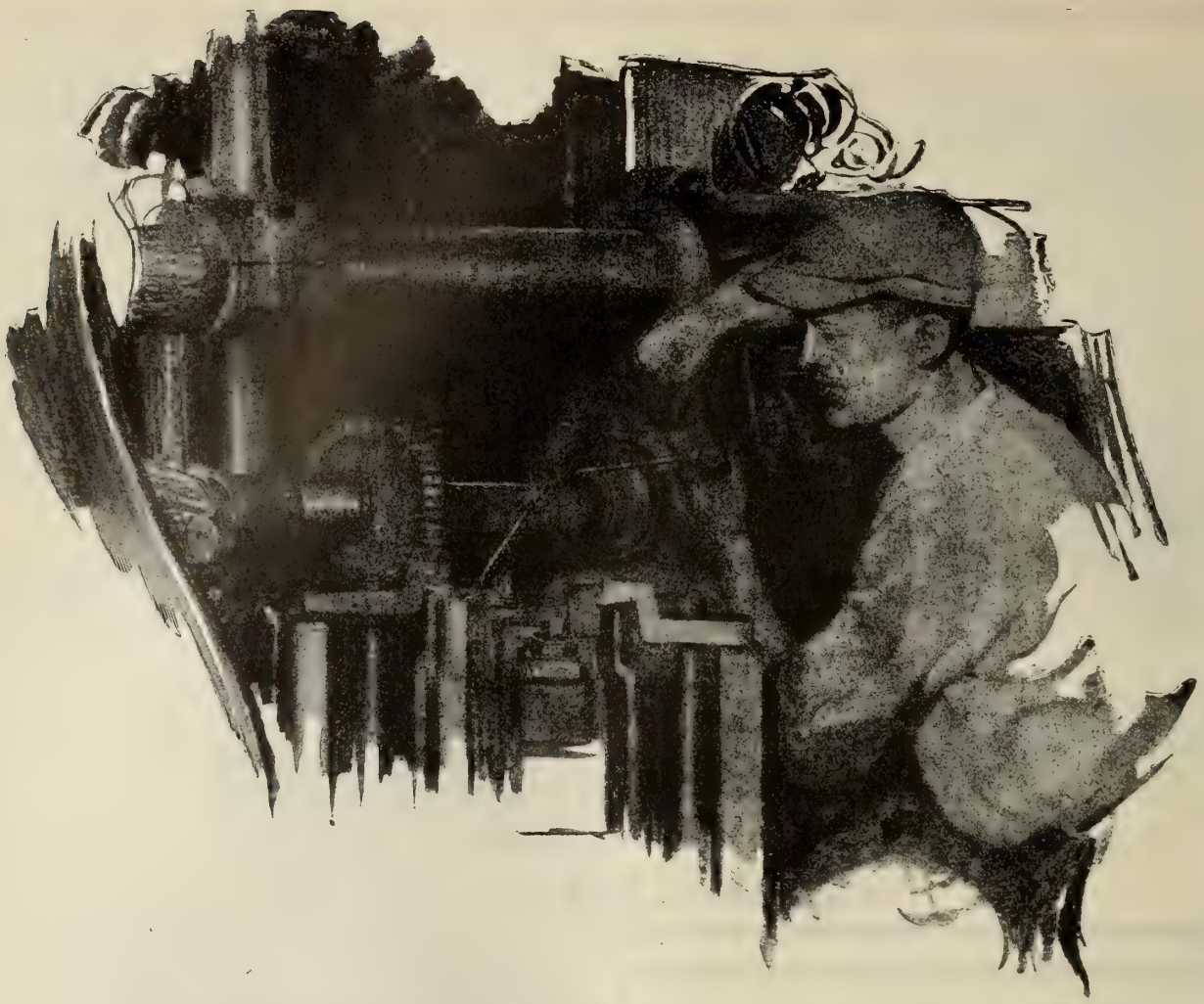
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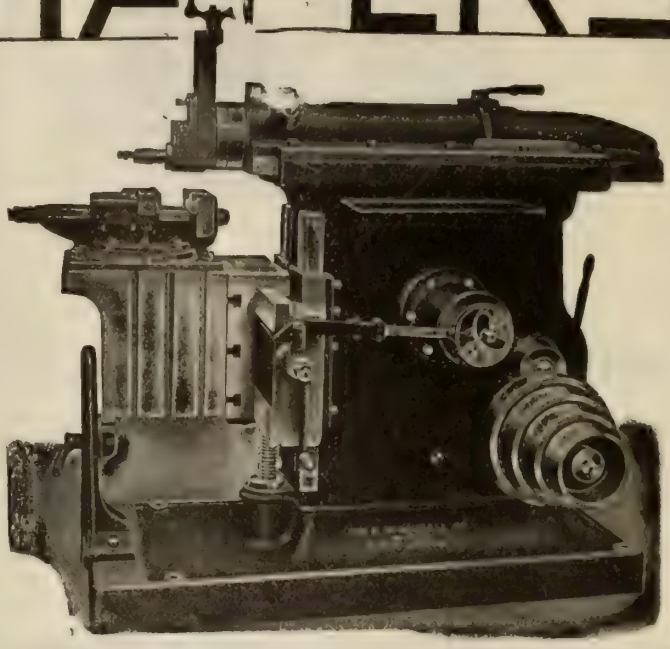
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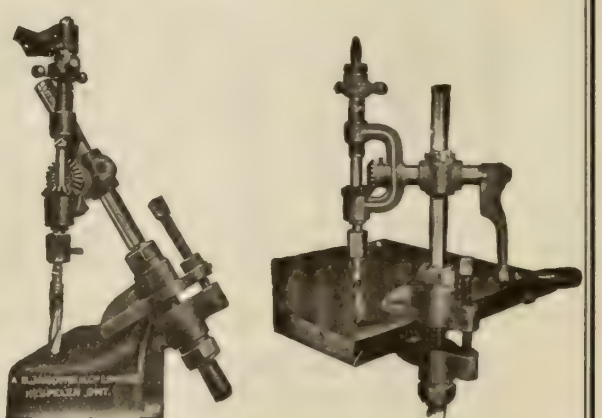
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1.075	1.362	1.464	2.40	.769	1.846	5.20	.377	1.964
1.150	1.312	1.509	2.55	.730	1.862	5.40	.364	1.966
1.225	1.264	1.549	2.70	.694	1.875	5.60	.351	1.968
1.300	1.219	1.585	2.85	.662	1.887	5.90	.334	1.972
1.375	1.176	1.617	3.00	.632	1.897	6.20	.318	1.975
1.450	1.135	1.646	3.15	.605	1.906	6.50	.304	1.977
1.525	1.096	1.672	3.30	.579	1.914	6.80	.291	1.979
1.600	1.059	1.696	3.45	.557	1.921	7.10	.279	1.980
1.675	1.025	1.717	3.60	.535	1.927	7.40	.268	1.982
1.750	.992	1.736	3.75	.515	1.933	7.70	.257	1.983
1.825	.961	1.754	3.90	.497	1.937	8.00	.248	1.984
1.900	.931	1.770	4.05	.479	1.941	8.30	.239	1.985
1.975	.903	1.784	4.20	.463	1.945	8.60	.231	1.986
2.050	.876	1.797	4.35	.448	1.949	8.90	.223	1.987
2.125	.851	1.809	4.50	.434	1.952	9.20	.216	1.988
2.200	.828	1.821	4.65	.420	1.955	9.50	.209	1.989
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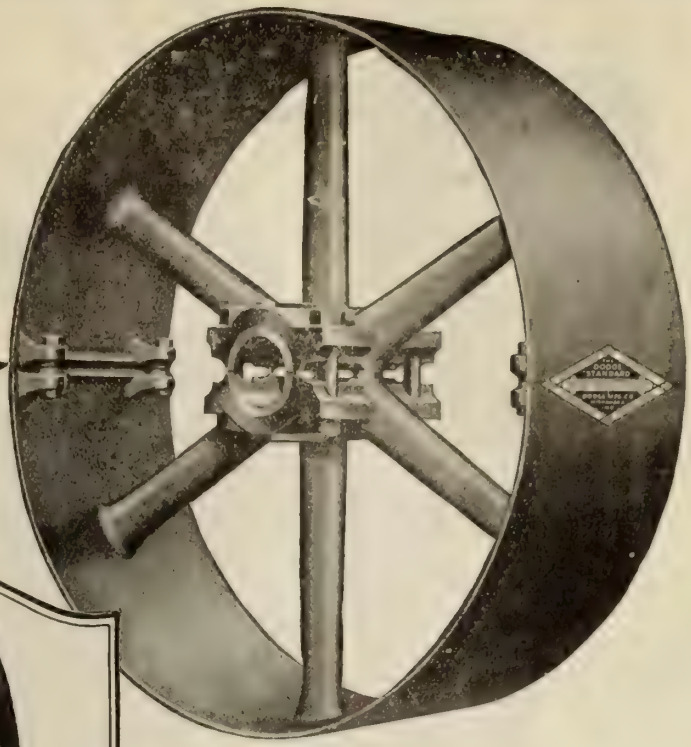
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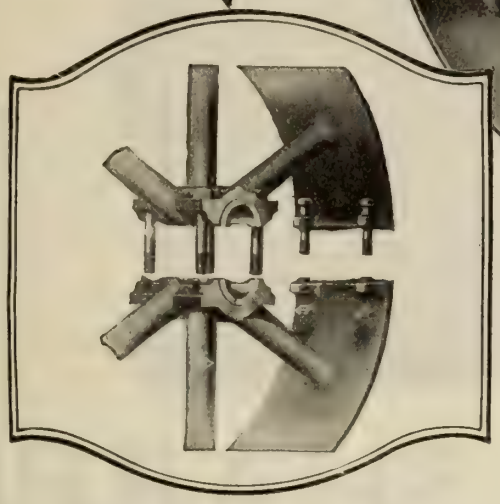
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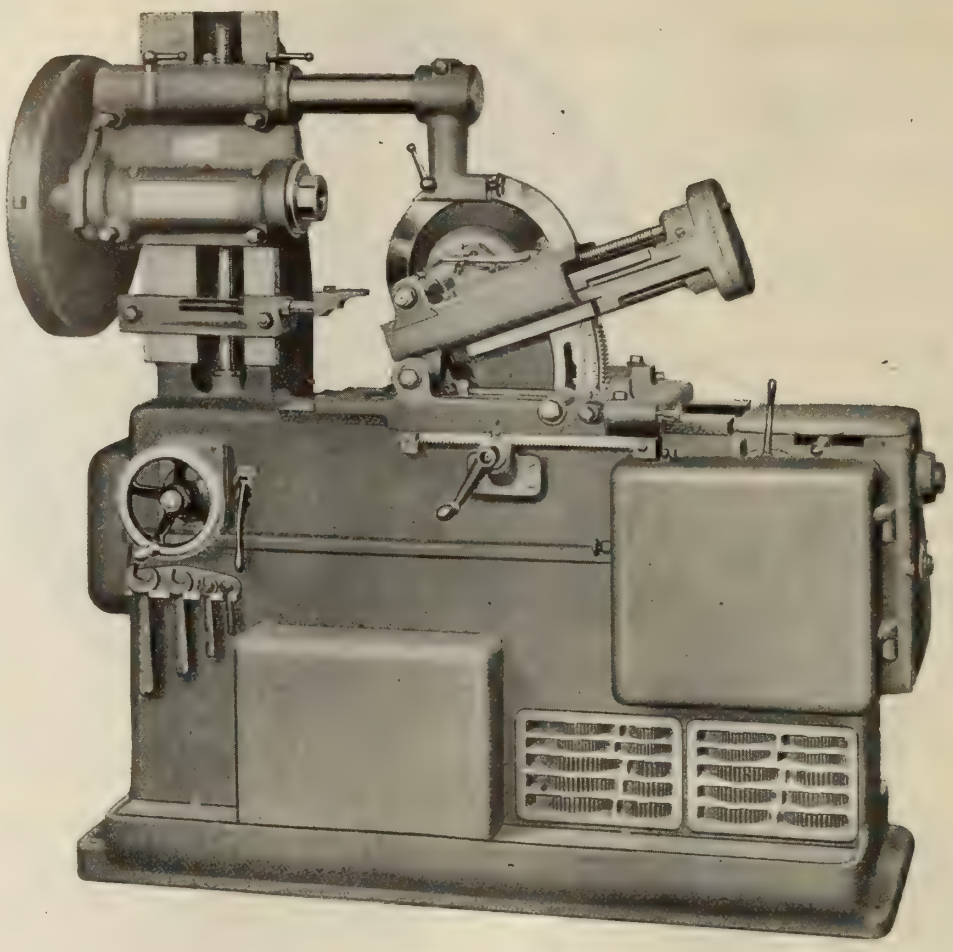
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CANADIAN MACHINERY
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VOL. XXVII No. 4. JANUARY 26th, 1922

Elements of Machine Design—Lesson No. 5

Classification of Fastenings—Types of Rivets Used—Riveted Joints and Factors Which Must Be Considered—How Rivets Should Be Placed—Shearing, Crushing and Tearing Possibilities

By L. T. RUTLEDGE

A FASTENING is a mechanical device for use in machines, structures and instruments to clamp or secure pieces and members together. They may be permanent, temporary, rigid or flexible, and can be divided into three main classes each having its own special characteristic and function. These are as follows:—

(1) Riveted connections.

(2) Threaded or screw connections.

(3) Keys, cotters and pins. The above will be discussed in the order given.

Rivets and Riveted Connections

A riveted connection is a permanent fastening removable only by destroying the rivets that constitute the fastening. In cases where steel members such as structural shapes, plates, etc., are to be joined together, the riveted connection is the type of fastening used. The mechanical student, no doubt, will be more interested in riveted connections used in the construction of boilers, tanks, steel cars, machines, etc., but the same general theory applies whether the connection belongs to a bridge or a steam boiler.

It is unnecessary to describe a rivet. Every mechanic is familiar with the term, but to make sure that the types in use are understood we illustrate in Fig. 24 three styles, viz., the steeple and core head, the button, and the countersunk head. The dimensions are given in relation to diameter "d" the size of shank before riveting.

The steeple, or sharp pointed rivet is one easily formed by hand riveting but it is weak to resist tension. The cone head is one of great strength and is much used in boiler work. The button head is used to a large extent in structural work. The countersunk head is only used where space for the head is lacking, but it weakens the plate to a great extent.

The Author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, Mr. Rutledge will be only too pleased to offer assistance. To save time, write direct to Kingston, explaining your trouble in detail.

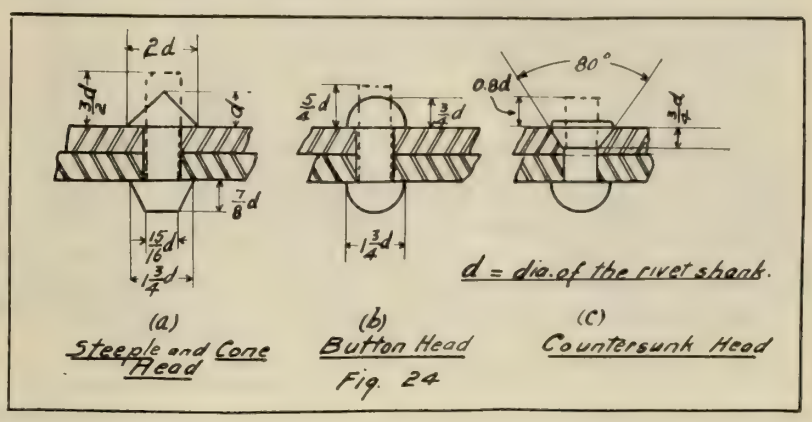


Fig. 24

Rivet Holes

Rivet holes may be either punched or drilled, but of course a drilled hole gives a much better job as it does not injure the metal around the edge of the hole to the same extent as punching. Rivet holes are usually made 1/16in. larger than the shank of rivet for the better class of connections; but in heavy structural work a clearance of ⅛in. is allowed.

This allows for inaccuracy in laying off the holes and punching. It is always anticipated, however, that the hammer blows fill the rivet shank to the size of hole, for to be effective, the rivet must be perfectly tight against the hole.

Types of Joints

The following is a general classification of riveted joints:

(1) Joints met with in the construction of pressure vessels, such as boilers and tanks, in which an internal pressure is resisted, and leakage overcome.

(2) Structural joints similar to the ordinary riveted type of a bridge. Resistance against leakage is not a factor to be considered.

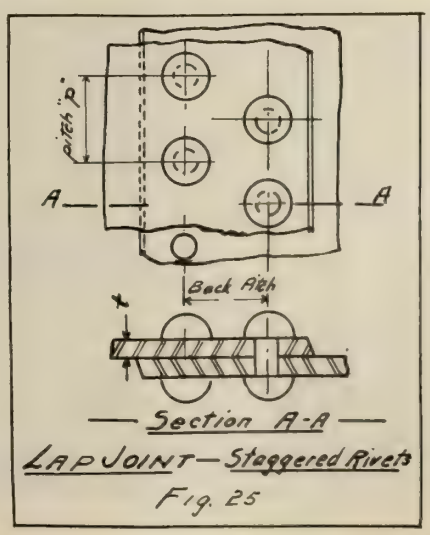


Fig. 25

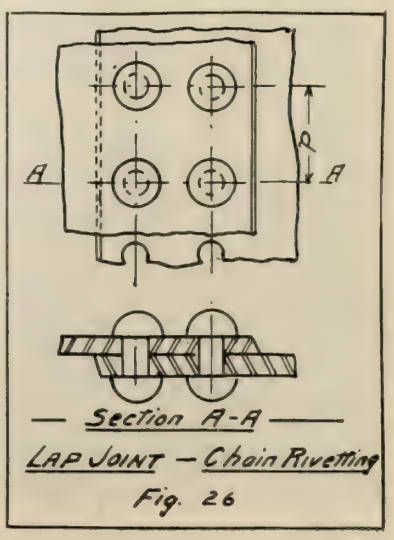


Fig. 26

(3) High-class joints such as are used in the construction of hulls of ships where great strength, stiffness, and durability are required, as well as precaution against leakage.

The following is a particular classification:—(1) Lap joints; (2) Butt points.

Figures 25, 26, 27 and 28 illustrate and explain the chief characteristics of these two types.

Riveting may be done in single, double or triple row as the load demands. Rivets in two adjacent or parallel rows may be opposite one another, as in chain riveting, fig. 26, or they may be staggered (or zigzag) as in fig. 25. In the case of butt joints, the plates which are butted together may be held by one strap, or by two straps, one on each side. In fig. 28, towards the end of this artcile, we show a triple riveted double strap, butt boiler joint. This is the most efficient joint in use and an analysis of it is made to determine its strength and efficiency in every particular.

Strength of Joints

In the design of riveted joints and the analysis of stress in them, the following nomenclature will be adopted:

d=diameter of rivet shank.

d'=diameter of rivet hole.

t=thickness of the plate used in construction.

t'=thickness of cover plates or straps.

p=pitch of rivets, which is the distance between two adjacent rivets in the outside row.

s^t=unit stress in tension.

s^s=unit stress in shear.

s^b=unit stress in bearing or crushing.

E=efficiency of the joint.

P=resistance against failure or the strength of the joint.

The units of measurements used are the inch and pound.

Rivets should always be placed at right angles to the force causing them to fail, that is, they should be subjected to a shearing or bearing stress only. If tension occurs at all, the permissible stress is quite low, about 7000 pounds per square inch.

A joint may fail by the following causes:—(a) shearing of the rivet:—

In a simple lap joint the rivets tend to shear at one section, generally on the contact line of the plates as illustrated in fig. 27 (c). This is called single shear. In the case of a butt joint with two straps, the rivets are in double shear since failure can only take place along two sections. It takes twice the load to cause failure in double shearing: therefore, it is apparent the resistance against this danger is twice that against single shear. The single shearing resistance of a rivet is the area of its cross-section multiplied by the unit stress in shear.

$$\text{or } P = \frac{\pi}{4} d^2 S_s \text{ ----(33)}$$

The safe single shearing value of a ¾-inch wrought iron rivet, whose cross-sectional area is .4418 square inches, is .4418 x 10,000 or 4418 pounds, where 10,000 lbs. per sq. in. is a safe shearing unit stress. Its strength in double shear is 8836 pounds.

(b) Crushing of the Rivet on the Plate

The rivet may fail by the load causing it to crush against the plate. The crushing force is distributed over a semi-circular area. However, it is customary to take the area resisting crushing to be the thickness of the plate, multiplied by the diameter of the rivet. This method really considers only the component of the pressure parallel to the force upon the rivet.

The resistance to this failure is:

$$P = tdS_b \text{ ----(34)}$$

The bearing or crushing value of a ¾-inch rivet against a ½-inch plate, for example, using the usual safe bearing value of 20,000 lbs. per sq. in. is

½ x ¾ x 20,000=7,500 lbs

Some designers use, instead of the diameter of the rivet, the diameter of the hole in the plate. If the rivet completely fills the hole, this latter method is more exact. The use of the rivet diameter is to be preferred, however, since it is the safer value.

(c) Tearing of the Plate Between Rivet Holes

In a riveted joint subjected to tension, the plates may tear along the line of the rivet holes as shown in fig. 27 (a). The length of metal between two rivets in a row is equal to the pitch less the diaemter of one rivet hole. The resisting area is t (p-d') and the resistance against failure is

$$P = (p-d')tS_t \text{ --(35)}$$

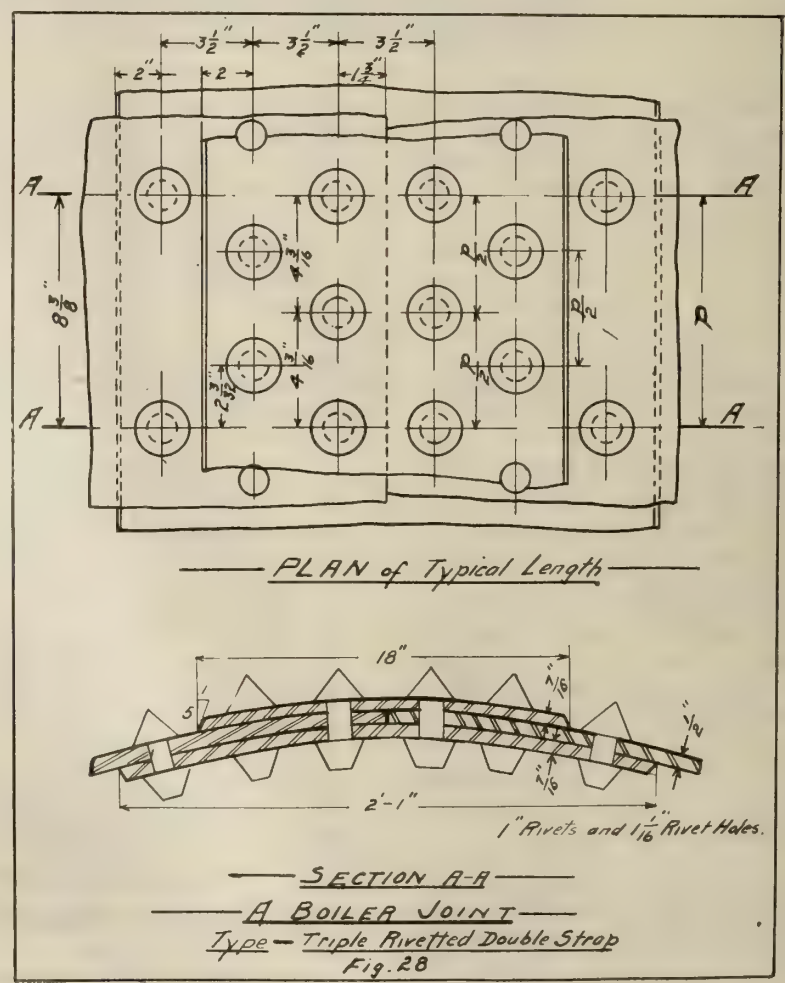
(d) Failure of the Margin

If the rivet is placed too close to the margin of the plate, failure may occur by a piece of plate of width equal to "d" pulling out, as shown in fig. 27. (e). For this to happen, the plate would have to be sheared in two places. If "y" is the distance from the centre of the rivet to the edge of the plate, the resistance against this method of failure is

$$P = 2ytS_s \text{ ---(36)}$$

The margin may tear out along one section as is illustrated in Fig. 27 (d). Formula (37) has to be modified to suit this case. To guard against marginal failure, designers usually provide a

(Continued on page 21)



PLAN of Typical Length

SECTION A-A

A BOILER JOINT

Type — Triple Rivetted Double Strap

Fig. 28

Using Gravity to Speed up Production

Watching Handling Time—Grouping of Machines and Operations Essential—Flexibility of System Advantageous—Transporting Material From Different Floor Levels

By J. H. MOORE

"WE MUST reduce operating expenses and increase production." This, in a nutshell, is the trend of thought being expressed by business men all over the world. There are many ways of reducing the cost of production, one of which is the rapid movement of material. Nothing ties up a product like poor handling facilities, and in many cases this cost is greater than the operation itself.

The foreman in charge, or whatever executive handles such work, should ascertain how much time is consumed on actual manufacture, then investigate the percentage wasted in handling. For example, a man at a machine might consume 4 seconds obtaining a piece of work, 3 seconds for the actual operation, another four to dispose of the piece, showing that 8 seconds is consumed in handling, against 3 for actual manufacture. This incident may seem an exceptional one, but in actual experience it is often found that 90 per cent is lost by careless handling of the product.

In the July 31st, 1919, issue of Canadian Machinery we published an article on Shop Transportation, which covered various methods of speeding the work through the plant. In the present material we will confine our remarks to gravity conveyors only.

The Gravity System

Lest there be any not thoroughly conversant with the gravity method of conveying, we perhaps had better explain that this system takes the form of a series of rollers, which together form a conveyor. Each roller is mounted on a ball bearng, which of course makes them sensitive to movement. The free power of gravity is used, giving the system its name.

We will not attempt to describe the many uses of such conveyors, for practically any product having at least one flat surface can be carried successfully. Two features which make this production aid a great convenience are its flexibility, and compactness. The gravity method is as flexible, if not more so, than any railroad track, and owing to the small space necessary, the conveyor can run between machines, around columns and obstructions without trouble.

The percentage of production gained depends largely on the type of installation used. In every case the sequence of operations should be carefully planned. The product should be kept travelling in one direction, as far as possible, that is to say, no jump backs should be tolerated. Shift the machines if necessary, but keep the work moving steadily.

Fig. 1 shows how the Buda Engine Co., use gravity conveyors to advantage. They have arranged their machines in such a way that each operation follows in proper sequence. Thus the operator merely places his completed part, so far as he is concerned, on the convey-

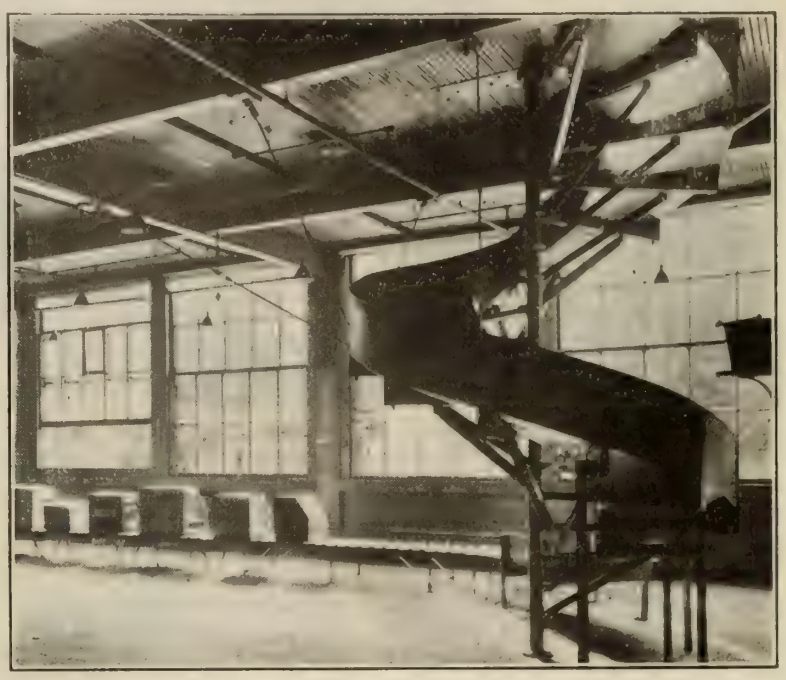


Fig. 3 — Showing how spiral chute can be used in conjunction with conveyor.

We are indebted to the Mathews Gravity Carrier Co., Port Hope, Ont., for Figs. 2, 4, 5, 6 and 7, also to the Lamson Co., Boston, Mass., for Figs. 1 and 3.

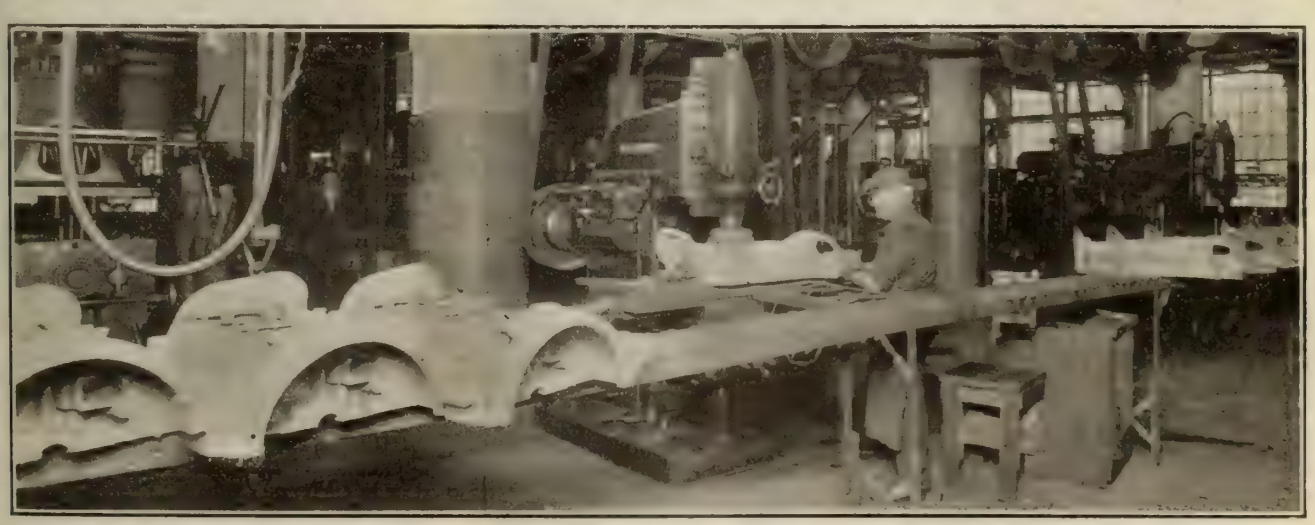


Fig. 1 — Showing how a number of machines may be linked up by means of conveyors.

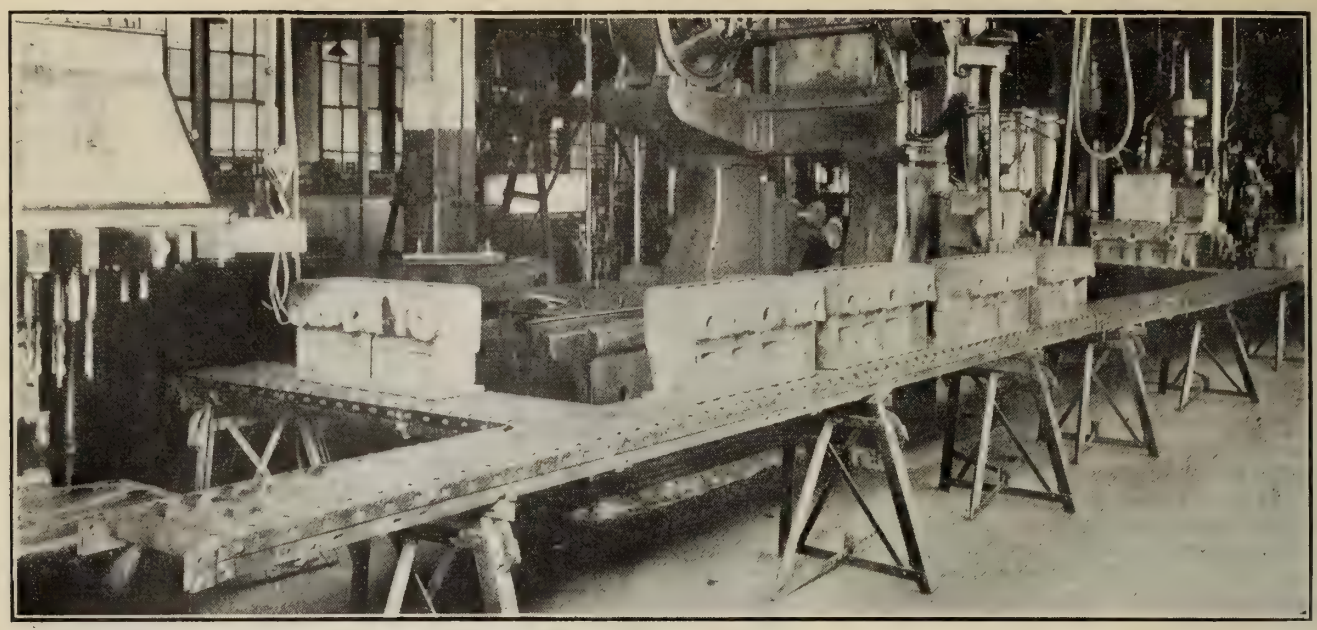


Fig. 2 — The Packard Motor Co. find many uses for such conveyors as shown in photograph

or and picks up another piece. Since installation, the stock in process, formerly piled on the floor at each machine has been eliminated, also the production time has been correspondingly lowered.

The Packard Motor Co., find this type of conveyor very useful. Fig. 2 depicts one line of track in use, and it will be noted that every s ooften, other tracks at right angles to the main line are arranged to carry the work in other directions. Again we see the advantage of careful planning of machine tool equipment for the operations in this factory are arranged in such a way that the parts keep moving forward.

In many cases it is desirable to transport material from one floor to another. This is easily accomplished by a spiral-conveyor of the type shown in Fig. 3. The National Cash Register Co. make use of this instal'ation for conveying boxes to waiting freight cars, and while this is a very important function, it is only one of many uses to which this style of chute can be adapted.

The first operations can be started if possible at the top floor, the product gradually working its way down until it reaches the cars. At each floor the material can be directed to other machines, or if desired, it can be kept on going down any number of stories. It all depends on the arrangement, which again emphasizes the flexibility of the system.

It is futile to a'tempt a description of the many uses of gravity conveyors in the machine shop, but here is one exam-p'e. The Domestic Engineering Company, Dayton, Ohio, use this s'yle of aid for transporting their Delco light outfits to the shipping pla form. The crates are bolted to the skids as the machines pass along. This method naturally saves time and labor. The shipping address is also stenciled while the product is, so to speak, on the move. The crated machines are then conveyed direct to the waiting car or delivery truck as the case may be. What holds true in this example can be applied in a multitude of ways to machine shop in general.

Good use of separate portable sec tions, or a complete installation can b made in any foundry. For example tak Fig 4. The pigs can be taken direct from the car to the pile without undu effort on the workmans' part. Thi naturally speeds up the work and re duces cost of handling.

Not only can this type of conveyo



Fig. 4.—A conveyor of this nature reduces considerable manual labor.

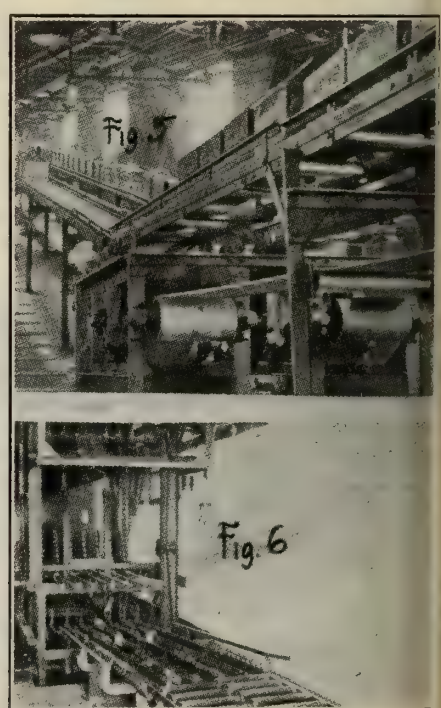


Fig. 5 — Showing portion of very large belt co veyor. The photograph shows two of a seri running in both level and inclined positions. Fig. 6 — Double roller gravity conveyor connect to an automatic straight lift elevator. Larg heavy shipping cases are handled on th system.



Fig. 7 — The small shops will find this idea particularly valuable.

be used in the yard, but inside the plant as well. Core shops find the method useful for conveying cores from the bench directly to the oven, and from there to the foundry.

In the plant itself the castings as they come from the molds are placed on the conveyors and transported to the cleaning room, later moving into the factory. Flacks are also moved around by this system, in fact the conveyor is used for all foundry purposes.

Automotive Field

The automotive trade owes much to this method of conveying. Many parts are handled efficiently that previously were a deficient problem until gravity was used to speed up production. Even complete automoble bodies can be easily transported, so that the system is by no means confined to small parts.

The wire mill industry finds this method to be ideal for the moving of bales and rolls of wire of all kinds, in fact, there is practically no industry which cannot use the system in some form or other.

Merchandise of all kinds can be carried upwards as well as down, but of course in such cases power units must be operated in conjunction with the gravity in order to form a complete conveying system. These lifting or carrying up units can vary in character, depending upon requirements. Belt, chain, apron or straight life elevators can be used, the product settling the type necessary.

Fig. 5 shows a portion of a large belt conveying system and it will be noted that a series of belts is running in both level and inclined positions. Fig. 6 depicts how the straight lift type of elevators is used, and in this case heavy shipping cases are handled. Fig. 7 tells its own story, and as we could illustrate hundreds of uses, we had better content ourselves with the views shown. Every industry finds its own particular adaptation, but all secure the same results, viz, a decided reduction in handling costs.

LESSONS ON MACHINE DESIGN

Continued from page 18

marginal distance equal to from 1½ to twice the rivet diameter. The greater value should be used on riveted joints of pressure vessels.

Design of a Riveted Joint

In the foregoing section, some important equations which are applicable to simple joints, were given. It should be recognized that the main object in a design of this nature is to make the joint equally strong against tearing of the plate between rivets, shearing of rivet, or crushing of rivet against plate. Assuming a lap joint with plates of equal thickness, and assuming that the joint is safe as far as the margin is concerned, then for equal strength the values of "P" in equations (33), (34) and (35) are equal. To determine the proper rivet diameter and the proper pitch of rivets, the three equations may be solved simultaneously. Equating

$\frac{\pi d^2}{4}$ to $2dtS_b$ we get

$$d = \frac{4tS_b}{\pi S_s}$$

Equating $\frac{\pi d^2 S_s}{4}$ and $(p-d')tS_t$ and assuming $d = d'$ we get

$$p = d + \frac{\pi d^2 S_s}{2tS_t}$$

Equating $2dtS_b$ and $(p-d')tS_t$ and as before assuming $d = d'$, the pitch becomes $p = d + \frac{2dS_b}{S_t}$

The above calculations would, in all probability, give a rivet of some odd diameter. It would be necessary to select a commercial size of rivet. This would, of course, destroy the equality assumed at the beginning.

Having selected the commercial size of rivet to be used, the pitch can at once be determined. In general, the method of procedure in designing a riveted joint, having been given the thickness of plate, is as follows:—

Sketch a joint that experience suggests will be suitable for the design in hand. Select a commercial size of rivet in keeping with the thickness of the plate. Consult the handbook while making this selection. Determine and list the expressions for all possible methods of failure. Determine the minimum resisting strength of the joint as far as shearing and crushing are concerned. Determine the proper rivet pitch by equating the minimum value already found to the value of the resistance against tearing of the plate between rivet holes.

Using the minimum value of the strength of the joint, as designed, determine the efficiency of the joint, which efficiency will be the ratio of the minimum value to the strength of the same length of solid plate.

$$\text{or } E = \frac{\text{minimum } P}{tLS_t} \quad \text{---- (37)}$$

Where L is a unit representative length of joint.

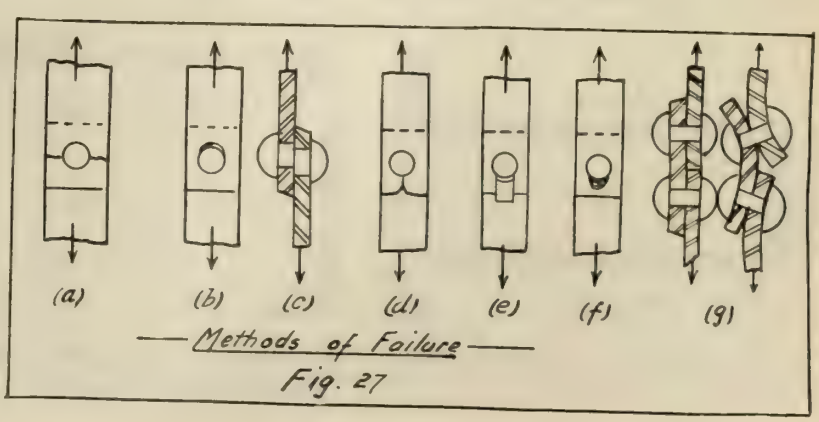


Fig. 27

News From the Welding Field

Importance of Autogenous Pipe Welding

Machine Operated Blowpipe Can Sometimes Be Used More Economically Than Hand Torch—Application of Hydrostatic Tests —Demonstrations of Strength of Welded Pipe Joints

By H. G. IGLEHART

THE welding of non-fired pressure vessels, though it is practised to a very considerable extent, seems to be somewhat shrouded in mystery. A clear understanding of its great advantages is not at all general, even in the engineering profession. As you all know, the most important parts of non-fired pressure vessels are the piping and fixtures, inclusive of connecting joints. Referring to the construction of such parts, one frequently hears engineers say that this, that or the other pipe must not have any welds. They are never able to give any satisfactory reasons for their views. Their answer, in every case, is equivalent to a plain "because"

This lack of understanding is very largely due to the fact that welding engineers and manufacturers of welding equipment have not given the subject of pipe welding sufficient publicity to acquaint potential users with the possible applications of the process and with approved practices in fabrication and installation.

There are still many who look on a weld in a pipe as a patch, yet who would not hesitate to insert a pair of screwed flanges with a gasket and bolts at the very point where welding is unwelcome. The flanged connection certainly has no higher strength efficiency than the welded joint, and it costs more to install, more to cover, and will ultimately prove a source of overtime for repairs which, in some instances, may require shutting down of the plant during busy periods. It is obvious, therefore, that the welded joint is more desirable in these respects, and I may add that it contributes to greater general safety.

There are several operations in pipe welding for which there should be specially designed machines. In acetylene cutting, for example, a machine operated blowpipe can be used much more economically than the hand cutting torch because of its greater speed, both actually and compared to the volume of gases consumed. The machine operated blowpipe also admits of far greater accuracy, thus reducing setting-up operations to a minimum and contributing to faster and better welding. The development of special machines should receive the united attention of oxy-acetylene welding instrument designers, machine builders, engineers, and pipe fabricators, for the purpose of bringing forth new and better mechanisms and appliances as rapidly as possible.

Pipe Welding

We will now take up a comparison of a plain butt weld and a regularly flanged joint. (See Fig. 10.) The flanges may be counterbored and peened; they may be rolled or expanded type, plain like a boiler tube or with grooves turned in the flanges; they maye be threaded only or threaded and peened, or of various other types, any of which forms can use rolled steel or cast iron flanges on steel pipe, but a lot of bolts and gaskets, are required to complete what when finished can only be a temporary splice, as everyone knows of the expense and exasperation of maintaining gasket joints. The welded joint, when properly made is as neat appearing as the pipe itself, does not interfere with hot or cold insulation and will not require any attention during the entire life of the pipe line, as a good weld does not deteriorate any faster than the parent metal.

To make such a weld properly the ends of the pipe should be chamfered at an angle of 45 degrees and be placed in line with the tips not less than one-sixteenth of an inch apart in order that

Author presented this matter before the Convention of the International Acetylene Association at New York.

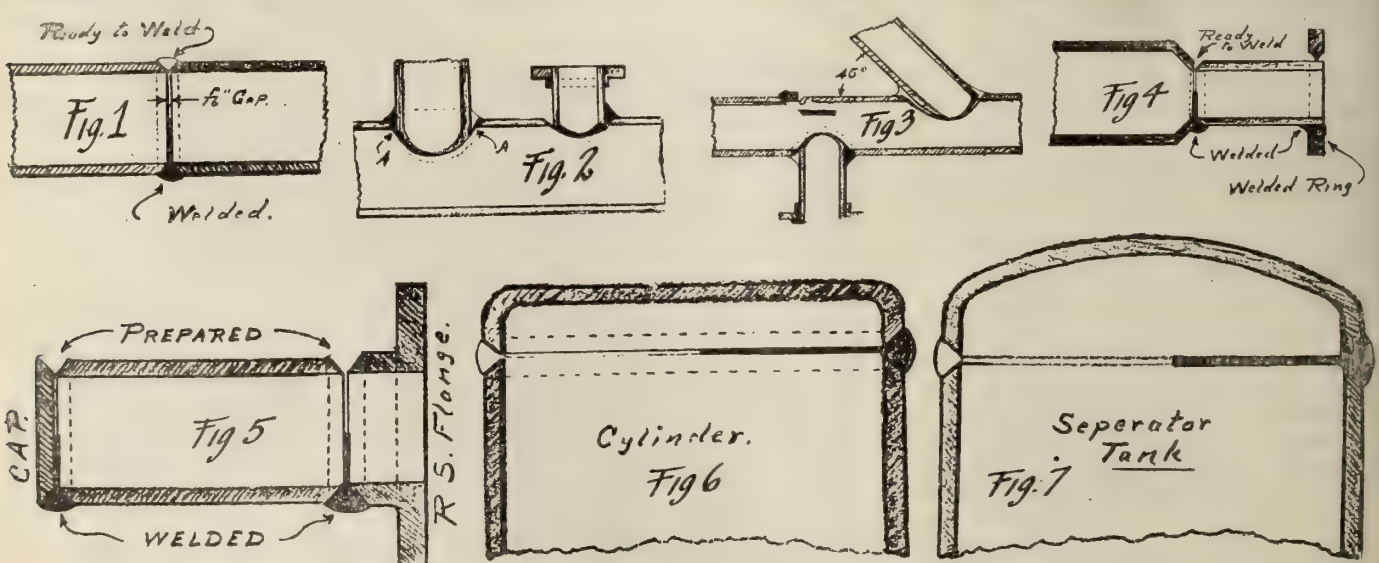


Fig. 1 — Plain butt weld on pipe line. Fig. 2 — Design for welding branch lines. Fig. 3 — A smaller branch requires shorter ends on the neck. Fig. 4—Preparation of ring welding flange. Fig. 5 — Hub welding flange. Fig. 6 — Cylinder head flanged. Fig. 7 — Cap both dished and flanged.

thorough penetration may be had to the inside of the pipe, which must be religiously done in all cases if the 100 per cent. mark of strength and efficiency is expected. The welding rod or wire should be of as near the same carbon content as the material in pipe as can ordinarily be had. Much depends on the welder, as no carelessness or guessing must be done in regulating flame of torch. The weld should be built up as rapidly as the molten metal can be handled without overlapping and in a continuous operation all around the pipe. If the welding flame is slowly moved over the first part welded for a few inches, the weld is automatically and homogeneously annealed for all practical purposes.

Hydrostatic Test

After completion of weld a hydrostatic test should be applied to at least double the working pressure to be carried. While the pressure is on, a vibration test should be added by free use of a medium hand hammer in striking sharp blows all around the pipe on each side of, and close to, but not on the weld. That will show up porosity or cold shuts, by removing the small particles of oxide which, in many cases, temporarily prevent leaks from showing up during tests in which vibration is not applied. The idea of not hammering directly on the weld is that in doing so it sometimes happens that a thin shell is forged over small leaks which will soon corrode away when the weld is in use and then a leak gives another black mark against welding, although it should be charged to the method of testing instead of to the welding profession.

A comparison of a welded neck or branch line, as from a header, and a regularly flanged tee with its gasket joints is not necessary, as any one can readily see. Regarding the welded neck or branch line (See Fig. 2) the operation requires a male and female cut, both of which should be machine made, when a machine can be built. The hole should be cut at a good wide angle in order to form a good groove for the weld. The neck or branch must be cut so that it conforms to the inner contour of the main or header.

The end of the neck or branch line will not require any bevel or chamfer at its short points, as there it goes through the other pipe, but at its long points it must meet the inner and outer face of main, therefore gradually lessening towards the short points. This would not be the case if the neck or branch is of smaller diameter than the main or header, as you can note by reference to Fig. 2 or 3, the smaller the branch compared with the main, the shorter will be the ends on the neck and less bevel at the long points.

Clearance Essential

Note that the hole must be cut so that when set up ready to weld there is the required one-sixteenth inch clearance at all points, points A A included. In welding it is, of course, impossible to make a thorough amalgamation with all of the fibre layers or courses of the neck or branch at points A A. Extra strength must be added by building up the weld to form a good fillet to a radius of about twice the thickness of the pipe. I have been referring to a 90 degree branch, but, except for the shape of cuts, it all applies to any angle branch line or neck. A neck should never be welded on and then have centre cut out afterwards unless it is short and of not less than 14 inches diameter, so that the end can be welded over after the cutting has been done; otherwise the weld will be a poor one and have a low efficiency. The testing of such welds, or in fact any pipe welds, should be as described for plain butt welds.

Very frequently flanges should be and are welded on necks, branch lines and main lines and headers. Sometimes screwed flanges are used and simply welded on the back as a sure seal, but usually they are of the rolled steel hub, or ring types (See Fig. 4). The plate shows a ring welding flange which is prepared by boring to exact size of outside of pipe and then chamfering each side to a 45 degree angle to centre. They are welded with a small fillet on the pipe side and straight on the face side, allowance being made to reface the entire flange after welding and before testing.

Hub welding flanges (See Fig. 5.) simply have a hub forged to practically same inner and outer diameter of the pipe; the end of the hubs are chamfered, thus the weld becomes a regular plain butt weld and is treated the same in every way.

Pipe With Closed End

Quite often the end of a pipe is to be closed with a welded plug or cap, as it might be called. (See Fig. 5.) The picture shows the best form of getting the most strength at reasonable cost in sizes up to 6 or 7 inch, provided, of course, the pressure to be carried is not too high, in which case it would be necessary to dish the cap. In some cases it is found better to make the cap flanges as shown for cylinder head at Fig. 6. The size of the pipe and the pressure to be carried have to be the governing factors in deciding the best and most suitable form for this work, as some cases require a cap or plug to be both dished and flanged, as shown at Fig. 7.

A welded separator or receiver head is by far the most serviceable when done as illustrated in Fig. 7. Steam separators are subject to sudden and frequent changes of temperature, causing terrific strains and stresses, with the result that riveted and caulked heads soon get to leaking in the joints and around rivets. The writer has had this very forcibly driven into memory by several severe experiences, which fact makes it a joy to say that no leaks or trouble of any kind have arisen from the numerous welded dished and flanged heads now in use, some of them being on very high pressure and high temperature work.

There are many people even in these modern times who will say "a welded pipe is all right if one only could be sure it is strong enough to be safe." I pity their mental condition. We cannot afford to break everything to pieces to ascertain its strength. We have the same methods and ways of testing the strength of a pipe weld as of any other article made by welding or otherwise. To substantiate these statements, I will describe some parts of a series of research operations carried out in the shops of the W. K. Mitchell Company in Philadelphia this year for the purpose of demonstrating and illustrating that welded pipe joints are strong when properly made. Early in the year the Power Piping Society requested the W. K. Mitchell Company to supply it with some data on tensile strength tests of welds shown porosity and crystallizatests was made. Following are condensed memoranda of findings:

Result of Tests

All specimens were cut from a length of 8-inch, 28½ pound steel pipe. They were 13 inches long and 2¼ inches wide, and milled down in centre to about 1½ inches in width for a clear length of 6 inches. A greater length could not be used in the machine at that time, but, of course, a 17-inch length would give greater accuracy in yield points and elongation.

The longitudinal strips without any welds averaged 57,625 pounds tensile strength. The longitudinal strips were for grip of testing machine. This flattening was done under steam hammer, cold. Longitudinal strips with oxy-acetylene welds in centre averaged 55,895 pounds breaking strength, or an efficiency of 97 per cent. Longitudinal strips with d. c. electric welds in centre not flattened except at extreme ends averaged only 44,245 pounds, being an efficiency of 78 per cent., the broken welds shown porosity and crystallization, a poor grade of welding wire having been used by mistake. The longitudinal strips were welded before being cut up into the 2¼-inch strips. Circumferential strips were welded after being cut off and straightened.

The straightening was done by slow pressure, the strip being heated to a dull red. Circumferential strips free of any welds or joints averaged 59,125 pounds tensile strength. Circumferential strips with the regular mill lap in centre averaged a breaking strength of 57,975 pounds, an efficiency of 98 per cent. Circumferential strips with oxy-acetylene welds in centre averaged 58,385 pounds, or an efficiency of 99 per cent. The circumferential strips with d. c. electric welds in centre averaged 54,515 pounds, being an efficiency of 92 per cent. All welds were made from outside of pipe only, as would be done in regular practice. You no doubt will have noted that the circumferential

strips averaged about 4½ per cent. stronger than the longitudinal specimens. Possibly the heating for straightening affected it some. That is a metallurgical question rather than one of welding.

For the sake of complete information, a few specimens were welded from both inside and outside. The breaking of them showed no gain at all in the strength, which proved that the pipe welded from outside only secures all of the obtainable strength. Many of the previously mentioned breaking tests did not break in the weld or close to it, which shows they often reach the full 100 per cent. mark.

A few months ago a number of practical demonstrations of strength welded pipe joints were made under the direction of the writer at the W. K. Mitchell Company shops in Philadelphia. The test pieces were later cut into sections for close examination and are still on exhibition at the Mitchell Company offices. Photographs were taken at the time, some of which are shown in this article. We took a piece of 6-inch pipe, about six feet long, with two four-inch branches welded in. One piece was old and rusty, the other was new. They were on exact opposite sides of the 6-inch pipe and about three feet apart. The six-inch pipe was clamped to a bending table, two eye-bolts attached to the branches, and they were then pulled up by use of a crane, no filling being in pipes. The old one cracked at an angle of 30 degrees (See Fig. 8); the new one developed a small crack on back at angle of 47 degrees. The cracks are about 1½ inches long. The old one went through at one point; the new one goes only one-third the way through. The sections of this weld show it would not have leaked with a water pressure of 500 pounds per sq. in. See Fig. 8, then Fig. 9 and note how the six-inch pipe was crushed, giving indisputable proof of the great strength of acetylene welded pipe joints. No heat was used when pulling.

We next made a regular butt weld in seven feet of 8-inch F .W. pipe. This was sand filled and regularly bent hot to a radius of 30 inches, then flanged and tested with 750 lbs. hydrostatic pressure. No leaks or any signs of distress appeared. Fig 10 shows the result.

We now took a piece of pipe made of four pieces of 8-inch F. W. pipe, with a flush butt weld in centre having a bored-out coupling slipped over it and welded at its ends. To the left was a regular threaded joint, with several reinforcing welded tacks. To the right as a regular butt weld. This was sand filled and "regular bent" hot on a thirty-inch radius as shown at Fig. 11. The two outer welds were cut away and the remainder of the bend flanged and tested to 750 lbs. cold water pressure. No leaks or defects appeared, but even so, this form of joint is not generally recommended, as it is expensive, being virtually three welds for one; and then there is an element of risk, by reason of the unavoidable strain of unequal expansion of the pipe between two welds and the coupling or sleeve, as the sleeve is of much larger diameter and would have a much lower temperature in any steam line.

We also took a 7½ feet piece of 8-inch F. W. pipe with a six-inch neck welded in. This was filled and bent hot on a thirty-inch radius, the neck being on the outside of the bend, causing a fearful strain on all parts of the welded joint. No rupture occurred, simply a slight elongation of the lower end of the six-inch neck, due to the natural stretch of the 8-inch, as you will note a Fig. 12.

We also had a number of fuel oil heater coils for steamship ballast tanks or special oil tank steamers. They were of two-inch extra heavy pipe. Each coil had fifty-one feet, four inches of pipe, with from two or three butt welds, made before bending. The bending was done hot, but without any filling in pipe. All were tested to 300 pounds cold water

Continued on page 26

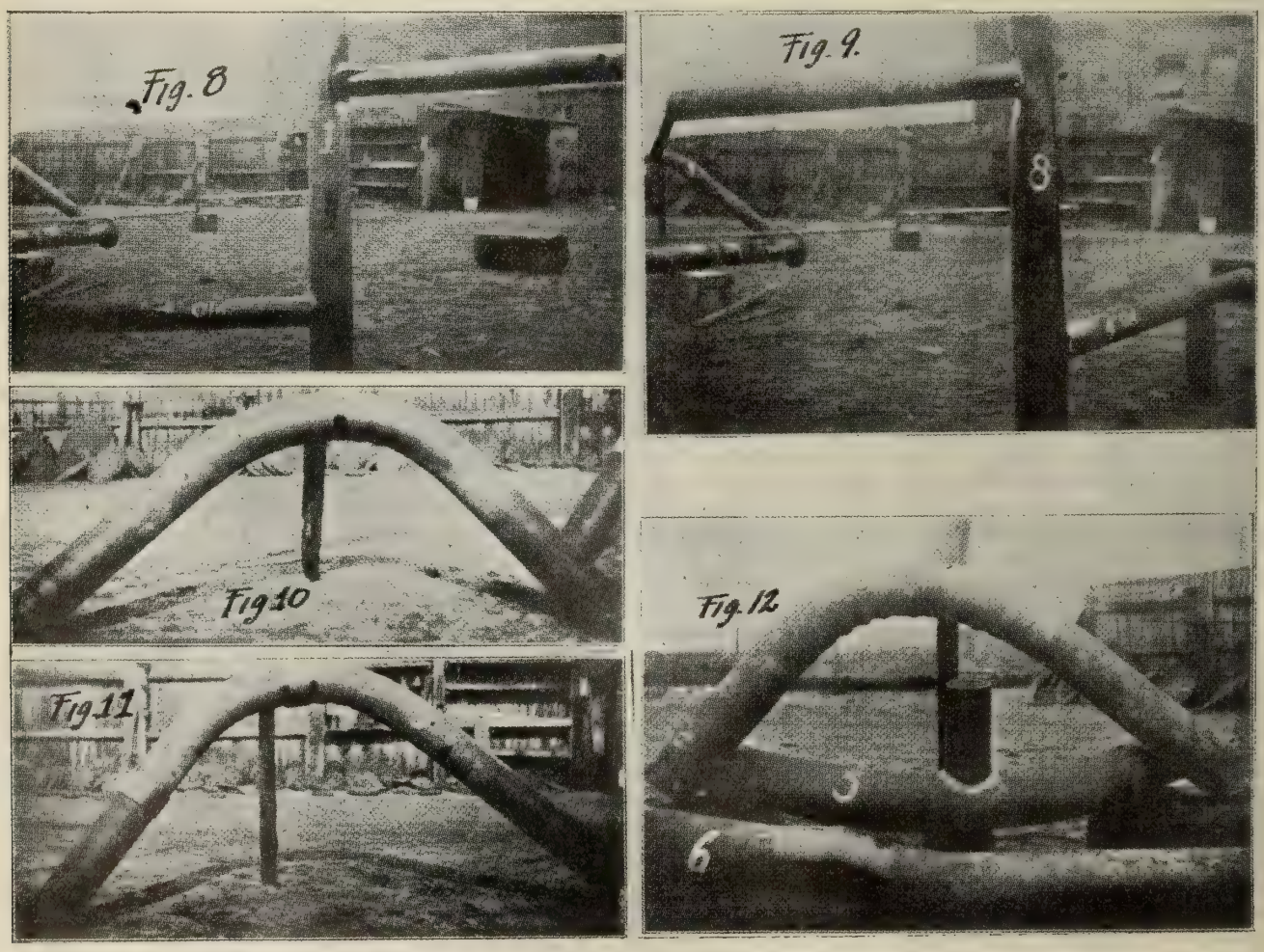


Fig. 8 — The pipe shown would stand water presure of 500 pounds. Fig. 9 — Showing strength of welded joint. Fig. 10 — Pipe bent and tested with 750 pounds pressure. Fig. 11 — Showing heavy bend test on pipe. Fig. 12 — Another severe bending test.

Practical Ideas from Practical Men

A MODEL LOCOMOTIVE

By R. H. TANNER

Believing that readers of Canadian Machinery will be interested in a model locomotive which I have completed, I append the following information regarding this engine. The photograph is self explanatory in so far as the exterior appearance is concerned, but in order to allow some conception as to the actual size of the model, I might add that as far as I possibly could I erected this locomotive to a scale of 1½ in. to the foot.

The length over all is 7 ft. 6 ins. The boiler shell is made from 5-16 in. plate, other parts including cab, fire box, etc., being 1-16 in. thick. The tender is made of 1-8 in. material and holds approximately 7 gallons of water. Over two hundred 3-8 in. rivets are used on the boiler, this portion being 8 in. diameter, and holding a pressure of 110 lbs. when in use.

The cylinders are 1 7-8 in. bore, 2¼ in. stroke, and the driving wheels are 7½ in. diameter. The bogie and tender wheels are 3½ diameter, and as will be noted the double type of truck is used. There are sixteen ¾ in. tubes in the boiler and when the engine has steam up has a capacity of pulling 1½ tons. The pump supplying the boiler runs off the back axle, and other interesting features include sight feed lubricators, whistle, pop safety valves, electric headlight, etc.

The model has a full Walschert movement, and all operating levers are duplicates of the actual locomotive. I built this engine simply as a hobby and it has taken, roughly speaking, about five years of my spare time. I have a small lathe, shaper, and drill fitted up in my back shed and the enjoyment I get from these few tools is well worth while. Incidentally I made the shaper myself, this having an 8 in. stroke.

Editor's Note:—Mr. Tanner enjoys his model making, and tells Canadian Machinery he is always learning something while amusing himself. How many others make good use of their spare time? For the best three letters telling us "How readers have made the most of their spare time," we will award a prize of a steel scale enclosed in leatherette case. The closing date of this opportunity is Feb. 16th. Write us now.

TWO VALUABLE IDEAS

By D. A. H.

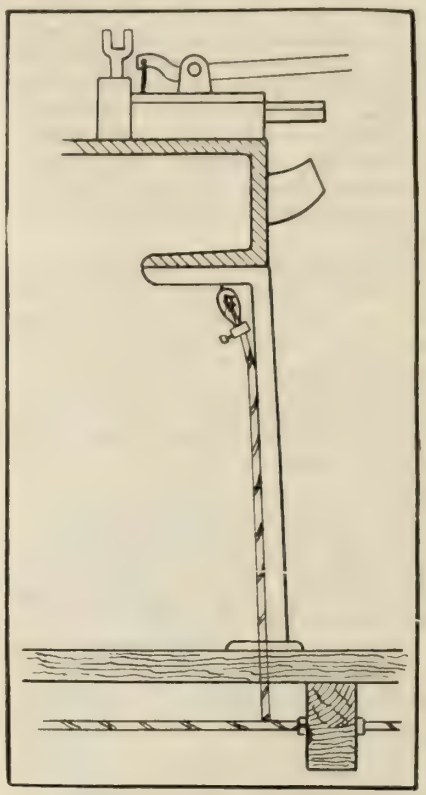
A four-slide automatic spring machine is used by a certain manufacturer of mouse traps to form a rather intricate spring used on one of the traps. Anyone who has had experience with this type of wire forming machine or in fact, with the simpler ones, knows that, while they are great producers, they are prone to little troubles—in fact, they are like automatic screw machines and other automatic machine tools in that they rarely run an hour without requiring some little attention at least.

This machine is no exception, though of the best, and it was placed in the best lighted spot in the factory so as to offer all assistance to the operator. But at least half the interruptions require him to look or work under the machine.

Now the under side of every machine is dark and a workman gets along if possible without hunting up an electric light extension, plugging it in, and working with one hand while he holds the light with the other. This thing was done in the trap factory hundreds of times—sometimes feeling in the dark and at others spending the time to get an inconvenient light. But the owner finally hit upon a scheme that is saving him time and money and giving him better results.

He tapped the lighting circuit in the floor and ran a flexible tube up in the corner of one leg, placing a 40 watt lamp at the top. It's the best thing I have seen. All the workman does is to turn the key and the under side is as bright as day. No delay, no trouble, no light to hold, no light to smash. It saves its cost every month.

After the war, first increased demand and then the competition price adjustment caused this same owner to want greater production from his spring machines. He had been running them for years at the maximum speed recommended by the machine builders—



Showing how the light was arranged.

and so his only hope seemed to be in purchasing new machinery. Not having the necessary capital, he turned again to his present equipment and began speeding it up against advice. Today he is running all of the machines from two to two and a half times as fast as formerly—and his monthly repair bill has not increased one cent. A production in direct proportion was thus secured; and this has been particularly acceptable during the past year since German traps have flooded American markets.



Showing the model locomotive from two positions

EARTH BORING TOOL IN USE IN THE KLONDIKE IN 1898

By H. A. WILSON

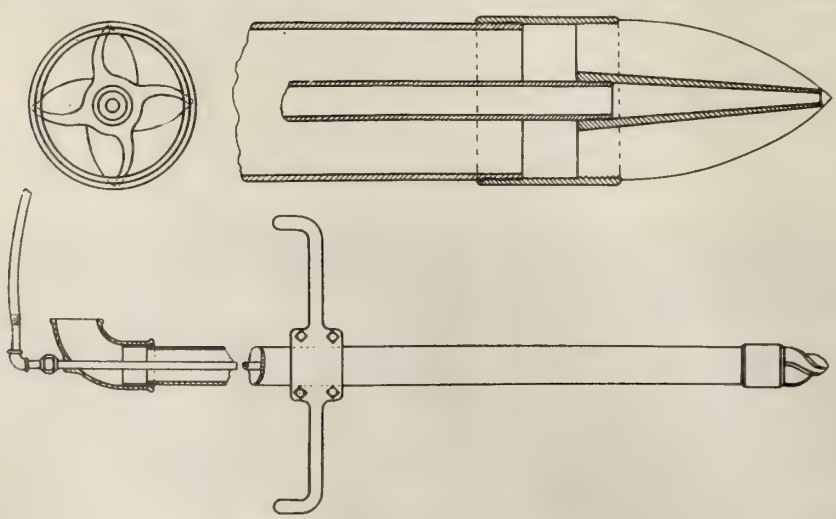
A few days ago the writer had occasion to visit the Montreal office of the John Bertram & Sons Co., Ltd., and among several articles on an exhibition table on one side of the inner office was the tool about to be described. It appears that at the time of the rush to the Gold Fields in the Klondike in 1898, the miners with their crude tools could not make a great deal of progress through earth which was often frozen to a depth of fifteen feet. The late John Bertram had some friends engaged in mining under the crude conditions existing at that time in that region, and they asked him to devise some simple tool of a portable nature that would enable operations to be conducted throughout the winter.

The tool shown in the illustration shows what Mr. Bertram designed and built.

The outside body is made from ordinary 4 inch steam pipe. The small pipe in the centre of the large one is 1 inch steam pipe. The coupling, shown at the bottom of the apparatus, connects the pipe to a spiral four bladed earth augur made of cast iron. In the centre of the augur is cast a nozzle.

The one inch pipe screws into the nozzle. Steam is conveyed through a hose to the small pipe. This steam is ejected through the nozzle in the augur blades, into the earth. The steam thaws out the earth, then the auger is revolved by means of the handles shown in illustration. The thawed earth is then broken up as the auger is revolved and draws itself into the earth. The pressure of the steam blows the earth up the four inch pipe and ejects it through the large elbow at the top of the apparatus. As the hole gets deeper, additional lengths of pipe can be added. The handle clamp bolts being eased off and the handle clamped in a convenient position further up the pipe.

The tool was a splendid success. It was found that at certain steam pressures certain results could be obtained. Radiation losses were great and increased with the depth of the hole. Atmospheric conditions varied, so that actual results could not be tabulated for definite steam pressures. An expert operator could break up the frozen ground and have same ejected before it became too sticky.



WHERE IS MR. WATT'S?

There is a cheque at the office for John S. Watts, formerly of Box 553, New Glasgow. The post office notify us there is no one at this address. Can any reader tell us where Mr. Watts has moved to? If so, write direct to the editor.

DETERMINING THE COST

By W. F. SCHAPHORST

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To figure the cost of your belt slip and creep you must first determine the percentage of slip and creep, which is a simple matter if conditions in the drive are such that the driven pulley can be operated for a while "without load." When no power is transmitted by a belt there is no slip or creep, of course. The driven pulley, then, will rotate as many times per minute as it is possible for it to rotate.

When the belt is transmitting full load, however, there is bound to be belt creep and possibly some slip, and the driven pulley will not rotate as rapidly as when "unloaded." The difference in r.p.m., then divided by the r.p.m. made "unloaded" multiplied by 100, gives the combined percentage of slip and creep.

For example, let us say that a given driven pulley runs 340 r.p.m. in an unloaded state. When the belt carries full load, though, it makes only 320 r.p.m. What is the combined percentage of slip and creep? Applying the above rule we get

340—320=20

20÷340=0.059

0.059 x 100=5.9 per cent. combined slip and creep.

Now, if this is a main belt drive it means that you are losing 5.9 per cent. of your coal pile through belt slip and creep. Thus if you spend $10,000 per year for coal you are losing

$10,000 x 5.9 per cent=$590.00 per year due entirely to slip and creep.

Why not apply some good belt treatment and save most of that? Spending a few cents to save several hundred dollars is surely a good investment. Why not take good care of your belts? Surely $590.00 per year is worth while.

MAKING A HOLLOW MILL CUT CLEAN

"Can you recommend a way of grinding hollow mill cutters so that they will cut a clean surface?" The question was asked by a reader of "Threads" recently and following is the answer given.

It is possible that when adjusting the tool the five screws on the face were not completely tightened. This would leave the cutters a little loose and cause the slight chattering which the samples show.

The evidence from samples submitted, is that faulty adjustment is the cause, although it may be that the cutters are somewhat too sharp. If this appears to be so, stoning the cutters very slightly on the cutting edge with a honing stone would relieve them slightly and give them better bearing.

At the end of the cut on the pieces sent is shown a burr which was thrown up ahead of the cutters. This would indicate that the hollow mill had been forced ahead just a trifle too fast on the stock. This could be proved by taking the cut a little more slowly and notice if the burr does not disappear.

PIPE WELDING

Continued from page 24

pressure without a break. In bending a group of 100, only one weld cracked in the bending, and that, being on the outside, was easily repaired.

In conclusion I will say it is well to bear in mind that pipe welding requires faithful attention on the part of the welder. All welders are not pipe welders. There is a need of much training to take care of the special conditions encountered. It is interesting work, and most good welders who take it up seem to like it as soon as they have been associated with it long enough to get familiar with the exacting requirements. This is another item to keep in mind as a part of the necessary research work by welding engineers to broaden the scope of practical uses of pipe welding.

Caoutchouc oil, if spread over iron and steel surfaces in a thin film with a piece of flannel and allowed to dry up will effectively prevent rust. If it should be desired to remove this protective covering it is only necessary to treat with caoutchouc oil again and wash after fifteen hours.

General Practice Adopted in Oil Refining

Selection of Refinery Site Very Important—Boiler Plant and Pumping Requirements—Details of Distillation Processes For Oils, Pitches and Asphalts—Fire Precautions

By C. D. DEAN, A.M.E.I.C.

AMONG all the great mass of technical literature, that devoted to petroleum refining is very meagre, partly on account of the great complexity in the physcial and chemical characteristics of crude oil and the products therefrom. In the past the technologists in the industry have been made from within and the extensions they made to the knowledge of the art were of a confidential nature until comparatively recent times, when the academically trained man with the scientific mind has found a place therein with the result that literature pertaining to petroleum has made its appearance, and no doubt from now on will increase in scope and volume.

The difficulty confronting anyone interested in the art and anxious to get a quantitative as differentiated from a qualitative knowledge of the industry is the preliminary data to which the usual engineering principles can be applied and in this paper by courtesy of Imperial Oil, some—at least—of this data will be given.

Selection of Refinery Site

In the selection of a refinery site, aside from the usual economic consideration such as markets, transportation, land values, labor and taxation the primary physical requirement is fresh water in comparatively large quantities for boiler and condensing purposes. Seaboard plants use sea water for condensing purposes if fresh water is scarce or difficult to obtain but one sea-board plant secures fresh water from a river 22 miles away.

Depending on the method of receiving crude and shipping finished products, as well as the variety of products to be manufactured, it is found that from 10 to 20 acres of land will be required per 1000 barrels of crude capacity daily. To minimize pumping heads, steam and electric power transmission losses, etc. the area should preferably be square and level, but as standard trackage is a necessity not only to handle current car movements, but also as storage for surplus empties, a rectangular area is usually selected—if available.

The total water requirements are usually found to lie between 1,000,000 and 1,500,000 imperial gallons per 1000 barrels of crude capacity daily, depending on the variety of manufacture, and ordinarily the pumping rate will be found to be quite uniform. For plants located on level ground the combined static and friction heads are rarely over 100 feet and during the past ten years the use of centrifugal pumps for this purpose, operating at speeds of 1500 to 2000 r. p. m. has increased, due to their well-known charactertistic of flexibility.

Aside from the requirements for mechanical power and heating, a great amount of steam is required for distillation and other uses in the process of refining and it is found that the steam requirements in our Canadian climate necessitate a boiler plant between 500 and 650 h. p. per 1000-35 I. G. barrels crude daily. The load is usually found to vary quite widely and overloads for sustained periods 25 per cent. above nominal rating are common. The water tube boiler is now coming into general use, but the nominal rating is figured 50 per cent. higher than the builders' rating and there is sufficient overload capacity left to take care of the variations encountered in refinery work.

Boiler Plant

Oil refining is a process carried on throughout the 24 hours each day and the boiler plant is the mainstay on which operation depends. The selection of the proper size of units for a boiler plant is sometimes rather difficult, but for refineries of up to 10,000 barrels of crude daily, 300 to 500 h. p. units are used. Above 10,000 barrels per day crude capacity, any large size of unit can be used, but it is generally felt that not more than 15 per cent. of the boiler capacity should be shut down at a time for repairs or cleaning.

As one-third of the total refinery fuel requirements which, if liquid fuel, would vary between 20 and 30 per cent. of the crude run daily, is consumed in the boiler plant, economizers and super-heaters, the former preferred, are a regular installation and it is pretty general the present day to install recording thermometers and water steam meters as well as CO_2 recorders, etc. in order to check and maintain efficiency and to ascertain, correctly, steam costs.

In certain locations fuel oil is used as refinery fuel, but it has so many advantages of an economic nature that makes it ideal as a fuel for ships and for heating purposes in cities, especially for offices and for public and private institutions, where transportation or cartage is a considerable item in fuel costs, that an effort is usually made to leave the fuel oil for these purposes. Generally speaking coal is favored as a refinery fuel and when it is used in boiler plants, especially in those of 1500 h. p. and up, stokers and power driven coal and ash handling apparatus are used, as in nearly every case they can be economically justified.

It is the general practice to locate the steam plant as near as possible to the centre of the refineries and carry the steam pipes supported on stanchions to the points where steam is used. In many of the processes, exhaust steam is as advantageous as the live steam and a network of exhaust lines, practically duplicating the live steam lines is installed. The steam pressures vary from 100 to 125 pounds gauge, while the exhaust line pressures are usually set at from 6 to 10 pounds gauge with an average of 8 pounds, and standard steel line pipe is used in both cases.

In general, it is found that the uses for exhaust steam are so varied and continuous that no waste from the exhaust lines occurs, and it is a rare thing to see the relief valves on them blowing. The current practice is to cover live steam lines with one inch of 85 per cent. magnesia, and one inch of hair felt with staggered joints and a final protective covering of roofing felt, while the exhaust lines have only a covering of one inch of 85 per cent. magnesia with roofing felt protection.

Under these conditions the radiation losses in live steam line are found to be approximately .248 b. t. u. per hour per square foot of external surface of pipe per degree difference in temperature between the steam and the outside air. The radiation losses from the exhaust lines are found to be approximately .463 b. t. u. per hour per square foot of external surface of pipe per degree of difference in temperature between the steam and the outside air. Taking the average boiler load throughout the year, it is found that the actual heat losses, from both live and exhaust lines, rarely exceed 5 per cent. of the generated steam.

The prices of coal have risen so much, compared with the prices of insulating materials, that a double jacket on exhaust lines would probably be financially justified. In designing live steam lines, the effort is made to keep the pressure drop for lines supplying large units of power to not more than 5 pounds.

Power Requirements

The requirements for mechanical power for pumping and other purposes, up to a few years ago, were all provided for directly by steam apparatus. In pumping, the duplex steam pump was used, while the throttling and occasionally the automatic cut off steam engine was depended on for general mechanical purposes, incident to the business. For some time a controversy has raged,

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Author presented this information before the Toronto Branch of the Engineering Institute of Canada.

as to whether or not there was a loss in using power apparatus, which required large quantities of live steam when the exhaust could be used so conveniently in the process.

It has been found by more refined investigation that the losses incident to the blowing of exhaust lines have been practically eliminated by the use of more efficient steam using apparatus and besides a real saving in boiler fuel for the same refining capacity has resulted from the same cause, seemingly altogether due to the more efficient use of the heat units absorbed in the prime movers.

The substitution of the centrifugal pump for the old style steam pump has had the largest effect in determining the modern trend for mechanical power in refining work. It is the nearest approach to a duplex steam pump for reliability in refining operations where liquids of a viscosity comparable with water are to be handled and its use has introduced the electric motor. Profuse lighting is a necessity for oil refineries and with the advent of the electric motor, an electric power plant became standard apparatus in a well ordered plant.

It is usually found for lighting and all mechanical purposes, except pumping high viscosity oils, the electric power consumption for a plant on level ground will be approximately 1000 k w. hours per 1000 barrels of crude run. For plants built on sloping ground where comparatively high static pumping heads are encountered, it will be found that the electric power consumption will vary between 1500 and 1750 k. w. hours per 1000 barrels of crude run.

It is generally found that the maximum peak at the switch-board will be not more than 2-1½ times the 24 hour average, and the demand factor, figuring input to motors and watts per lamp, ranges around 40 per cent. but this latter figure must be accepted with reservations for obvious reasons. As far as the peak load ratio is concerned, intermittent services like loading and discharging steamers are not included because as they usually occur throughout a 24 hour period continuously, they simply add their input rating to the refinery peak. While it is true the refinery process is continuous, it is found that the peaks occur between 7 a. m. and 6 p. m.

The power characteristics usually selected are 440 volt, 3 phase, 60 cycles or 25 cycles, depending to some extent on the type of prime mover, and 440 volt apparatus was chosen primarily, because of the opinion that prevailed that this voltage would be safer for the operators, although the writer believes doubts on these points are confessed. The lighting voltage is all 120 and in the case of a small refinery is stepped down at the switch-board to save transformer costs. For large transmissions and comparatively large powers, where economically justified 2200 volts with step-up transformers are used and latterly for certain purposes 2200 volt apparatus is coming into use, although it is considered in its experimental stage, as far as oil refining work is concerned. Motor drives throughout are either the constant speed or variable speed induction motor, the latter being a rarity as it is only used to drive plunger displacement pumps.

POINTS TO REMEMBER

Fresh water, in comparatively large quantities, is necessary for condensing purposes.

From ten to twenty acres of land is required per thousand barrels of crude capacity daily.

A boiler plant of between 500 to 650 h.p. is necessary to supply steam for every 1,000-35 I.G. barrels of crude daily. The refining process is carried on throughout the 24 hours each day.

Exhaust steam is used extensively, so that there is practically no waste.

Power Factor

The power factor at the switch-board is found to be between .8 and .9 although on occasions the writer has seen certain plants go as low as .7, but it will be found that if the water pumps are carefully calculated and the oil pumps are designed to take the worst case, as far as head conditions are concerned, the motors will run close enough to full load capacity to give good power factor, especially if the generator capacity is flexible enough to have as near full load operation as possible. The transmission lines give a line loss of from 5 to 8 per cent. and trunk lines are generally liberally figured, because of the certainty of adding additional apparatus from time to time.

The type of prime mover used to drive the generators, is either steam engines or turbines, oil engines of the full Diesel or semi-diesel type and gas engines. The steam engine is favored for units up to 200 h. p. each, while for larger units than this the direct connect turbine or the belted oil engine is chosen with preference for the former unless the advantages of the latter are overwhelmingly in its favor.

The gas engine driven units are not adopted unless the plant is located contiguous to a large field yielding natural gas or unless the refinery produces large quantities of by-product gas and only then when fuel is high, giving the gas a high comparative value. As a rule the oil and gas engines are not flexible and cannot respond to overload without distress, and the manufacturers usually recommend that they be operated on continuous loads of 80 per cent. or less than their rating.

Crude Oil Reception

Crude oil in quantities is received by tank car, by pipe line and by tank ship, or any combination of these methods. The most favored means are by tank car or tank ship, because these means are independent of any field. As a rule, oil producing is a hazardous game and a pipe line usually requires a comparatively large capital expenditure. For short distances to the sea-board, a pipe line is preferred to tank cars, if the field warrants, while for long distances over land, the decision for pipe is a matter of considerable moment, and requires the exercise of judgment, based on long experience in the vagaries of oil production.

When crude is received by pipe line the tankage for receiving it is usually in two units, of sufficient capacity to hold a full week of pumping to guard against possible shut-downs of the line which frequently occur, enough to warrant the expenditure for this safe-guard. The two units are necessary to gauge receipts properly.

When receipts occur by tank cars, provision must be made for interruptions in railway service, as well as for the vagaries of train movements and transfers, so that it is customary to carry about a week's supply, although it is not unusual for the tank car situation itself to dictate the amount of storage necessary for crude because of fluctuations and peaks in the movement of finished products at certain periods of the year. When crude is received by tank ship the capacity of the largest ship, plus about fifteen days' supply must be provided for, due to the hazards of navigation and the difficulty of adhering to a pre-arranged schedule.

In the case of crude receipts by tank cars, pumps must be provided for unloading and these are usually made large enough to permit unloading and the redispatch of the empties within the standard 8 or 10 hours day between switchings if two per day can be arranged. While it may seem like an economic waste to dispatch cars empty, the fact is cars in crude service must be cleaned to carry refined oils and besides the cost of cleaning and the time lost to do this, is the uncertainty of load in the direction of the crude supply. Tank ships are equipped with steam pumps for discharging their cargoes, but the rate of discharge which should be high to minimize avoidable demurrage, is influenced by two factors; the capacity of the ship's boilers and the allowable pressure on the hose connecting the ship to the permanent lines on the dock. If the lines to the crude tankage are long or if the static head ashore is comparatively high, shore booster pumps are used of large enough capacity to accommodate the rate of discharge of the largest ship.

First Distillation

The first distillation of crude oil occurs in crude stills, which are operated either continuously in a battery or batch singly. Sometimes a combination of methods is used but the effort always is to get the most out of the crudes without using too much apparatus and the whole operation depends on the characteristics of the crudes—no two of which are alike.

In the first distillation the separations that are made are naphtha distillate, refined oil distillate, gas oil, lubricating distillate and fuel oil, as well as coke if distillation is carried to dryness. These distillates are usually run to gravities which have a range of boiling points, in which run considerable latitude is necessary but the aim is to approximate a degree of separation that reduces the necessity for subsequent distillation.

Continuous Method

The continuous method lends itself to an exchange of heat between the ingoing charge and the distilled vapour, as well as the residual bottoms and thereby gives an opportunity for fuel saving, but it is only used when running for fuel oil or in refining parlance topping, because it does not give good separation. In running for fuel oil, the aim is to prevent cracking and while distillation occurs at what is called "atmospheric pressure," the temperature rises and reaches the critical temperature for certain fractions. To eliminate this tendency in distillation, the temperature is reduced by introducing dry steam, which owes its efficacy to the law of partial pressures, but which, as before mentioned, causes the factions to overlap.

To get the most from crude in the sense of securing all the products with characteristics that are the most useful in industry, it seems to be necessary to distill to coke and do whatever cracking will naturally occur with a given crude at atmospheric distillation, which in reality is about ½ pound gauge.

In the skimming operation alone it is ordinarily found that from 8 to 35 cubic feet of fixed gas, under standard conditions, is produced per barrel of crude run, while in coking from 50 to 120 cubic feet of fixed gas is produced, and it is found that a relation exists between the gas and coke produced. There is a distilling loss which probably averages for paraffine base crudes around 5 per cent., but for asphaltic crudes goes as high as 15 per cent. As far as they will apply, considering the uncertain element from cracking, the specific heat of oil on the pound degree Fahrenheit basis is ½ b. t. u., while the latent heat ranges between 140 and 150 b. t. u. per pound for atmospheric distillation.

An effort is made to secure as good fractionation as possible in the first distillation by using reflux towers through which air circulates and knocks down the heavier fractions in the vapour stream. In designing these towers they are made as flexible as possible by some system of control of the air circulation and for certain crudes and certain rates of running, it is sometimes necessary to jacket the towers, at least, in part.

The modern still of 1000 barrels capacity, has two towers and 3 worms or condensing coils, or 3 towers and 4 worms and the design of worms is made altogether on the basis of a low rate of heat transference, about 1000 b. t. u. per square foot of surface per hour so as to provide great flexibility. Ordinarily the stills run either a 2 day or 3 day schedule, depending on the characteristics of the crude. The condensing water used is altogether based on the heat to be extracted from the oil and the rate of distillation, and for oils that have no viscosity the temperature is allowed to go as high as 120° to 140° F.

Cooling Certain Oils

For such oils as have viscosity at ordinary temperatures, as would retard flow in the worms and thereby increase the time schedule the practice is to cool these to a temperature that gives them low viscosity and this is done by taking the condenser water at 120° or 140° degrees F. from the light worms and using it to cool the contents of the heavier worms.

It will be appreciated that distilling to coke means very high temperature and the flue gases reach as high as 2000 F. towards the end of the run. As a general thing, the temperature of operations are all very high and as a result the labor needed to effect current repairs is as great as that needed in operations. All still equipment is designed to permit the making of repairs as cheaply as possible by arranging the fire sheets and brick work so as to minimize the amount of tearing down in order to affect the real repairs. For the same reason the worms are built of cast iron pipe installed so that any section can be removed and replaced without disturbing the other parts.

The draw-offs from the towers are arranged so that they can be sent back to the stills or on through the worm to the receiving-house and the run-backs to the stills are equipped with traps. Each worm runs to a look-box or turret in the receiving-house and the manifolds delivering to the receiving tanks are ordinarily placed in the ground floor of the buildings.

The gas is taken from the discharge end of the worms by a suction of about 2-½ inches of water, so as not to lift off any light vapours.

Treatment of Distillates

The finishing of the distillates is done by treating to remove unsaturated compounds, which give odor, color, etc., and subsequently distilling, but the order in which these are done depends on the product. In general, it may be said that treating is the first process in naphthas and refined oils and the last process in lubricating oils, but this is not necessarily so.

The treating of naphtha distillates is done either continuously or batch, and consists in bringing the distillate into intimate contact with commercial sulphuric acid of 66° Be. and after the re-actions have proceeded allow the sludge to settle out. The oil is then washed with water to remove all traces of the acid that can be removed by this means then settled again, after which it is treated with caustic soda or soda ash to neutralize the acid that still remains. The sludge is again settled out after which the oil is washed with water. In general, it is found that the quantity of water required in treating is equal to about 35 I. G. per barrel, while the quantities of acid vary between ½ and 12 pounds per barrel, and the quantity of soda solution is approximately 12 gallons per barrel. There is always a loss in treating, varying between ½ and 3 per cent.

From the treating plant the naphtha distillate is ready for finishing and is charged continuously to a steam still, where the gasoline is extracted by fractionation leaving a bottom or residue that is largely kerosene.

Steam stills, since they run continuously, are equipped with vapour heat exchangers, oil heat exchangers, oil coolers, water separators, etc., and in addition have over the still a large tower, where the ingoing charge trickles over stones through which the out-going vapours pass. The object of the tower is to knock down any kerosene fractions that may be leaving the still with the gasoline. The heating medium free live or exhaust steam is introduced into the still beneath the oil surface and it owes efficacy to the operation of the law of partial pressures, previously mentioned. The pressure in the still is not allowed to exceed about ½ pound gauge, if possible, but on occasions it may, and the still is, therefore, usually built, with spherical heads or is otherwise braced.

These stills are built usually of 1200 or 1500 barrels batch capacity and the running rate depends on the condensing surface in the worms which is, therefore, made ample. It is found that approximately 8 pounds of steam is required per gallon of gasoline or roughly 1 pound of steam per pound of gasoline overhead and the charge is fed at the rate of about 60 to 75 barrels per hour per still, requiring about 450 to 550 boiler horse power depending on the percentage taken overhead. On the condenser end of the vapour line means is provided for expanding the vapours before they enter the worm so as to take out any condensed steam and at the outlet end of the worm a trap is provided that takes out most of the water from the interior of the worm and discharges it to a sewer. It may be mentioned here that for this and all other stills, about a two inch thickness of magnesia blocks and a weather protection are used to minimize radiation losses.

In next issue we will take up the treatment of refined oil, proper storage, and other important points in the refining process.

The past year has been an active one in the building business in Hamilton. The annual report of the Building Inspectors' dept. shows the total value of all structures erected in Hamilton during 1921 at $4,649,450 as compared with a total of $4,340,220 for the previous year. In other words an increase of $299,230.

Review of Course of Business During 1921

By JAMES S. ALEXANDER
President National Bank of Commerce, New York

IN A REVIEW of the course of business during 1921 we look for an answer to the question as to what progress has been made in improving the conditions under which the peoples of the world must live and work. At no time in our history has this question been fraught with greater significance. Following are what appear to be the salient facts in the year's business history.

Anxieties, discouragements and great difficulties beset industry, commerce and finance during a large part of the year. Business throughout the world was groping for a way out of a maze of perplexities. While confidence was felt as to the ultimate outcome, it was impossible to plan beyond the pressing requirements of the moment.

Course of Business in 1921

A review of business developments in America during 1921 reveals with particular clearness the effects of community of interest with other nations upon our affairs. A consideration of these international bearings is necessary to a clear understanding of events in the year just closed and an intelligent outlook on what lies ahead.

The early weeks of 1921 were marked by a restricted movement of raw materials and manufactured goods, a continued rapid and irregular fall in prices, and a declining scale of industrial and commercial operations. Lower prices and lessened business reduced the pressure on bank resources despite the persisting burden of slow commercial credits. Wage reductions and unemployment reduced buying power, further curtailing business activity. Effective demand was further impaired by the failure of retail prices to decline commensurately with wholesale prices so that the net proceeds from the operations of farmers and other wholesale producers were not sufficient to cover a normal volume of purchases by them as retail consumers.

It was clearly evident that foreign conditions were exerting a particularly great influence in the situation. It is true that much of the weakness was caused by the inevitable reaction from domestic over-trading during the post-war boom. Nevertheless it was apparent that the present situation was essentially different from previous business crises. America's position in international trade had been greatly expanded and the world's impaired buying power proved insufficient to pay prices covering production costs of existing stocks or even to take new goods at reduced costs of production. The same was true of all other exporting countries, but, since America had the greatest export trade, its losses were commensurately large in the wave of cancellations of contracts, repudiations of shipments and defaults of commercial credits that swept over the world.

These world influences explain in a measure the halting progress and the disappointment of apparently justified hopes during the year under review. In the spring of 1921 there were some superficial signs of seeming improvement. Interest rates began to fall, reflecting better credit conditions, but reflecting also reduced business. The foreign exchanges grew stronger, but this reflected prospects of a satisfactory settlement of the German reparations, the shipment of gold to this country and the poor state of foreign trade in other countries, rather than any fundamental betterment in world conditions. There was a revival in the automobile industry, and a measurable improvement of sales in needed staple goods, but no general lift in activity.

World Price Situation

The basic business conditions continued to be subject to the weight on the markets of the world of accumulated stocks of merchandise. Prices continued downward. While price readjustment was a revival in the automobile industry the irregularity of the movement produced a difficult world situation not only in respect to different classes of prices, but also as to price levels between nations, adding to the difficulty of international trade and to the instability of the foreign exchanges. A renewal of reactionary movements and increased pessimism characterized American business at the middle of the year. Slackening industry here forced labor to accept further wage reductions.

The dullness and pessimism that characterized the summer months were followed by a revival of activity in the closing months of the year, largely seasonal and mixed in net results, but more substantial in character than that in the spring. Favorable crop conditions resulted in large yields of grain. The proceeds of the crops provided a measure of relief to the rural banking situation through a moderate liquidation of loans. But the full stimulus of what, by itself was a successful agricultural season, was not felt in the retail markets and related industries because of high retail prices relative to the extensively deflated prices the farmers received.

Sustained activity in the investment market occurred the latter part of the year. This reflected completion of the liquidation of security holdings brought about by business reaction, the accumulation of idle funds seeking employment as a result of reduced business demands, and particularly it reflected a levelling process resulting from declining interest rates, which made it increasingly profitable to buy securities at prevailing low prices and consequent high yields. The movement resulted in extensive absorption of United States Government issues, carrying them up toward par, and probably constituting their ultimate distribution on a permanent investment basis.

An important development in the closing weeks of the year was the vigorous upward movement in leading foreign currencies, sterling going to 4.24, the highest point reached since October, 1919. Sales here during the year of securities from foreign sources, net shipments of about $700,000,000 in gold to America and large speculative dealings in foreign currencies contributed to the improved position of several of the foreign exchanges. Barring broader elements of strength back of these factors their ultimate effect might well be further weakness of the foreign situation. This is particularly true in respect to the further distortion of the world's gold supply that occurred. We may, however, feel confident that accumulating elements of betterment in world economic conditions were indicated by progress in solving major problems of unsettled national relations as foreshadowed by the promise of favorable results from conferences on the Irish question, on the German reparations and on the limitation of armanents and Pacific problems.

Strong Condition of Banking System

The year's end found our banking system in a notably strong position. Cognizance must be taken of the fact that there remains a considerable residue of non-liquid bank loans, whose settlement constitutes a particularly difficult phase of deflation because of especially hard conditions in respect to the businesses and the merchandise markets involved. But the burden of retarded credits has been very materially lightened. The total volume of commercial credit has contracted in keeping with lessened requirements due to lower prices, liquidated transactions and reduced activity.

The position in respect to gold reserves is unprecedented. In fact, due to the flood of the metal from abroad, the nation has an embarrassment of riches in this respect, involving the conceivable possibility of cheap money and

credit inflation. But serious results need not be feared if the requirements of sound business rather than the physical volume of gold be made the essential criterion of credit expansion. Fortunately the enlightened policies and skilled management of the Federal reserve system have firmly established it in the confidence of the nation's practical bankers as an instrumentality with which they can co-operate effectively in conducting commercial banking as a whole on the common sense lines which this situation requires.

Keener Competition

In the industrial and commercial situation, many elements of weakness have been eliminated through adjustments to new conditions accomplished by the stronger concerns and through the reduction in the number of weaker and uneconomic business units brought into being during the boom period. There has been a return of keener competitive conditions, and an increase in both personal and corporate efficiency and economy. Potential demand exists for goods really desired or needed, coupled with a spirit of thrift that in the long run creates more staple and desirable markets. The period of collapsing price movements, yet in progress at the opening of 1921, is generally over.

Against the general factors must be set off certain unfavorable conditions still inhering in the total situation. Particular emphasis must be placed upon the adverse aspects remaining in the element of prices due to the lack of alignment as between consumers' and producers' prices and also as to price level between nations, and the accumulation throughout the world of excessive supplies of many commodities whose distribution was halted by world-wide impairment of buying power. While probably no general state of overproduction exists, and while excess stocks habe been lessened, further substantial reductions or better distribution must occur before price equilibrium and market stability can be assured. Further reduction of production costs is necessary. This is rendered difficult by high overhead charges from expensive, over-built or idle plant equipment, by too high railroad rates and by the burden of government taxes.

Necessary Cost Adjustments

It is beyond argument that the nation's heavy war obligations must be met, and sufficient taxes must be levied to meet them. But business should assert its rights to unceasing economy in public expenditure and to further adjustments of taxation to reduce to a minimum its hampering effect on productive effort. Railroad transportation costs must be reduced to a more economic relationship with industry and commerce.

Although this involves wages and efficiency, the interests of labor in these readjustments are absolutely identical with the interests of business and of the public in that they will make for stability of employment and lower the costs of living.

The net situation presented by these various factors warrants confidence. No great difficulties appear in general financial aspects in the domestic field at the end of the year comparable to the inflation, no-liquidity and widespread insecurity of credit prevailing at the opening. Fears of credit stringency have been replaced by a justified confidence that funds for desirable business will be available at reasonable rates. The chief drag on business now is from market, not financial conditions. It can be lightened only by the processes which will restore equilibrium between supply and demand. Because this is a world-wide matter, confidence in America's business future must be tempered by conservatism in making business plans. If we were a wholly self-contained nation and consumed all that we produced the balance of favorable over unfavorable factors would be our warrant for looking ahead with unqualified confidence. Related as we are to the rest of the world the practical outcome will be largely affected by what happens in other nations.

The foregonig facts emphasize with particular force the imperative character of the conservatism and economy which the times demand. In personal matters, in corporate management, in government administration and in international conferences they must dominate the conduct of affairs and constitute the chief end sought. The world must produce more than it consumes, if resources are to be found for strengthening the weakened structure of industry and commerce. It must employ its energies efficiently if the structure is to be staunch and if progress is to keep pace with human desires. There is no magic to wipe out the effects of the great war. That can be done only by hard work, efficiency and economy. These have been the great source of safety in the year just closed and are required for success in the year that lies ahead.

HELPFUL FIRE PREVENTION MEASURES

Lack of precaution is often the cause of a disastrous fire. In the interest of fire prevention due attention should be paid to the following points, each of which is an acknowledged contributory cause of many fires:

Keep buildings clear of litter and rubbish; never allow accumulations at the bottom of lift wells, nor permit rubbish to stand by stairs, in corridors or near stoves; place all waste paper, rubbish, etc., in metal receptacles, and have them emptied regularly.

Keep roofs and gutterings free from paper, dry leaves, etc., as these may easily be ignited by sparks and burn for some time without being noticed.

Avoid swinging gas brackets which may be pushed against curtains or woodwork.

Use only fixed metal tubing for gas stoves. Rubber connections and flexible metal tubing (which is rubber lined), may fuse if the flame "fires back." If this remains unnoticed, the connection burns away and the gas flame pours out from the tube, firing everything within reach.

Place all gas heaters and stoves on metal stands.

Never permit electric wires to remain uncased or to be left severed with the ends unbutted.

Disconnect wall plugs from all electric radiators when not in use.

Keep floors of all oil stores as free from oil as possible.

Have all oily waste put into metal bins provided with lids.

Never permit turpentine, paraffin, and similar highly inflammable liquids to remain in "drip" tins.

Never allow smoking in the vicinity of highly inflammable substances or packing materials.

Never allow wooden boxes to be used as coal boxes. They are liable to be used for ashes raked from the fire and these may easily break into flame.

Never rake out fires before leaving for the night. Use a guard or dampen down if there is too much fire.

Forbid the throwing down of lighted matches or cigarette ends, either on the floor or out of the windows.

PORTABLE OIL FUEL BURNER

Mr. A. H. Wilkie, 78 Duke Street, Liverpool, England, has developed an oil fuel burner of the portable type that is especially designed to be of use in foundry work. Two types are made, one operating by means of compressed air, the other by a hand air pump. The compressed air type has the advantage of instantaneous starting. There is no preheating necessary, and as there is no coil, there is no choking through carbonization. Any kind of oil fuel can be used. The burner is said to be particularly economical when used to dry floor moulds. The use of the burner to dry steel moulds is also said to have shown remarkable results. The fuel saving is from 25 per cent. to 50 per cent., and in two hours a mould can be dried that would require twenty-four hours with a coke fire, according to the maker.

For lighting up a cupola it is also used to advantage. A 5 inch steel pipe is placed in the bottom of the cupola and the coke placed on the hearth. The pipe is withdrawn preferably through the rear opening if one is provided on the cupola. Thus an arch of coke is formed and the burner flame introduced here. The result is the first iron down is clean and hot. There are no ashes in the bottom of the cupola, and no fear of a back draught. The burner is used to preheat castings for burning or welding drying ladles, and heating steel ladles prior to taking the metal from the convertor or electric furnace. This method of preheating ladles is clean and can be continued up till the moment the ladle is required, thus avoiding the possibility of chilling.

New Things in Shop Equipment

ADJUSTABLE RATCHET WRENCH

The Simplex Iron & Tool Co., Toronto, Canada, has developed and marketed a new type of adjustable ratchet wrench which is said to do away with the use of numerous spanners. The makers claim it is adjustable to any nut within its range, that it is fool proof, that the nut or rack will not strip, that ratchet locks in any of nine positions through an arc of 180 degrees, and that no corner is to awkward for its use. The wrench is made of drop forged steel and is especially hardened throughout. Three sizes are carried, 6 in., 8 in. and 12 inch.

DETACHABLE COUPLING

A ready detachable, leak-proof, metal coupling, known by the name of "Knorr" has recently been placed on the market by the Barlow Mfg. Co., New York. The coupling is suitable for hose used in pneumatic or hydraulic lines. It has shown its ability to withstand pressures up to 450 pounds per square inch. Three or more arms closely embrace the end of the hose of any given outside diameter, these arms being held in place by a steel ring. The grip of the arms on the hose is actuated through a wedge or spreader nut, threaded on the shank of the coupling, which forces out the arms at the hose end of the coupling. This lever action enables the user to exert an easily adjusted pressure upon the hose when attaching to a piece of hose and to detach quickly by revolving the spreader nut several times. Slight variations in the thickness of the hose do not interfere with the action of the coupling

ELECTRIC PLANER CONTROL

The General Electric Co., Schenectady, N. Y., has recently placed on the market an apparatus for preventing the tables of electrically controlled planers from over-travelling. The apparatus makes use of the dynamic system of braking for stopping the table, as it is claimed it will prevent over-travel either on the reversal of the planer or because of the failure of the voltage. A selective-resistance contractor is used to adjust the value of a dynamic brake resistance for either direction of rotation and can be adjusted independently. It is possible to set the braking effect at 200 per cent. instead of 100 per cent. of full load thus greatly reducing any tendency to overtravel.

It is claimed that this method of control will give absolute dependability as well as ease and certainty and also lends itself to a wide application. It is also a great time-saver. Should the contacts or tips become welded together because of severe service conditions the planer will stop, but it will not overrun its set limits. Should a failure in voltage occur, overtravel is eliminated because of the fact that the motor is always connected on the dynamic brake. It is possible to "jog" the table using either a master switch or a push-button station. The selective-resistance contractor enables the machine to operate on jobs allowing but small tool clearance. It also is possible to work on jobs where the duty varies from no load to full load and where cuts are made to the extreme end of the travel.

GRINDING AND SEWING MACHINE

The Wonder Grinder Co., Erie, Pa., has recently placed on the market a spindle type grinding and sanding machine, which was designed primarily for internal circular grinding in both wood and metal. The work-holding table of the machine is circular, and is provided with two bearings through the medium of which it can be tilted 45 degrees on either side. The table automatically locks in position at right angles to the spindle. However, it may be set and locked in any desired position within its range, by means of a knob located in front of a protractor scale.

The spindle or roll carrying the abrasive is mounted on a vertical shaft and driven directly from a ¼ h.p. motor which is mounted in the base of the machine. The motor is accessible and can be easily disconnected and removed. The spindle revolves at a speed of 1725 r.p.m. The top bearing is adjustable to compensate for wear. Lubrication is through the medium of a grease cup. The spindles are 9 inches in length, and are provided in diameters of 1¼, 2¾ and 4½ inches. The oscillation of the spindle is ⅞ of an inch. Various types of motors can be supplied either direct current, or alternating current to operate on 25, 40, or 60 cycles. The controlling switch is conveniently located on the column. The diameter of the table is 20½ inches and the height above the floor is 37 inches.

GASOLENE-KEROSENE BLOW TORCH

The Turner Brass Works, Sycamore, Ill., have placed on the market a blow torch of new design, which will use either gasolene or kerosene. The shut-off valve in this torch is placed below the orifice. This idea prevents enlarging of the orifice through shutting off tightly when hot by forcing the point of the needle in, or through fuel corroding the needle point when the torch is cool. All gases are permitted to escape through an adjusting needle and any desired size of flame can be obtained without destroying the orifice. Regardless of the flame adjustment, a cone shaped tube on the burner siphons the correct amount of air. The feed tube is located on the outside of the tank thus preventing any possibility of heating the fuel in the tank to a degree that would cause any danger of an explosion from gas pressure. The leather in the plunger of the air pump is loose in the cylinder, thus decreasing wear, and allowing air to pass freely on the upward stroke. On the downward stroke the leather flares out and forces a large amount of air into the tank.

LARGE DIE SINKING MACHINE

A new die sinking machine incorporating unique features particularly adopting it to handle large dies, has been placed on the market by the Pratt & Whitney Co., of Hartford, Conn. By means of "Bayrer's Compensating Arms," a die weighing four tons may be suspended by elevating screws and readily placed in position on the table and easily swiveled, tilted or turned on edge by the operator. The hand feeds are thereby rendered sensitive to light cuts and the die may be fed over to extreme limits for cutting gates without the slightest cramp.

The compensating arms can be folded back and latched against the sides of the column. The hinge shafts for the arms with the massive ears, are attached to the column. The arms are carried on roller bearings supplemented by ball bearings; they are therefore, very sensitive to any movement imposed on the die. Both of the outer carrying arms are provided with balance beams and adjustable weights by which the load of the die can be approximately balanced and relieved from the table. Crabs attached to the ends of die provide trunnions by which the die is supported and on these trunnions it may be readily tipped on its side for edger cuts. When the die is being tipped on its side the table is dropped clear of the die, the arms sustaining the entire load.

The machine is of the knee type permitting proper elevation of the dies of various thicknesses to bring the cut to a convenient level for the operator. To this end the range of the knee travel is kept exceptionally low down and platforms are unnecessary. The cutter spindle is mounted in a counterweighted vertical head provided with hand feed with a graduated dial. A rapid traverse for the quick adjustment of the head is provided. Power to the cutter spindle is transmitted through a quarter-turn belt from the gear box in the rear of the machine. All changes of speeds and feeds are made by levers in front of the machine convenient for the operator.

Hand and power feed are provided for both the longitudinal and cross feed of

the table. In addition a rapid power movement is provided for all movements of the table including elevating and depressing. The mechanism driving the power movements operates through friction to prevent injury to parts in case of over-running.

A cherrying attachment is readily applied to the cutter head; drive is effected through gearing to the nose of the cutter spindle. When not in use the cherrying attachment is swung back out of the way and does not interfere with the use of the machine. The machine is equipped for either a constant speed drive direct from a line shaft or from a motor mounted on the machine. It is also made with and without the die-carrying arms.

Dimensions of Machine

Table top dimensions ..	22 in. x 48 in.
Table longitudinal feed	48 in.
Table cross feed	17 in.
Table vertical feed	15 in.
Cutter head vertical feed	12 in.
Spindle speeds (12) ..	27 to 79° r.p.m.
Table power feeds (9)	9/16 to 10 in. m.
Table rapid traverse	42 in. per m.
Floor space parallel to table	10 ft.
Floor space right angle to table,	10 ft.
Height of machine	9 ft.
Weight, approximately	16,000 lbs.

GRINDING, DRILLING AND TURNING MACHINE

The Ex-Cell-O Tool and Mfg. Company of Detroit, Mich., have recently developed and placed on the market a combiation machine which is capable of handling grinding, drilling and turning operations. The new tool is essentially a bench machine, the frame consisting of a central circular column symmetrical throughout, the upper portion being turned. A large filleted flange at the bottom serves as a foot. The machine handles a variety of work, among which is the grinding of valve reseating tools and valve cages, turning commutators and gears, sharpening milling cutters, drilling and regrooving of pistons, and the milling of key-ways. The machine is equipped with a spindle at the top of column, and this spindle carries its own ¼ h.p. motor whch is connected by a belt. The spindle can be inclined at any angle, and speed changes are provided through the changing of pulleys. Reciprocating motion can be imparted to the spindle for grinding and milling operations.

The lower spindle is mounted on a head which travels on a guide rail, which is in turn clamped to the column. This can also be swiveled to any angle. It can be equipped with a 6" face plate, or a 4" scroll chuck, and is operated by means of a hand wheel. It can also be power driven by the electric motor, through the medium of a "V" belt which operates on a pulley on the shaft extension of the motor and on the hand wheel that has a V groove turned in its large diameter. The upper spindle is equipped with ball bearings throughout, and the work spindle has a straight bearing which extends its full length, and it has a ½ in. 45 degree angle-thrust bearing. Both internal and external grinding operations can be taken care of. The lower spindle head has a travel of 7 inches and a vertical movement of 8¾ inches. The machine has an over-all height of 24 inches and weighs about 135 pounds.

DIAL INDICATOR

The Atlas Indicator Works, Chicago, Ill., have recently placed on the market two types of Dial Indicators, known to the trade as the "Atlas Junior" and the "Atlas Universal." These instruments are designed to be of use to die makers, inspectors and tool makers, or in any operation wherein delicate measuring is essential. A pamphlet describing various applications of these indicators has been prepared. The outstanding principle incorporated in the design is that the indications, or readings, are made from a dial, and not read from the ordinary sector. Attachments are provided in the regular equipment, which permit the instrument to be used in a multitude of ways. From one side of the dial casing a small rod extends to which is attached a clamp. In a lug of the clamp there is a small hole of suitable size to permit the pointer or scriber of a surface gauge to be inserted. A small thumbscrew tightens down on the scriber after it has been inserted. In using the indicator in this way accuracy and speed are obtained as well as deriving the added advantage of direct reading.

Several cuts in the pamphlet show numerous applications. The instrument is equipped with a goose-neck rod extension which attaches to the frame of the dia.. This rod can be clamped in a tool post to gauge the eccentricity of a revolving piece in a lathe. Similarly the indicator can be used on vertical milling machine horizontal boring machines, etc. There are many other applications such as one which enables the plunger to extend at right angles to the face, as well as the ordinary extension of the plunger, parallel to the face of the dial. The accessory attachments are universal in range.

Another important feature is that it is capable of adjustment. That is to say, if the dial registered, say .003 in. eccentricity or variation, and for the purpose of getting relative measurements or indications on subsequent readings, the reading could be made zero and from then on, all readings would be made relative to that zero point. The indicator reads by thousandths of an inch to .130 inches, and is provided with an extra tip to be used on uneven surfaces. This tip lessens vibration and gives more accurate measurements on these rough surfaces. The machine is light in weight, nickel plated and comes complete with all attachments.

The Junior indicater, also illustrated on a leaflet, has been produced to meet the need of those who require a small, light, but highly accurate tool. The net weight is ¾ of an ounce. The circular dial is 1 inch in diameter, and the over-all length is 2½ inches. The instrument is very sensitive and durable, and the housing is made of machine steel, case hardened. The important working parts are made of high grade tool steel hardened and polished. The housing is mounted in a swivel clamp and the dial is graduated to read .001 of an inch, at an angle of 90 degrees, but the contact point can be set in any desired position so that the reading may be magnified or diminished to facilitate inspecting operations. This latter instrument is also capable of adjustment.

STAYBOLT ATTACHMENT

The Acme Machine Tool Co., Cincinati, Ohio, has placed on the market some improved staybolt equipment which has been designed for use on their flat turret lathes. An overhanging plate is bolted to the turret and two die-heads are used. The equipment has several special features and it is claimed by the manufacturers that it will produce a staybolt which is accurately made as to concentricity and lead. It is very essential to have both die-heads cutting the thread simultaneously, so that the leads will correspond exactly with the taps. The rear die head is made adjustable so that any length of bolt within a wide range can be handled.

When using bar stock the sequence of operations are as follows: The roller back rest multiple turner is used to turn the thread diameter. While this is being turned the recessing slide is use to complete the relief. Both die-heads are operated simultaneously to cut the thread. The dies are set from a master or staybolt tap to insure the two threaded portions to be as one continuous lead. The last operation is to cut the staybolt from the bar with cut-off tool held in the slide tool. When using forgings forged to the correct thread and recess diameters, and length where the continuous lead is desired the two die-heads are used in the same manner as for bar stock. On the 2¼ in. x 26 in. Acme machine, 1¼ in. diameter die-heads are use, an the maximum length of staybolt that can be machined is 25 in. On the 3¼ in. x 36 in. machine, 1½ in. dia. heads are used and staybolts up to 33 in. can be handled. On the No. 3 Universal machine 1½ in. die-heads are also used, but a length of staybolt of 36 in. can be machined.

WRITING ON STEEL

Writing on steel can be effected by first cleaning the metal with oil, wax over it. The writing should then be done on the beeswax with any convenient sharp tool and the marks painted with a small brush dipped in a liquid composed of one ounce of nitric acid and one-sixth of an ounce of muriatic acid. The lines, filled with this corrosive acid, should remain for five minutes, after which the metal is dipped in water, then cleaned and dried.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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There Is Need For Haste

ARE WE going to have a New Machinery Hall at the Toronto Exhibition grounds this year? Canadian manufacturers are vitally interested in the proposed structure, and have shown their interest in no uncertain manner. Up to the present time guarantees have been given for three times the space occupied by the now obsolete building which was used again last year.

The gentlemen appointed to secure these space guarantees have turned over their report to the exhibition committee, who will consider it some time within the next few days. It is to be hoped that a decision will be arrived at which will mean an immediate start on this building, for it is badly needed.

A new machinery hall would be an added feature to the exhibition and if placed in a more suitable location, would attract many visitors, who at the present time do not know a machinery exhibit exists. The city authorities have the final say regarding the erection of the new hall, and we cannot too strongly urge them to give the matter their immediate endorsation in order that erection can commence at once. If the building is to be used during the Fall of 1922, it means that all concerned will have to work rapidly and in absolute harmony.

Reducing Handling Costs

ON EVERY hand, plant owners are looking for ways and means of reducing production costs. In some cases wages have been reduced, but this is a very small item when compared with other efficiency leaks which are often allowed to pass unnoticed. Take for example the handling cost.

Sometimes, an otherwise capable superintendent, fails to grasp the importance of proper handling facilities. Lest this may seem a rash statement, here is a case in point. In a large agricultural implement plant a certain part had been drilled in a standard manner for several years. Production engineers felt that the method employed was about as simple and efficient as possible, yet were not satisfied with the drilling cost. It was the operator of the machine, who, unconsciously, solved the difficulty.

"If I didn't have to dig into that truck for the pieces all the time," he grumbled, "I could get the parts out quicker." Like a flash, the engineer saw the solution. A chute was made which fed the parts by gravity to the workman. Production soared, and a piece of tin, not even a roller conveyor, accomplished the whole thing. Simple—yet its very simplicity allowed the engineer to miss the point until it was called to his attention.

On another page of this issue appears an article on gravity roller conveyors. Many plants have found this system to reduce handling costs considerably, but the problem does not end here, for cranes, trucks, and all other transportation aids enter into the handling problem.

Have you ever walked through a plant which was well supplied with cranes in the center portion, but poorly equipped on either side? Then there is that type of factory which refuses to purchase new trucks, with the result that their handling costs soar, whereas by buying a few modern trucks, the saving effected in handling would soon pay for the new equipment.

When considering the purchase of handling facilities do not look at the initial expense only. This is a small item when compared with the ultimate saving. It's like putting money into a good investment, for not only have you the article itself, but the resultant benefits and saving. Even though times are such that expenses must be curtailed to a minimum, do not adopt a penny wise, pound foolish policy, but where you see the chance of eventual saving, do not hesitate to secure the necessary handling equipment.

No Room For Pessimists

IF THERE was ever a time when men required common sense optimism, it is now. This is no time to preach blue ruin, and apart from that, there is no reason to feel that things are going to the tarnation bow-wows, for they're not.

Have you ever met that type of man who keeps on kicking about the inefficiency of the government, the possibilities of strikes, and displays a disgust of the world generally? Of course, you have, for unfortunately, like the poor, they will always be with us. There should be some form of punishment meted out to this type of individual. In fact a good plan would be to start a colony of such croakers and they would soon tire of their own twaddle.

We are living in a great country, and we are right in the midst of one of the greatest periods for usefulness and common sense the world has ever seen. We all need to put our shoulder to the wheel of industry, for only by concerted effort can we get out of the mire of stagnation.

The world in general has passed through a churning process during the last few years, and we cannot expect things to settle all at once. It will take time, and while this evolution is taking place, it will pay us to practice sane optimism and clean thinking. The next time you meet a pessimist, and he starts grumbling, ask him what's wrong with Canada. If he answers your question intelligently, then we miss our guess.

Latest News From Various Markets

A Better Feeling Exists On Some Markets

Orders Being Closed Are Small in Volume But Large in Number On Good-Sized Business Concessions Made—Small Tools And Supplies Active—Machine Tools Still Dull

THERE is a decided improvement in the local market this week. Steel merchants are finding business better than they expected, and the total of January should show up favorably. No particular line is being sought after. Orders are for small quantities, but the number closed, makes up for the size of the order.

Small tools and supplies in both the Toronto and Montreal fields, are in good demand. High speed drills have dropped ten per cent on the local market. This is expected to stimulate the demand.

Scrap metals are weak, cast iron being the only one to hold its own. Other metals such as lake copper, tin, and antimony, have tapered off slightly in price.

Machine tools are still dull. Enquiries continue to come in, but the largest percentage do not materialize into orders. No improvement is looked for at present, and until factories open up, no special demand is expected.

Pittsburgh reports a highly competitive market. Every mill feels that they must secure all possible business as there is not enough to go around. Concessions in price are more frequent, especially on an order of any decent proportion.

Sheets are firm, with wire products next in order. No material decline in steel prices is looked for, as it is thought the market holds little room for further drop. The mills, while eager for business are not slashing prices.

Manufactured steel prices have dropped somewhat during the past few weeks, but this move was expected as this class of goods did not decline as rapidly as the hot rolled milled products from which they are made. Rivets, chain, and bolts are included in the reduced lines.

KEEN COMPETITION ON STEEL MARKET; MANUFACTURED STEEL ARTICLES DROP

PITTSBURGH, January 25th.—Demand for steel is increasing in the new year but at a slower rate than was expected in most quarters. The result is a highly competitive market. In the trade generally, remark is being made as to the keenness of competition. The attitude of the mills is plain. Each feels that there is so little business going that it must get every order it possibly can. There seems to be a fear on the part of the individual sellers that if they once get out of the market they will never get in again. There is no thought of any mill, except very small ones, closing and waiting a few months for conditions to get better. This situation is of course due to the very large steel producing capacity existing. If one-third of the mills should withdraw entirely, the remaining two-thirds could make more steel than was required before the war when the country was very busy and consumers of steel felt they had all the business they wanted. The point must not be overlooked that a volume of business that would satisfy consumers to a certain extent would not satisfy producers to the same extent.

Concessions More Frequent

A very decided change has come over the situation as to finished steel prices in the past ten days, one that is a matter of common remark, but the change is not that the market is quotable on a lower basis. As a matter of fact bars, shapes, plates, hoops, wire, nails, sheets, pipe and tin plate are every one quotable, in the open market, at the same figures as for a month past. Yet on the whole the market is lower. The change is that concessions from regular prices that were formerly being made on large lots have now exteneded to moderate sized lots. In some commodities the concessions are so frequent that the regular prices apply only on orders up to say 100 tons. A 250-ton order would draw a concession from the regular price when two or three weeks ago it would require an order for say 1500 tons to cause the same result.

The regular market remains quotable as follows: Bars, shapes and plates, 1.50c; hoops, 2.00c; standard steel pipe, 71 per cent basing discount; plain wire, 2.25c; galvanized wire, 2.75c; wire nails, $2.50; blue annealed sheets, 2.25c; black sheets, 3.00c; galvanized sheets, 4.00c; tin plate, $4.75. Of all these, black and galvanized sheets are easily the firmest.

So far as is known, no buyer has been able to budge any mill from the quotations shown, and in blue annealed sheets the market is probably firm also. Blue annealed sheets are misrepresented in some quarters by references being made to sales by plate mills. Such sales are made on the plate mill basis, and the price is necessarily lower than the blue annealed basis, but the material is not blue annealed sheets. The thickness may be the same but the finish is different and the material is practically certain to be less true to gauge. In the heavier gauges some buyers are satisfied with the plate material, when they can save money by buying it.

Wire products probably come next to sheets in point of firmness. There are some price irregularities, but perhaps these are simply departures from Pittsburgh basing, not representing weakness as to deliveries in most sections of the country. In tin plate, concessions are given on large orders, just as was the regular thing before the war. In pipe, the irregularity is chiefly that the independents are going a trifle under the prices of the National Tube Company, as they usually do.

Rate of Production

Mills had so little forward business on books that the decrease in consumption that comes with winter, and the lull that occurs in buying just before the annual inventory date, promptly made an impression on the rate of production. In most years the mills have enough momentum to carry them over the turn of the year. While a close estimate cannot be made, it seems to be a fair guess that at this writing steel ingots are being produced at the rate of 18,000,000 tons a year, against average rates of 20,000,000 tons in December and 23,000,000 tons in October and November.

As has been the case most of the time for over a year, the United States Steel Corporation is operating at a considerably higher percentage of capacity than are independents. One estimate is that at present the corporation is running at 40 per cent. and the independents at 30 per cent. The corporation has an advantage on account of its holding prices down in 1920 when the independents advanced, and allocating its output fairly to its various customers. The corporation has no price advantage over the independents now. As a matter of fact, since February 1, 1921, the corporation

has, on an average, received slightly higher prices than the independents.

Market Prospects

There is no likelihood of any material decline in steel prices. Averaged according to the total tonnage being sold, concessions from regular prices only run say $1 or $2 a ton, and it is noticed that very large orders do not draw materially lower quotations than a few weeks ago. The market has little room to decline farther, except in a few lines, nails no doubt being one of these. Prices are approximately at cost of production and in the case of many mills they are at less than cost of production. The mills are competing eagerly for business but they are not slashing prices. If a much larger operation were attainable mills might go lower, because then they could get down their costs.

Manufactured Steel

For the past year it has been noticeable that various manufactured steel articles, fine nuts and bolts, rivets, chain, cold finished steel bars, spikes, cold rolled strip, etc., did not decline as rapidly as the hot rolled mill products from which they are made. These lines in general have been showing a declining tendency lately. Rivets, formerly 2.25c for structural and 2.35c for boiler, can now be bought at 2.20c and 2.30c respectively, perhaps in the case of large orders at 2.15c and 2.25c. Chain recently declined from 5.90c to 5.50c, in the base price. Cold finished steel bars, recently steady at 2.00c, can be had at 1.90c possibly even in carload lots. In the past few days nuts and bolts have been shaded particularly. Large machine bolts which ten days ago were steady at 70 and 10, have been obtainable in the past few days without difficulty and 70, 10 and 10.

Pig Iron and Coke

The pig iron market remains very dull, quotations being still $19.50 for Bessemer, $18.25 for basic and $19.50 for foundry, f.o.b. valley furnaces. Connellsville coke for spot shipment is easier. Furnace coke can be picked up at $2.75. Foundry in ordinary grades still sells at $3.75 but the $4.50 price on fancy brands has disappeared, $4.25 being a price that would command almost any brand. Some coke is offered at $3.50 but it does not appear to be standard.

POINTS IN WEEK'S MARKETING NOTES

Keen competition exists on the steel market. The mills feel there is so little business to be secured, that they must get every order they possibly can.

A decided change has come over finished steel prices. Concessions, which were formerly made on large lots are now extended to moderate sized orders. In fact in some cases the regular prices apply only on orders up to say 100 tons. Above this figure, a better price would be given.

No material decline in steel prices is looked for as it is felt that the market has little room to drop further. There may be a few exceptional lines which will drop slightly, but generally speaking, present prices are very close to the cost of production.

Manufactured steel prices show a tendency to sag however, for rivets, chains, cold finished steel bars, and all sorts of bolts have dropped in price during the last week or two.

The pig iron market remains very dull, while coke is somewhat easier.

Montreal reports little change on the market. The only department which has picked up at all is the small tool and supply business. This has improved considerably, and farmers are purchasing engines and other farm equipment.

Steel dealers on the local market are quite satisfied with the volume of business passing through their hands. It is better than they expected and although competition is keen, they find the total amount closed to be worth while.

A ten per cent. drop in high speed drills is announced. Small tools and general supplies are moving at a fair rate of speed, and continued improvement in this line is looked for.

Machine tools are still quiet, and the scrap market is also rather sluggish.

LOCAL MARKET SHOWS IMPROVED TONE

TORONTO, January 25th.—Steel men in the local market are quite satisfied with conditions. They frankly admit that business is better than they expected it would be, so therefore they are happy. Keen competition exists, and it is the man who gets out in the field that lands the business. Usually the order is not very large, making the situation all the more difficult. To bring up the total of business, it means that salesmen must land just that greater number of orders. Price cutting is still pretty prevalent on this market, but these tactics are confined to a few who did not liquidate soon enough, and now must get rid of their materia.. Some of the figures quoted by these men are so low that they cannot last long. They are altogether too close to the actual mill price to allow deals to make any profit, so that this drag on the market is soon expected to disappear.

One steel dealer speaking on the present situation, referred to a speech of Judge Gary's, made some time ago, when he said that we had just passed through a period of Extravagance and Extortion. "The truth of this remark has made itself felt during the past year, when we have all been getting back to a decent level," remarked this dealer, "but now we are in a much healthier condition," he concluded.

The month of January, taken as a whole, will be a fairly good one for steel men, and they have no reason to complain. The demand is general, no one line being in demand and this again is taken as a healthy sign. Pig iron has dropped in price as will be noted from the quotation pages.

The metal market merely moves along. Non-ferrous red scrap is fairly steady but buyers are not eager to pay the top figure with the result that not many orders are being taken. Copper wire is being offered at 11½ cents, but finds few buyers at this figure. Red brass is selling at 9½ cents and No. 1 red turnings can be purchased in fairly large quantities at from 6¾ to 7 cents. Ordinary yellow casting brass remains a dead issue although the better grades of yellow brass are in somewhat better demand. Even this is not sufficient to take up the surplus being offered. White metal alloys are also very quiet.

Scrap cast iron is merely holding its own, but other grades of scrap iron show signs of weakness. Frieght rates and cost of labor are yet too high to allow any further reduction in scrap prices.

Machine Tools

If enquiries meant orders the machine tool market would be in good shape. Unfortunately however, many of these enquiries die a sudden death, and in fact some having been traced, have been found to emanate from purchasing agents who are anxious to strike the level of current values. Others again write in for a price on a tool, merely to get a figure for inventory purposes, so that when we speak of the number of enquiries, it is no sign of an up-grade market.

So long as factories remain quiet, we cannot expect much improvement in this line. One dealer, who is a firm believer of keeping his men constantly on the road, says "that the only way to get business these days is to go out and dig for it, digging good and hard at that." In these few words he pictures the real situation. Orders are small, therefore to bring up the total, dealers have to work all the harder.

Small Tools

Another good week is reported in the small tool market. Business has picked up quite a bit during the past two weeks, and dealers confidently expect the improvement to continue. High speed drilled, dropped 10 per cent., and it is expected that this decline will stimulate business in this particular line. Farmers are coming into the supply market in good shape, purchasing gasoline engines, and other farm equipment. Generally speaking the market is considerably improved.

STEEL BUSINESS IS STAGNANT; ACTIVE BUILDING SEASON LOOKED FOR

MONTREAL, Jan. 25.—The jobbing houses dealing in merchant bars, plates and structural shapes claim the volume of business at the present time is very disappointing. All through the closing months of 1921 conditions were bad enough, and when this small volume began to disappear entirely in December, there was a tendency to believe it was the Christmas season that was the cause of the depression. However, Christmas has come and gone, yet the condition of practical stagnation still exists. Dealers in this part of the province can advance no reason, and are now inclined to look forward to the seasonal stimulation that is always evident in practically every line of business in the spring.

It has been stated that it is not likely that production of iron and steel will drop to the level of 1921. The out-put of pig iron for the whole world in 1921 was 35,810,000 tons, and the production of steel ingots was 40,731,000 tons. In 1920 the output of pig iron was 60,635,400 tons and of steel ingots 63,321,000 tons. These figures show a big decrease in production. It is interesting to note that in 1913 the pig iron produced in the world was 76,594,000 tons, while in the same year, 74,629,000 tons, of steel ingots were purchased. This comparison shows that we have a long way to go before we equal the production and consumption figures of the pre-war year, 1913.

Conditions Have Changed

Of course it must be borne in mind that conditions have undergone a great change in the last eight or nine years. If our present demands for pig iron and ingots should increase overnight to a figure that was representative of 1913 conditions it is doubtful if such a demand could be supplied. Owing to the destruction of plants, and the dispersal of organizations in central and eastern Europe, the total capacity of the world has been greatly reduced. In fact the world's production figures mentioned above were made up in no small way by the production of Lorraine, of the Far East, and the Antipodes.

It is estimated that the world's capacity to-day is 70 million tons of pig iron, and about 80 million tons of steel ingots. Only 51 per cent. of the blast furnaces were in operation last year, and about the same ratio of steel making units. The production in America has not been quite up to this percentage figure showing that production has been curtailed here to a greater extent than it has been elsewhere.

The prices of steel products have not undergone any changes during the last few weeks, although the present quotations are considered weak. The prospects are good for a very active building season in the province. There are a number of big jobs that have been carried on all winter such as the Mount Royal Hotel, The Canada Cement Building, and the New Low Level Pumping Station.

Pig Iron has dropped two dollars a ton. Unsettled conditions in the States have caused the prices to break, although they were already down to production costs. The Canadian prices were reduced in order that outside iron would not be dumped here. There is no money in it for the producers at this price. Even the reduction has not increased the amount of business being done, although it is hardly time yet to place much weight on this fact. No actual orders have been received but it is a fact that these figures are being used by foundries on all estimates and quotations, so the results of the present reduction may not be felt for some time yet.

Not Much Activity

The machine tool business has not shown any more activity. Dealers do not look for any more than nominal improvement for some time to come. One dealer has recently put out a very elaborate catalogue, and the results from this medium have been very satisfactory so far as the small tool and supply end of this business is concerned. No particular lines seem to be moving, but rather a fair movement of all lines.

Another large supply house reports that business has improved with them a great deal during the last two weeks. Small shop tools and machine shop supplies are in much better demand than they have been for the past month. Throughout the city the report is that the rural people have been buying more or less mechanical equipment. Gas engines have been moving rapidly in the last two weeks. In the maritime provinces the fishing fleets are being fitted out, and activity in marine supplies is rather evident. Every year a large number of marine engines are sold, and an even larger number overhauled.

The non-ferrous metals have not been active the past week, but prices have been very weak and several reductions in quotations have been received, as will be noted on the quotation page. The scrap metal market is still very quiet.

Interesting Books:

"Industrial Mathematics Practically Applied," is the title of a book by Paul V. Farnsworth, published by the D. Van Nostrand Co., 8 Warren St., New York. It contains over 1,000 problems and answers, and has 250 illustrations which are very well arranged. This work is claimed to be the result of 12 years' experience by the author as supervisor of apprentices, designing, shop foreman, and instructor in evening classes in technical schools. Every attempt has been made to simplify and analyze, step by step, the various problems, and the author has succeeded in making the examples both practical and instructive.

He starts with signs, symbols, etc., goes through addition, substraction, division, cancellation, and so on, working up gradually into ratio and proportion, going from here into square root, mensuration, geometry, cost calculations, gearing definitions, lathe change gears, rope drives, shaft design, strength of materials, and many other subjects of interest to the student, and ambitious mechanic.

To go into all the subjects discussed in the 274 pages is impossible in this space but any reader desirous of brushing up or learning afresh, the many subjects covered, will find this book interesting and thorough. The publishers price is $2.50.

Another interesting book, published by the same company is titled "Centrifugal Pumps," and sells for $3.75. The author J. W. Cameron, A. M. I. Mech. E., starts off by describing the action and advantages of Centrifugal or Turbine pumps. The chapters following the introductory one touch upon the following subjects:—The theory of the centrifugal pump, hydraulic losses during the passage of fluid, manometric head, change of pressure, and hydraulic efficiency.

Then comes disc friction bearings, effect of angle at discharge on the efficiency of pump, details of construction, axial thrust and its balancing, calculaton and design of a single stage pump, then the same on the multi-stage type. Chapter eleven discusses various types of pumps, this being followed by methods of testing.

This book is chiefly arranged for engineers, draftsmen, and designers, and the author has been very careful in his descriptions. The subject is one on which little is known by the average draftsmen, so that the book will no doubt be welcomed by those in the profession.

NEW TYPE LOCOMOTIVE TO BE GIVEN TRIAL

E. R. Webb, of the St. Thomas division of the Michigan Central Railway states that a new passenger locomotive is to be given a 90-day trial on this line.

It is considered one of the fastest of its kind on the North American continent, and will be used for hauling the Wolverine and the Detroiter. Among railroaders the engine is known as the K-3 model. The other day another fast run was made over the division. Train No. 15 travelling from Windsor to St. Thomas, a distance of 112 miles, in 91 minutes.

W. A. Grayson, manager of the Washington, D. C., plant of William Jessops & Sons, Sheffield, England, is going to England on a business trip shortly. He sails on February 15th.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$19 50
Lake Superior, charcoal, Chicago.	30 00
Standard low phos., Philadelphia.	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 25
Toronto price:—	
Silicon, 2.25% to 2.75%	27 15

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 3 25
Steel bars, base, Toronto	3 25
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 50
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 60
Tank plates, Pittsburgh mill price	1 60
Structural shapes, Pittsburgh mill prices	1 60
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 50
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	58	78
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 20	17 25
Castings, copper	17 00	17 00
Tin	36 75	34 50
Spelter	7 25	7 50
Lead	6 50	6 75
Antimony	6 75	8 00
Aluminum	25 00	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.08	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.59	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Do., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and less	55
Coch and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine screws, fl. and rd. hd., steel cut thread	37½ & 1
Machine screws, o. and fil. hd., steel cut thread	3
Machine screws, fl. and rd. hd., brass cut thread	1
Machine screws, o. and fil. hd., brass cut thread	3
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	$1.25
Nuts, hex., tapped off net list	75c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 90
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	0 87
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$5.00 base
Hexagons and flats	5.00 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	57
Class B	22	32
Class C	14	22

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 75
Sheets, blue ann., No. 10	4 00	4 25
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates, all bright	8.50	
Apollo brand, 10¾ oz., galvanized		
Queen's Head, 28 B.W.G.	7 50	
Fleur-de-Lis, 28 B.W.G.	7 00	
Gorbal's Best, No 28		
Colbornes Crown. No. 28		
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz.	650	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60 0/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	1.01
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft.	3 25
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 75
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	4 00

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

WASTE

XXX Extra	16½	Atlas	18
Peerless	21	X Empire	13
XX Grand	15½	Ideal	18
Superior	20	X Press	11½
X L C R	14½		

Colored

Lion	12	Popular	9
Standard	10½	Keen	7½
No. 1	13	Fancy	13½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored. 13
Mixed colored. 14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 8 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.18
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

INDUSTRIAL NEWS

Leslie and Hardy, Georgetown, Ont., are in the market for machinery for making skates.

The Board of Waterworks, Essex, Ont., is in the market for oil engines to operate their waterworks pumps.

The city engineer of New Westminster, B. C., is preparing plans for reconstruction of water works plant and system to cost $250,000.

The Carter White Lead Co., of Canada, Delorimer Avenue, Montreal, Que., has awarded a contract for plant revision to cost $13,000.

The Standard Steel Construction Co., 29 Cross St., Welland, Ont., has the steel contract for a factory for the Universal Cement Casket Co., London, Ont.

The Harper-Fresnail Cigar Co., Hamilton, Ont., will resume operations to the full capacity of its plant the first of next week. This will give employment to 150 men.

The Hiram Walker Metal Products Co., Walkerville, Ont., is overhauling its foundry and installing the latest equipment for handling grey iron castings on a productive basis. Included in the equipment is a Whitney self-feeding cupola. A separate building is being fitted out for the production of Chromel wire.

The manufacture of Vacuum Cleaners on a large scale is intended by The Mis-Can-Ada Mfg., Co., 12 Chamberlain Ave., Ottawa, Ont., recently incorporated at $65,000. The company does not intend to build a plant, as a lease has been obtained for suitable quarters, but do expect to be in the market from time to time for machinery and supplies.

Quite a cheery view of the business situation is taken by Mr. H. B. Christie of the Sawyer-Massey Company, Hamilton, Ont. He says that although the present is by no means the busy season of the year for his company, they have taken on since the first of the year, over one hundred additional men and that more were being taken on daily.

Captain S. J. Gregg, of the Toronto Carpet Co., says his firm is operating overtime, running the plant 55 hours a week. Moreover, he says the outlook for the next six months in the carpet industry is a very satisfactory one. Production at the present time is solely for the Canadian market. A number of United States orders were filled last summer and autumn, owing to strikes at the American mills, but the last of these were completed about a month ago and the goods being turned out at present are for the domestic trade.

The city council of Blenheim, Ont., is planning an electric light and power distribution system to cost about $40,000.

The Utilities Board of Simcoe, Ont., plan to install additional equipment in electric light plant to increase its capacity.

The factory owned by the McCarter Shingle Co., Rock Avenue, Victoria, B. C., was damaged by fire with a loss to building and machinery of $60,000.

Contracts for structural steel and steel stairways required for Ottawa schools, costing $700,000 have been awarded to the Dominion Bridge Co., Montreal.

The Goderich Elevator Co., London, Ont., are in the market for grain handling and unloading machinery, also two steel unloading towers for grain elevators at Goderich.

The Verity Plow Co., Brantford, Ont., have announced that within the next few days from fifty to one hundred additional men will be placed on the payrolls.

The Sarnia Paper Box Co., Sarnia, Ont., whose capital is being increased to $300,000, and who are going to move to London, Ont., is in the market for machinery and equipment for the manufacture of fibre and corrugated shipping containers.

After being closed for about three weeks, The Rail Mills, Blooming and Open Hearth Furnaces of the Dominion steel plant will resume work within the next few days on a 10,000 tons rail order for the Grand Trunk. This work will take over a month and will give employment to five or six hundred additional men.

An industrial survey for the province of Alberta is being made through its trade commisioner. The purpose is to inquire thoroughly into the industrial situation, taking into consideration the number and kinds of industries, whether or not they are working on full time, and if not, why not. This will be with a view to giving assistance later in the widening of existing markets for Alberta products.

Work on the International bridge between Sandwich and Detroit will start within 30 days according to a report from Windsor. The Sandwich Town Council has given permission to the bridge company to drill at certain locations and to ascertain the nature of the strata, depth and strength of foundation rock. The exact location of the Canadian end of the bridge has not yet been determined, but the action of the engineers in seeking permission to drill at Sandwich would seem to indicate that this location is favored.

Over 500 engineers from all sections of Canada will assemble in Montreal from Jan. 24-25 at the annual general meeting of the Engineering Institute of Canada.

The Sarnia Collegiate Institute and Technical School is nearing completion and is now ready to purchase machinery and equipment for the several departments.

The Sarnia Collegiate Institute and Technical School is nearing completion, and they are about ready to purchase necessary equipment for this building, according to the secretary of the Sarnia Board of Trade.

Conditions are very satisfactory at the plant of the English Electric Co. of Canada, St. Catharines, Ont. Inquires for new equipment are numerous, and orders on hand are sufficient to keep the factory busy for some time.

The Clyde Shipbuilders anticipate, with confidence, much busier times shortly. Work has been resumed on a number of vessels, principally of the passenger type. Returns for the Clyde Area for 1922 show 249 vessels of 511,000 tons completed, against 330 vessels of 672,000 tons in 1920.

London, Ont., has suffered from a $350,000 fire. The three firms affected are: The David Cowan hardware store, loss $100,000, The Morrison Shoe Co., loss $50,000, and the Stafford Furniture Co., whose stock was absolutely wiped out. It is contemplated that these business buildings will be re-erected in the very near future.

Quebec will spend $1,000,000 for new roads, and a similar amount for maintenance, also a further million for education according to a statement made by Premier Taschereau a few days ago.

The Canadian Natural Clay Products Association will hold their convention in Toronto on Feb. 7th, 8th, and 9th. Various papers will be presented.

The attendance of buyers at the annual Furniture Exhibit at Kitchener, Ont., for the past ten days has exceeded all previous records. Buyers have come from all parts of the Dominion. Most of the manufacturers in that vicinity who have exhibits report splendid orders which will keep factories busy for months to come.

Industrial conditions show signs of improvement over the past week end. The W. E. Sanford Mfg. Co. announce that it has increased its staff to 75%, the number of regular employees hired during favorable conditions. The clothing industry was hit hard after the war, but an official of the Sanford Co. says there are now indications of better times.

The National Fibre Co., of Canada, a new concern have located in Toronto. Sales office will be at 220 King St., West.

A by-law has been passed by ratepayers in Niagara Falls, authorizing the expenditure of $40,000 for construction of an asphalt plant.

The Drake Engine Company, of Grand Haven, Mich., have opened a Canadian Sales office at 45 Adelaide Street, Toronto. Capt. Stitt is in charge.

A bridge is to be constructed across the Gatineau river at Gracefield according to a report from Ottawa. Construction will start early in the summer and will take about two months to complete.

Plans have been prepared at Truro, N. S. for a hospital to cost between $75,000 to $80,000. Two sites are being considered and the Council have been asked for a further grant to help along this work.

The ratepayers of Port Arthur, Ont. have passed a by-law authorizing fixed assessment and other concessions to the Provincial Paper Mills, Ottawa, Ont., in connection with the erection of a mill which will cost $1,500,000.

The month of December closes a successful building year at Niagara Falls, Ont., there being a total of 263 permits issued, valued at, $1,145,589. These figures show a large increase over the previous year, when only 133 permits, valued at $473,065 were issued.

Mr. A. Milton, 67 Frederick St., Toronto has been appointed the Ontario representative for George Ellison, & Co., of Birmingham, England who manufactures electrical control equipment of all kinds. This concern are going to carry a considerable stock in Toronto, and Mr. Milton is looking for good business in this line during the year.

A new six-story hotel may be built in Sault Ste. Marie. The site proposed is that of the present Windsor House and a plan whereby the city will be called upon to guarantee bonds to the amount of $250,000 is being drafted. The total cost of the new hotel is placed at $600,000 and the board of trade will conduct a campaign to have a by-law, which is to be submitted to the ratepayers, carried.

The Victoria Machinery Depot, Victoria, B. C., has been awarded the contract for repair work to the Canadian Pacific car ferry No. 8, driven ashore last month at Porlier Pass and later salvaged by the Canadian Salvage Company. The figure is understood to be in the neighborhood of $50,000. The same firm also has the contract for the overhauling of the C. G. S. Newington, the lighthouse tender operated by the Prince Rupert Agency of Marine. A new tail shaft will also be fitted to the steamer. The Newington is now southbound and expected in a few days at the Upper Harbor yard.

The Ford Motor Car Co., of Canada, have acquired the plant of the Bain Wagon Works, Woodstock. This plant will be used exclusively for the manufacture of Ford trucks.

The Wayne Forge & Machine Co. report business as very encouraging. They recently sold a heat treating furnace to a Toronto can factory, to be used for the tempering of dies, etc.

Building figures for Windsor, Ont., for 1921 show an increase in permits to the value of $123,270. In 1920 1,109 permits were applied for, the value of which were estimated at $4,850,010.

Construction of the Lloyd George Hotel, London, Ont., will be started within a month. Anglin-Norcross Co. of Montreal, will handle the construction work and the approximate cost will be $1,500,000.

Hugh Stewart, formerly with the H. W. Petrie Co., Toronto, has joined the staff of the Albert Herbert Ltd., 1-3 Jarvis St., Toronto. He will act as salesman on all lines handled by the latter mentioned firm.

The Vulcan Co., 84 Fulton St., London, Ont., manufacturers of iron castings and equipment are in the market for metal working machinery, lathes, planers, shapers, welding equipment, riveters and beltings.

The Rose Co., dealers in industrial diamonds have discontinued their Toronto office. All Canadian business in the future will be handled from the New York office. E. Weimer their Canadian sales representative has gone back to the New York office.

The Canadian Fairbanks-Morse Co., Montreal, state that the business closed in their small tool and machine shop supply departments has increased to a very marked extent during the past two weeks. During the last two weeks in December, and the first week in the New Year, very little business was offering but the volume closed in the last week has been quite up to that of last autumn when conditions were very satisfactory in this department. The rural population have been purchasing very freely of late this firm states. Gas engines, pumps, and many specialties for farm use are moving quite nicely.

The production of pig iron in November for the Dominion was fairly well maintained. The total of basic iron amounted to 41,232 long tons as compared with 42,356 tons in the preceding months. The production of ingots and castings in November showed a decided improvement, the output rising from a high record of 72,204 long tons in the month just closed. Of the November output 73,806 tons were made by the producers for their own use mostly in the manufacture of steel rails. A small amount was produced for direct sale, the total under this item being 1,233 long tons practically all of which was in the form of steel castings.

Fire damaged the foundry plant of McLean, Holt Co., St. John, N. B. to the extent of $20,000.

The Columbia Macaroni Co., Lethbridge, Alta. contemplate building a $50,000 plant, which was recently destroyed by fire.

Fire losses in Canada during the week ending December 28th were estimated by the "Monetary Times" at $716,000, compared with $798,600 the previous week.

The erection of a bank building to cost $400,000 is proposed by the Bank of Montreal at Victoria, B. C. Erection of an Agricultural Building at the cost of $25,000 is contemplated by the Provincial Government to be erected at Ste. Joseph, Quebec.

The Canadian Manufacturers' Association is sending out a circular among its members with a view to ascertain how many will partake of a tour of the British West Indies under the auspices of the association. The itinerary, after leaving Halifax on February 17, includes the most important points in the islands and is expected to last 60 days. The object of the visit is to investigate the possibilities of trade between Canada and the West Indies.

Construction contracts awarded in the Dominion of Canada for the month of December, 1921, totalled more than $19,000,000. The construction work which was contemplated for December, 1921, amounted to $14,000,000. The total contracts awarded for 1921 in the Dominion had a total of $240,133,300. Industrial buildings erected in 1921, for the Dominion totalled approximately $13,000,000. This item of course does not include business buildings such as offices, etc.

Mitchell, Ont.—The Wettlaufer Co. manufacturers of concrete machinery, is making preparations for the erection of a one-story building, 75 feet wide by 80 feet long, of concrete and steel. The new addition, which will be in the rear of the main factory, will be used as an erecting shop, and will have a traveling This firm which ships its cement mixers crane running through the centre of it and other machinery to all parts of the wordl, even as far as China, intend to employ a larger number of men during the coming spring and summer months.

It will be noted from the following figures that there were 200 branches of Canadian Banks opened during 1921 as compared with 135 branches closed, which makes a net gain of 65 new branches. The period responsible for this increase was February, March and April 1921. In February, 15 branches were opened and only four were closed, in March 10 were opened and seven closed. In April 24 branches were opened and seven closed. There was only one month in the year when the total of branches closed exceeded that opened. This was in December when eight branches were opened and 25 closed.

BRITISH TENDENCY TOWARD LARGE CAPITAL ORGANIZATION

A STRONG tendency toward large capital organization is evident in the industrial and financial life of Great Britain, according to the National Bank of Commerce in New York. Wartime expansion of post-war foreign competition, it declares, have led to consolidation and larger resources at the expense of the smaller individual enterprises.

"The impulse toward consolidation of interests and resources which produced in America the United States Steel Corporation, the Standard Oil Company and the Ford organization has in recent years been felt with particular force in British industry," the bank says in the December issue of its magazine, Commerce Monthly. "The desire for expansion of enterprise during and after the war and the need for liquid capital to maintain expanded enterprise in the face of tightening conditions were alike conducive to enlarging the capital of commercial and industrial companies. Fear of foreign competition emphasized the desirability of eliminating by amalgamation or agreement major competition at home and of securing the resulting economies in production. Either course tended to produce large organizations with extensive capital resources at the expense of the smaller individual enterprises which have played so large a part in the industrial life of Great Britain.

"Besides new organizations which sought capital during 1919 and 1920, numerous long established companies increased their capital either for the purpose of expanding business, extending plant or purchasing allied concerns. New issues of capital for commercial and industrial purposes in Great Britain in 1920, exclusive of conversion loans, bonus shares, and shares issued to vendors, amounted to about three times prewar amount in 1919. In the first nine months of 1921, however, the general business depression was clearly reflected in a marked decrease of new capital issues. The largest relative expansion occurred in the iron, steel, coal and related industries, miscellaneous commercial and industrial enterprises, banks, motor traction, and breweries.

"A second characteristic of the period is the number of amalgamations which took place. This was in many instances but the continuation of a movement which had been going on even prior to the war, notably in the iron, steel and coal, and the textile industries.

"In contrast with the elaborate anti-trust laws of the United States, the common law is practically the only check upon combinations in Great Britain. It holds null and void agreements in restraint of trade, but is has been broadly construed and considerable weight is given to freedom of contract, so that combination is not prohibited. Existing combinations range all the way from associations somewhat resembling the German cartel, in which each firm retains its identity and its independence in all save certain specific matters controlled by the association, to complete amalgamation.

"Recent tendencies appear, however, under the pressure of external competition, to be definitely away from this type of more or less temporary co-operative organization and in the direction of permanent control through amalgamation or through share ownership in subsidiary companies. Many of the largest capital issues in 1920 were for this purpose. Corporations or holding companies of this kind do not require for their success the inclusion of practically an entire industry and they make possible economies of production as well as regulation of output and selling price. Their effect upon price has a very definite relationship to the extent of their dominance in the field of industry concerned, but through the advantages of a large scale organization technical knowledge, makes possible they can exist on a competitive basis while a monopolistic position is being attained.

"The tendency toward large scale organization of industry and capital is a natural step in the progress of industrial evolution, continues this report, as it provides greater resources, encourages the development and inter-change of economies of production, and lessens the variety, if not always the severity, of competition. There are, however, offsetting influences to this development. The size of plant and organization which can be handled economically under single control has definite limits. Moreover, the effect of large scale organizations upon the whole economic and social structure cannot be overlooked. The far-reaching results of the failure or disintegration of a large concern might tend to prolong its existence beyond economic usefulness. The influence upon workmen, likewise, of a scale of production which destroys the sense of craftmanship is already being felt throughout the industrial world in unrest and loss of efficiency.

"Great Britain appears still to be under the influence of centripetal forces. In some of the most important industries, which had long since sought the international market for their products, the tendency toward consolidation appeared before the war, and recent developments represent merely a continuation and to some extent an acceleration of the movement. Other industries seem definitely to have arrived at this stage of progress since the war. In general, the movement appears not to have advanced so far in Great Britain as in the United States. In the face of keen international competition, both prospective and actual, however, British industry appears to be approaching rapidly to the stage of large corporate organization."

NEW IDEA IN STEEL— IDENTIFICATION AND STORAG

IT often happens that, due to an absence of standard equipment on th market, or lack of a standard way o doing things, manufactuers are force to create new methods or devise ne equipment that will exactly fit int their particular system of operatior With the result that the new idea evolv ed and executed is generally an im provement over everything of a simila nature that has preceded it.

Such a condition caused the firm o Gould & Eberhardt to devise the fol lowing method of marking their stee bars for identification and also de signing and constructing suitable stee storage racks to conform with the high ly developed manufacturing system em ployed in their new plant at Newark New Jersey. Several new ideas in stee marking, together with a novel desig in storage racks is the result of thei efforts to solve their own factory prob lems.

In the manufacture of shapers an automatic gear cutting machinery, the use many different kinds and sizes o steel bars—round, square, hexagon, an rectangular in shape, so that the nev system of storing and marking the var ious grades and sizes entirely elimin ates the possibility of an error in find ing the required piece.

Colors Play Important Part

Plain colors and combinations of col ors play an important part in the scheme of marking the steel, each color hav ing a direct significance with regar to the metallurgical contents or the particular make of steel. The identifi cation colors are painted on the ends of the bars as they are received in the shipping department.

To assist the raw material clerk in selecting the proper steel, a very noticeable identification board is hung above each rack. On this rack are listed all the different kinds of steels the company uses, with a two inch diameter disk, painted in the corresponding color, opposite each name. The board has a white background which shows the various colors to great advantage.

The various steels with their corresponding colors as listed on the board are:

30-45 Machine	Red
Hy. Speed Tool	Blue
Crescent	Yellow
10-15 Machine	Green
Cold Rolled	White
O. C. N. S.	Halves of Green and Red
Simplex	Green with White Stripe
Tap	Halves of Green and White

Each rack is built up of five duplicate sections, spaced four feet apart and properly braced to form a very rigid rack sixteen feet long. The entire rack being bolted together with one-half inch bolts.

The individual section has a base consisting of a heavy eight inch I beam eight feet long, with six heavy 2 x 2

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1—18x11½x8 Gas Furnace,
1—Edlund No. 2-B High Speed Drill,
Racine High Speed Hack Saw Blades,
3—Davis 24-in. Turret Lathes,
1—36x18 Putnam Engine Lathe,
1—18x8 Rae Engine Lathe,
1—16-in. Bardons & Oliver Turret Lathe,
1—18-in. Oliver Turret Lathe,
1—McKechnie-Bertram 20x12 Engine Lathe,
1—Racine No. 10 Hack Saw,
1—16x6 Lathe,
4—Woodward & Rogers Four Spindle Drills,
1—Canadian Allis-Chalmers 5 H.P. Motor,
1—Roots No. 1 Pressure Blower,
1—Perfect No. 3 Hack Saw,
1—12-in. Dividing Head for Ford-Smith Miller,
1—Plain Vise for Ford-Smith Miller,
1—Buffalo No. 3 Blower,
1—Champion 20-in. Drill,
1—Grant No. 80-B Riveter,
1—12-in. Three Jaw Universal Chuck,
1—Burke No. 1 Bench Drill,
1—Smart-Turner 4½x2¾x6-in. Pump,
1—Goldie-McCulloch Pump,
1—Greenerd No. 3½ Arbor Press, with Stand,
1—Landis 12x42 Plain Grinder,
1—Greenerd No. 3½ Arbor Press, without Stand,
1—Bellevue Double Oil Furnace,
1—Silver Three Spindle Gang Drill,
1—Silver 20-in. Drill,
1—Canadian Allis-Chalmers 5 H.P. Motor,
4—Speed Lathe Beds,
1—Air Compressor Stand,
1—No. 190 Brown-Boggs Press,
Chain Hoists,
Motors, varied H.P. and Current,
1—30-in. Straightening Roll,
1—30-in. Bending Roll,
I.R. Air Compressor with Tank,
Lot of Friction Rolls, Log Chains, Shafting, etc.
1—36-in. Back Geared Drill Press,
1—American 14x6 Double Back Geared Lathe,
1—16-in. Ohio Shaper,
1—Acetylene Welding Outfit on Truck, Portable,
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inch angles, seven feet high, equally spaced and forming uprights to divide the section into five tiers. These tiers are in turn subdivided by one-half inch rods which extend from top to bottom thereby making ten tiers available in each rack.

Cross pieces or shelves on which the steel bars lay are heavy 2 x 2 inch angles, spaced about twenty inches above each other at bottom and diminishing in this distance until at the top, where the very small rods are stored, the distance between is about six inches. The top piece of each section is composed of a heavy 2 x 3 inch angle, making a very rigid top brace to complete the frame of the section, and also permiting the storage of extra large diameter short bars on top of the rack.

The five cross sections are spaced and held together to form the completed frame work of the rack by 2 x 2 inch heavy angle stringers extending the full length of the rack at the top and bottom of each side. Extra longitudinal bracing is provided by ¼ x 2½ flat bars crossed between and bolted to the top and bottom of the sections.

An extra angle on each side at the top and extending the length of the rack prevents pieces from rolling off, while further precaution is taken by having timbers with half round notches cut in them extending along the front on top of the rack, permitting short round pieces to be layed in place.

Naturally, the most convenient way to place the steel in the rack would be to have all the steel of the same kind in one tier with the largest and heaviest pieces on the bottom shelf and the varying sizes in regular order, according to their dimension, with the smallest at the top. This order has been reversed wherever possible, in some cases the square, hexagon, or rectangular shaped bars, which are generally smaller in size, being placed on the bottom shelves and the very heavy bars on the very top so that they may be easily handled with the travelling crane which travels above these racks.

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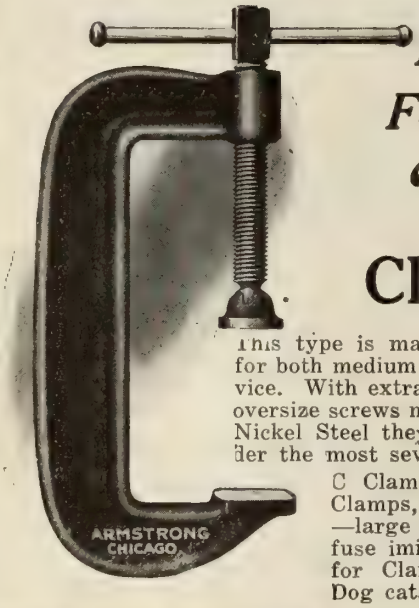


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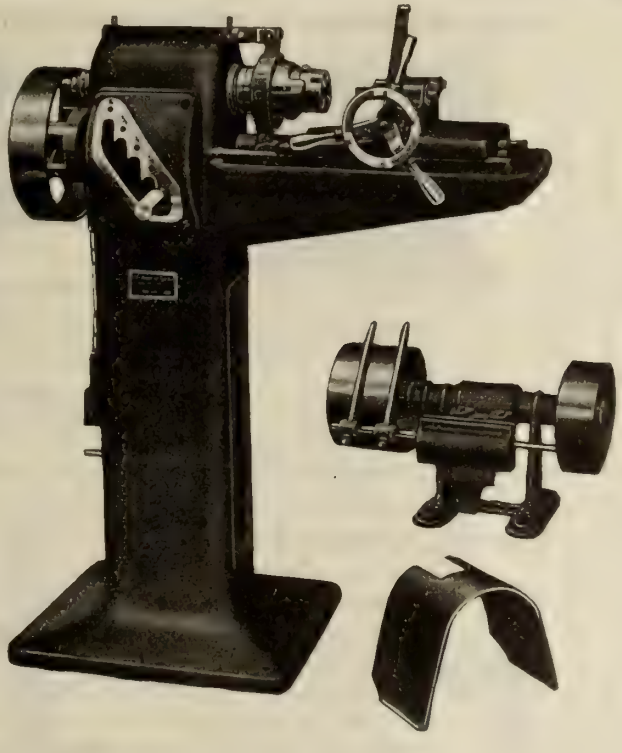
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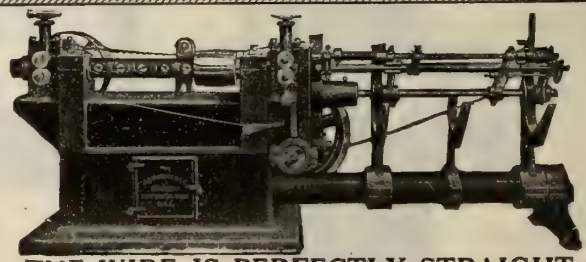


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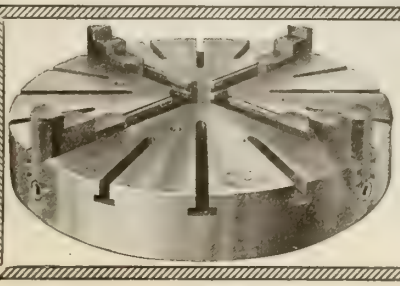
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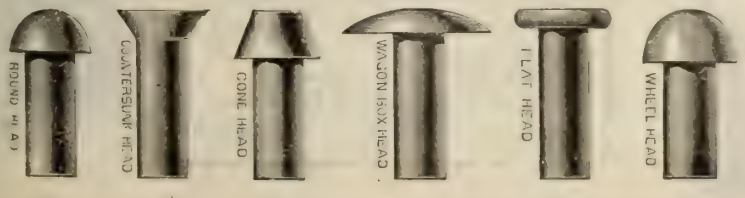
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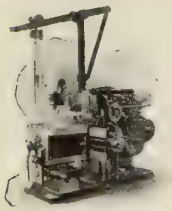
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Canadian SKF Co., Toronto, Ont.

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Landis Machine Co., Inc., Waynesboro, Pa.

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

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McDougall Co., Ltd., R., Galt, Ont.
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Starrett Co., L. S., Athol, Mass.

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Langley & Austin, Galt, Ont.

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Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

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Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
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Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
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Bertram & Son Co., Ltd., The John, Dundas, Ont.
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Gisholt Machine Co., Madison, Wis.
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Pryibil Machine Co., New York, N.Y.
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Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
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Union Mfg. Co., New Britain, Conn.

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Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

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Petrie, Ltd., H. W., Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

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Jones & Glassco, Montreal, Que.

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

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Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

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Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

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Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drill Press Sleeves.
Preston & Schwartz, Galt, Ont.

BUYERS' DIRECTORY

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Combination Centre.
reston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada. Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Hardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Williams Machinery & Supply Co., A. R., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto Ont.
Strand & Co., N. A., Chicago, Ill.

Forges, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Lt Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., E., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Atkins & Co., Inc., E. C., Indianapolis
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., E., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co. Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., E., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont
Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal Que.
Hamilton Gear & Machine Co., Toronto,

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto, Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal, Q.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwarts, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lathes, Extension and Gap
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto Ont.

Monel Metal
International Nickel Co. of Can., Ltd Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mas

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.
Quaker City Rubber Co., Philadelphia Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd. Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phospher Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.

BUYERS' DIRECTORY

Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Prybil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co. Ltd Kitchener.
Henburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Robertson Co., H. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Prybil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd, Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd, Toronto, Can

Separators, Oil and Waste
Bowser, S. F. & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill

Shafting
British Empire Steel Corporation, Montreal, Que
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Prybil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence R.I.

BUYERS' DIRECTORY

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres,
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal Q
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.

Welding, Electric
McLaren Belting Co., J. C., Montreal Que.
Steel Co. of Canada, Ltd., Hamilton, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.

Welding Supplies
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wiping Cloths
The Levi's, Toronto, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

List of Directory of Dealers will be found on page 56

Classified Opportunities

FOR SALE

FACTORIES FOR SALE — TWO DESIRABLE plants; one at Mount Forest, constructed of brick, floorage over 40,000 square feet, formerly operated by Weir Wardrobe Co.; and the other at Guelph, stone floorage over 50,000 square ft., formerly operated by Dominion Casket Co. Apply Box 777G. Canadian Machinery.

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1521
(TF)

POSITIONS WANTED

MECHANICAL DRAFTSMAN DESIRES A change; age 30; married. Experienced in tool, jig and machine design. If you are looking for a young man who by practical shop experience, knows his job from the drafting office to the shipping platform, arrange interview, at your convenience. Box 798, Canadian Machinery. (c4m)

MECHANICAL ENGINEER, COLLEGE GRADuate, twelve years' practical experience, able executive, thoroughly experienced in modern methods of production and management. Desires position as works manager or general superintendent with moderate sized concern where concentrated effort and ability would be appreciated. Moderate salary with percentage. Location immaterial. Box No. 800, Canadian Machinery.

MACHINERY WANTED

WANTED — A LATHE AND GEAR CUTTER. Must be in good condition. Advertiser desires to get in touch quickly with any person who is able to offer same. Apply Beaver Machine Shop, 1110 Center St., Calgary, Alberta. (c5mlg)

MACHINE WORK WANTED

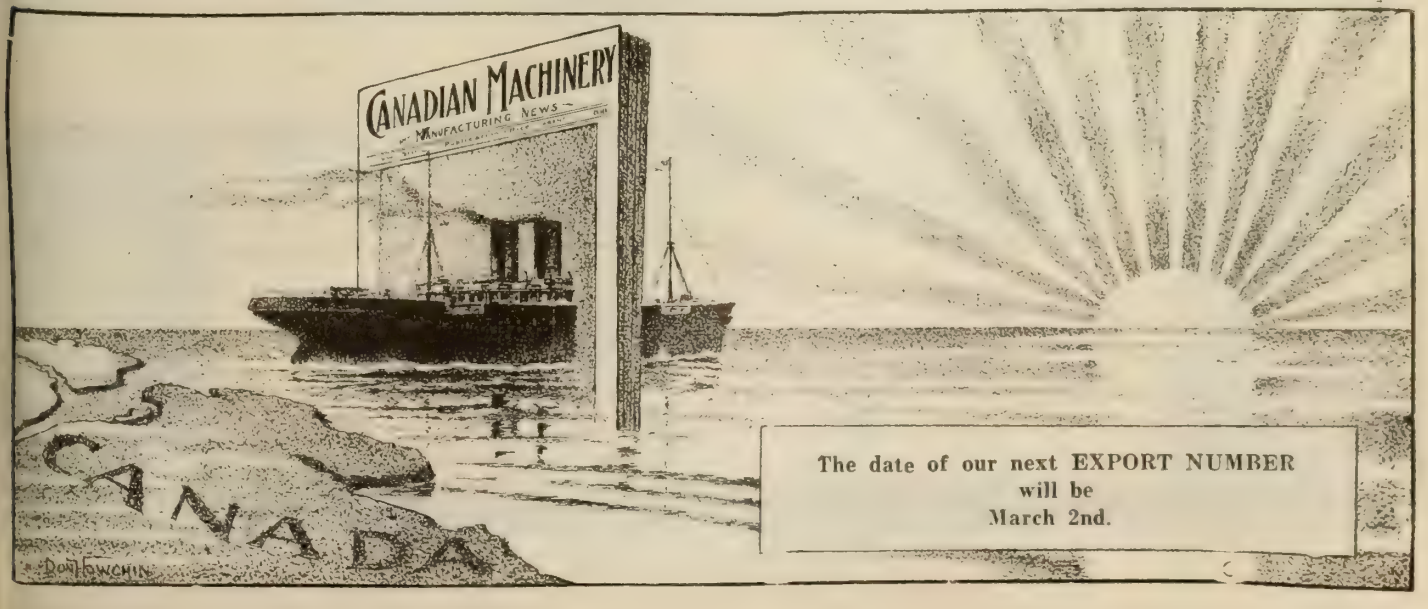
MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W.H. Sumbling Machinery Co., Toronto. (etfm)

EQUIPMENT WANTED

CAFETERIA EQUIPMENT — RANGE, STEAM table, glass shelving, urns, Cash register, etc. Must be in first class condition. Give description and prices. State where may be inspected. Box No. 801L, Canadian Machinery.

RATE FOR CLASSIFIED ADVERTISING

Rates (payable in advance.): Two cents per word. Count five words when box number is required. Each figure counts as one word. Minimum order $1.00. Display rates on application.



The date of our next EXPORT NUMBER will be March 2nd.

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

Representing
WASHINGTON GAS COAL CO.
CANONSBURG GAS COAL CO.
COUNTRY CLUB COAL CO.
WEST PENN. BY-PRODUCTS CO.

HIGH GRADE
COAL AND COKE

Mines and Coke Ovens
WASHINGTON, PA.
MEADOWLANDS, PA.
CANONSBURG, PA.
CONNELLSVILLE, PA.

BRITISH-AMERICAN FUEL & METALS LIMITED
McKINNON BUILDING TEL. MAIN 7815 TORONTO

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Emblem of Integrity

LIQUID AIR Co

Standard of Excellence

OXYGEN
ACETYLENE
BLOWPIPES-REGULATORS
FILLING RODS - FLUXES
ACCESSORIES

THE LIQUID AIR Co

SOCIÉTÉ L'AIR LIQUIDE

FACTORIES FOR SERVICE

HALIFAX, THREE RIVERS, MONTREAL, TORONTO,
LONDON, SUDBURY, WINNIPEG, CALGARY, VANCOUVER.

OPERATED IN CONJUNCTION WITH A CONTINENT WIDE NET-WORK OF DISTRIBUTION STATIONS



"Liquid Air" Oxygen Means a Saving in Transportation

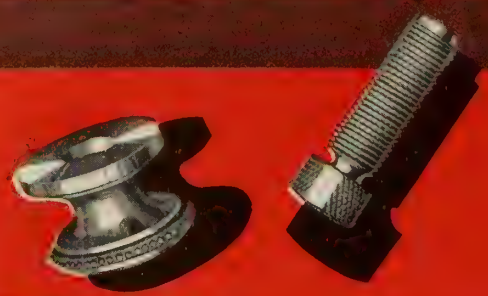
With a network of Factories not only planned, but in actual operation, and a number of Distribution Stations situated at all large centres all over Canada, Purchasers of Oxygen can obtain their supplies at a point very near to the point of consumption. This completely obviates heavy freight charges on cylinders and assures an immediate supply at any time within a few hours and even minutes after the orders are placed.

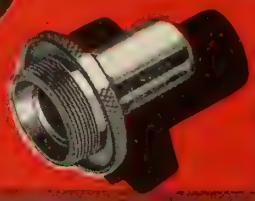
All cylinders conform to the specifications of the Canadian Railroad Board and are made to ensure safety without unnecessary weight. When purchasing "Liquid Air" Oxygen you not only save on freight, but in very many cases this expense is almost eliminated.

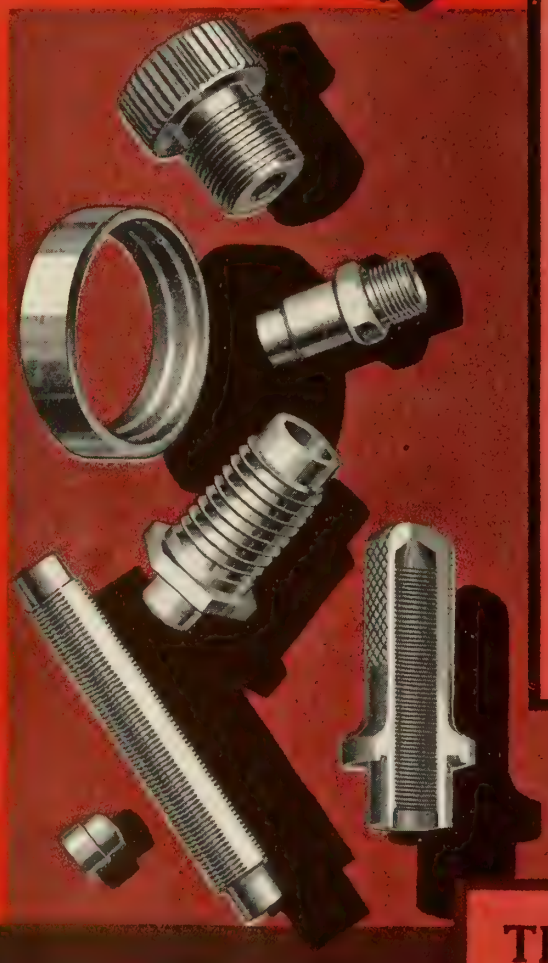


Namco Parts
For Auto Accessories









It makes no difference whether you need—One thousand tiny Adjusting Screws—Ten thousand Hardened and Ground Spring Bolts—or any other kind of milled parts up to 2¼ in. diam. Our well-equipped product plant is at your service.

Extensive knowledge of special operations and a mechanical equipment for practically every variety, enables us to take care of new and highly specialized products without the loss of time caused by slower methods, or the cost of experimenting to find quicker ones.

Standard Cap and Set Screws, also Finished Nuts and Studs from stock.



THE NATIONAL ACME CO.
MONTREAL, P. Q.

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVII. No. 5 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Feb. 2, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO | Check | See Page | READ AND PASS TO | Check | See Page

"IMICO"



Detachable and Riveted Drive Malleable CHAIN

for Agricultural and General Machinery

"IMICO" Detachable and Riveted Drive Malleable Chain is made in all standard styles and sizes. We guarantee our chain to be interchangeable with all standard makes and to fit all standard sprocket wheels. "IMICO" Chain is thoroughly tested as to pitch and tensile strength before leaving our modern factory, and represents quality through and through.

We also manufacture **Malleable and Grey Iron Pipe Fittings, Malleable and Grey Iron Castings, Malleable Clevises, Whiffletree Hooks, Ferrules, Wagon Stakes, Silo Lugs, Pipe Shoes and Malleable Washers.**

International Malleable Iron Co., Limited

Head Office: GUELPH, Ontario

Selling Agents:

Nova Scotia: Mr. Geo. D. Hatfield, Bedford Chambers, Halifax, N.S.

New Brunswick: Messrs. H. G. Rogers, Ltd., 147 Prince William St., St. John, N.B.

Prairie Provinces: Messrs. Harry F. Moulden & Son, Confederation Life Bldg., Winnipeg, Man.

British Columbia: Messrs. Ames Bros., 325 Howe St., Vancouver, B.C.

STAYBOLT TAPS



The Better the Man, the More He Appreciates Them—

Not only good when new, but heat treated and seasoned to maintain this goodness. Can be ground on face of cutting edge without affecting their size. That's why you'll find Pratt and Whitney Stay Bolt Taps on the job long after cheaper, "just as good" tools are buried in the scrap pile.

Threads accurately and cleanly cut, with the least expenditure of time and effort, are other reasons why these better Taps are favorites in the shop.

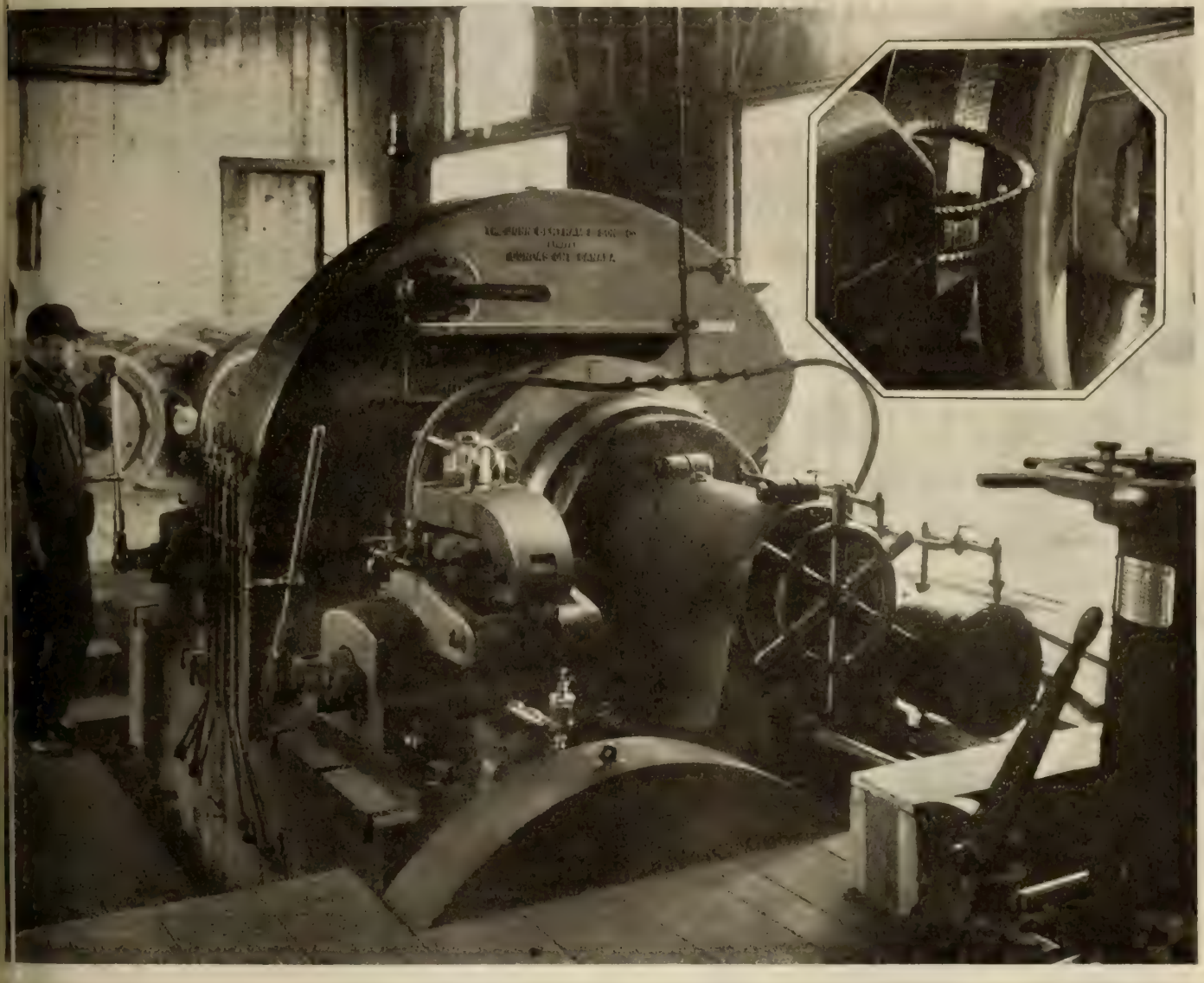
If you've used them before, you know just how good they are. If you haven't, send us your first order—we know you'll be back for more. They're carried in stock in our sales rooms in all large cities.

PRATT & WHITNEY CO.
OF CANADA, LIMITED
Works: DUNDAS, Ontario

MONTREAL
723 Drummond Bldg.
TORONTO
32 Front St. West
WINNIPEG
1205 McArthur Bldg.
WALKERVILLE
103½ Sandwich St.
HALIFAX
Roy Building
VANCOUVER
B.C. Equipment Co.

PRATT AND WHITNEY

BERTRAM
MACHINE TOOLS



Shop View of NO. 5 CAR WHEEL LATHE, a number of which we have recently furnished to Canadian Railways. (Inset—enlarged view of cut on wheel.)

Note these Features:

Pneumatic Tool Clamps,
Movement and Clamping of Tailstocks, by Air Cylinders,
Automatic Gap in Driving Gear,
New all-steel Herring-bone and spur gear drive,
A.C. Motor Drive through Speed Box,
Hardened, ground and lapped shoes on Tool Slides,
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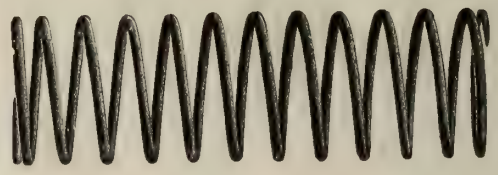
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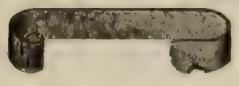
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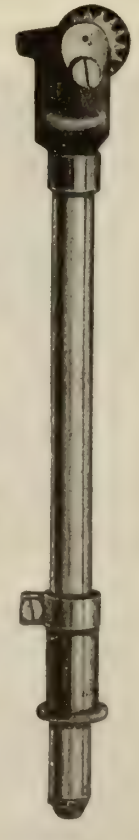
DESMOND-STEPHAN COMBINATION DRESSER

renews like magic the cutting surface of abrasive wheels. Insures better work in quicker time.

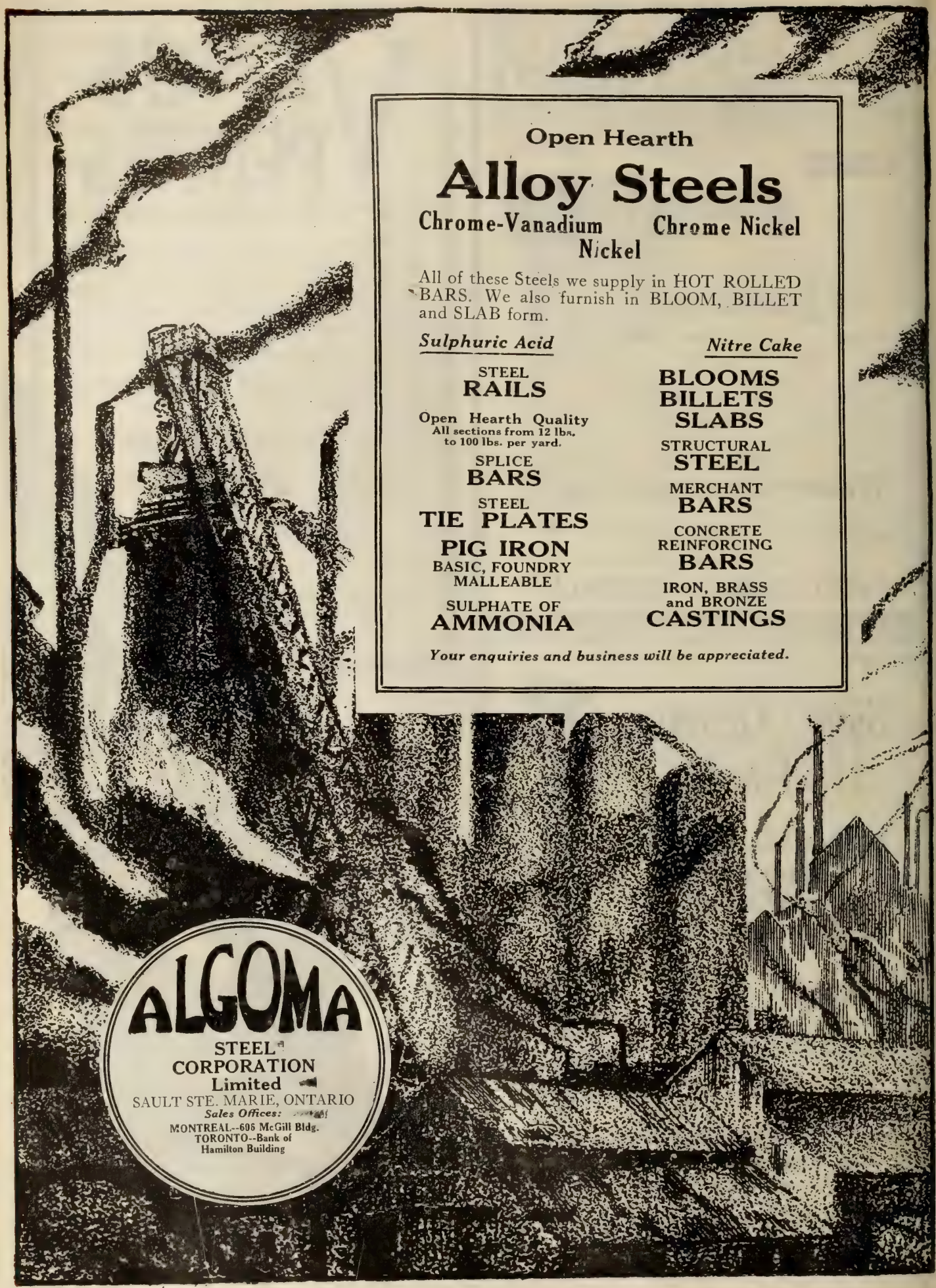
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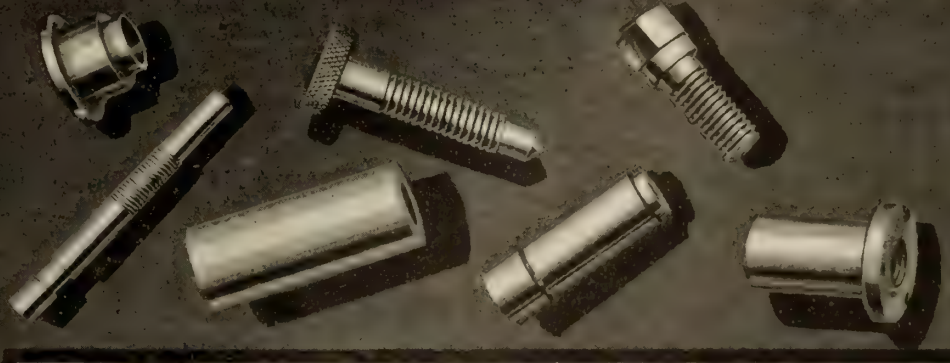


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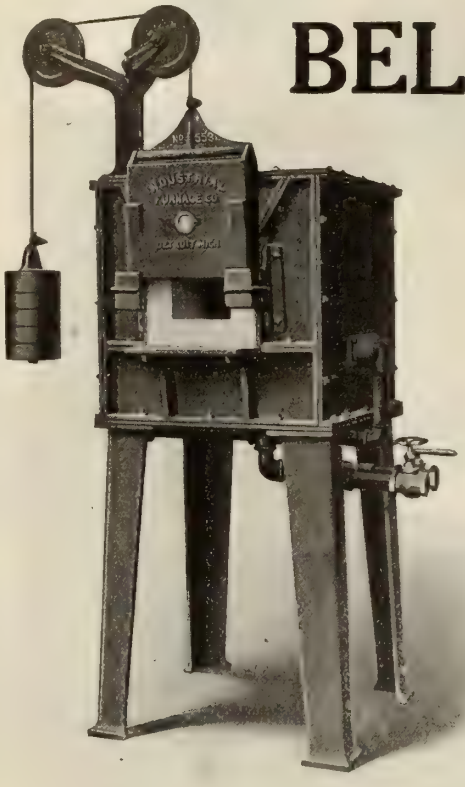
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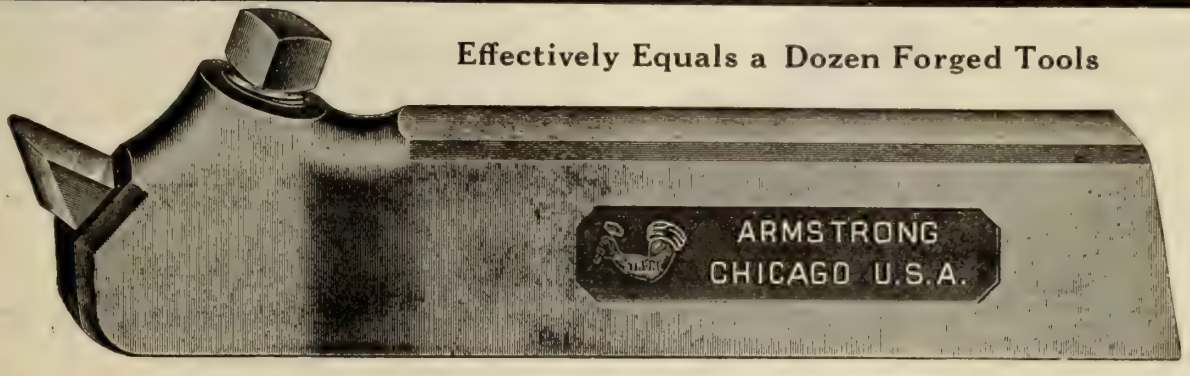
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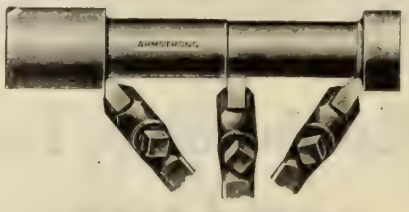
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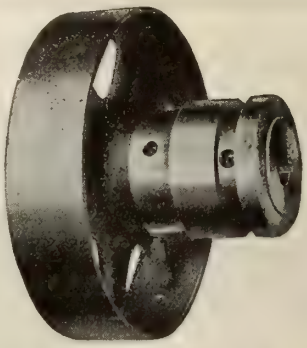
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Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
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Built in eight sizes.
Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting. etc.
Send us sample assembly parts with rivets or sketch of your work,

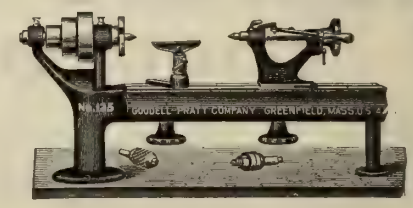
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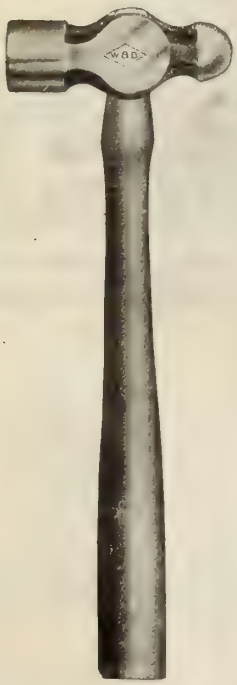
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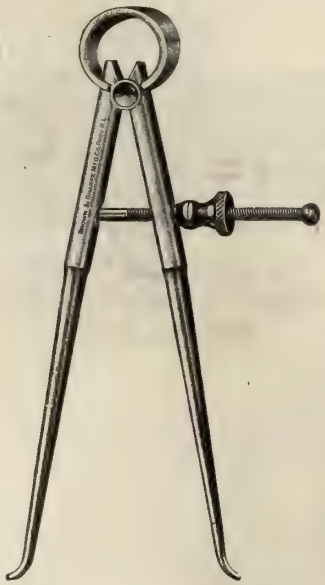
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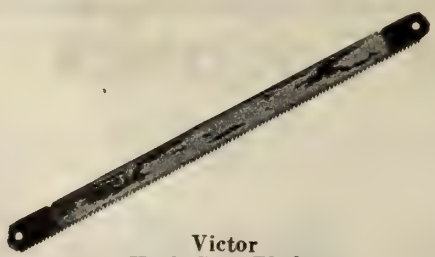






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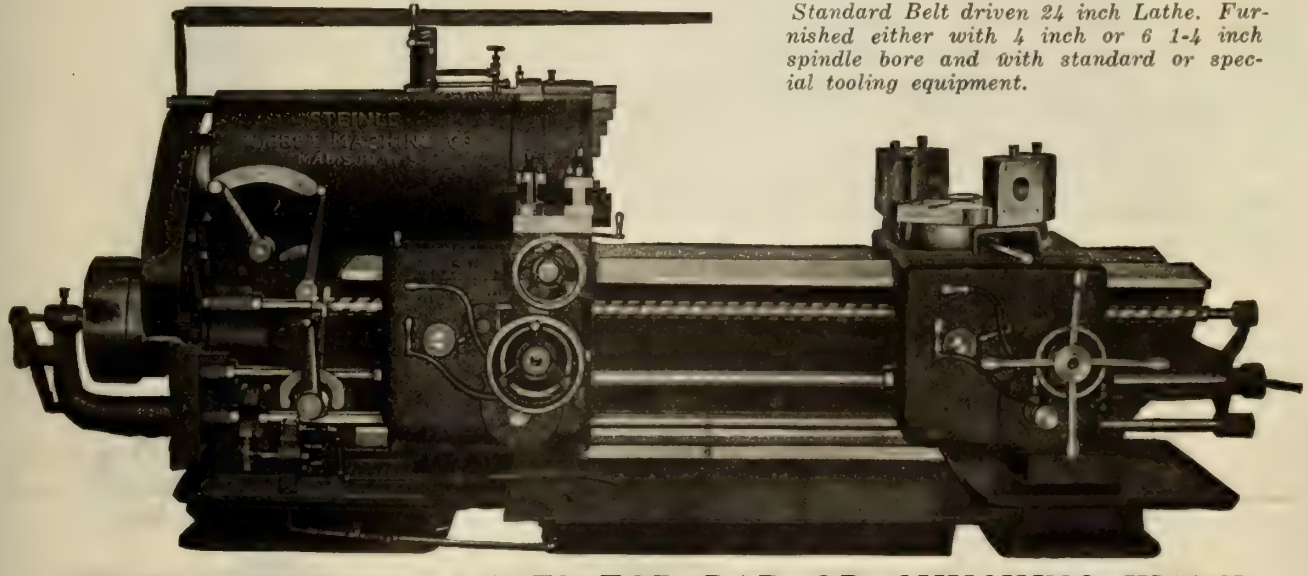
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BROWN-BOGGS

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Could Any Other Press Give Better Service?

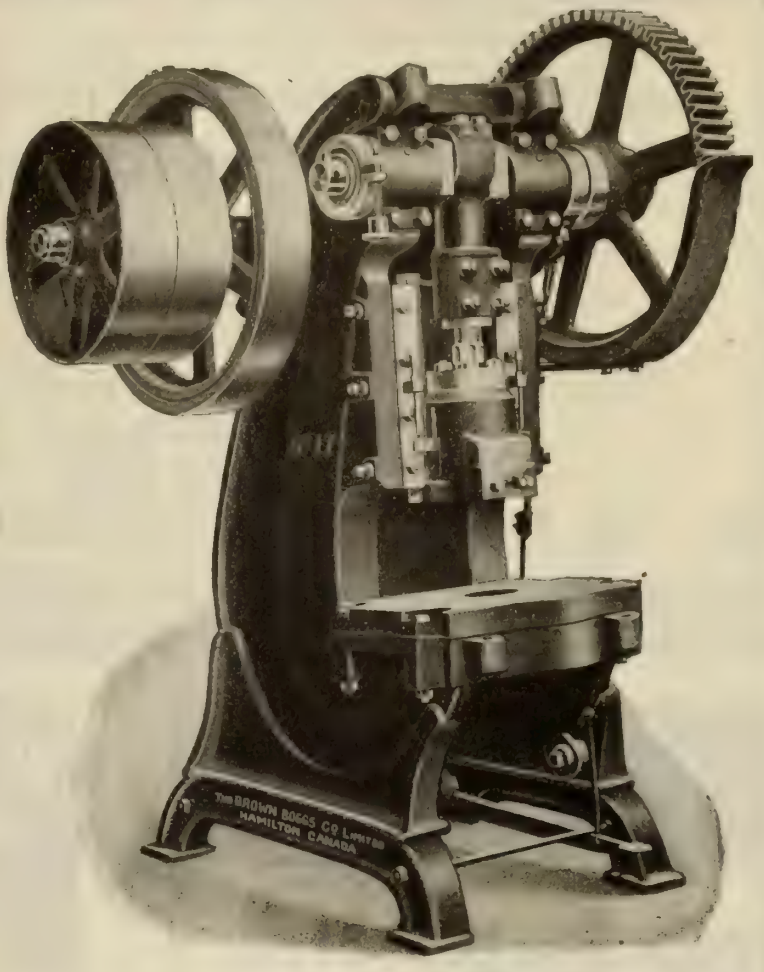
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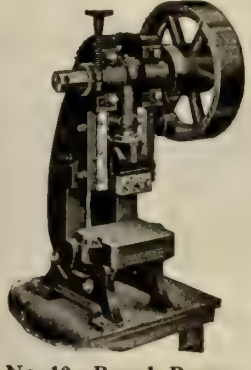
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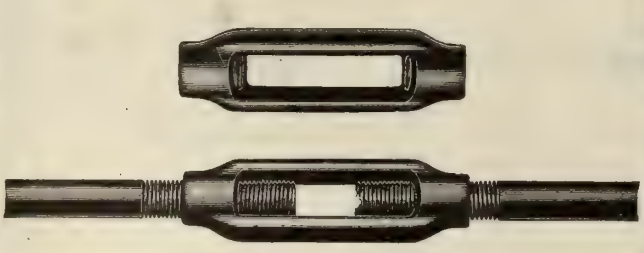
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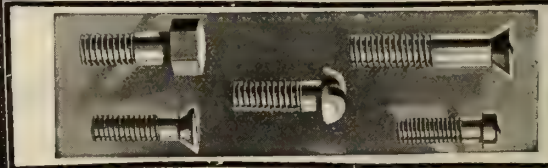
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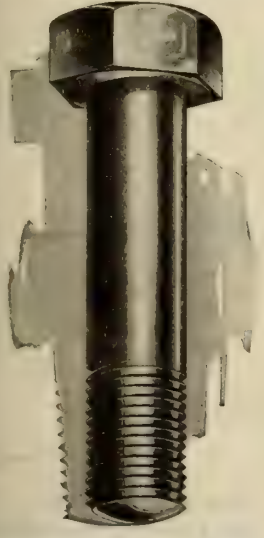
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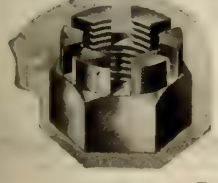
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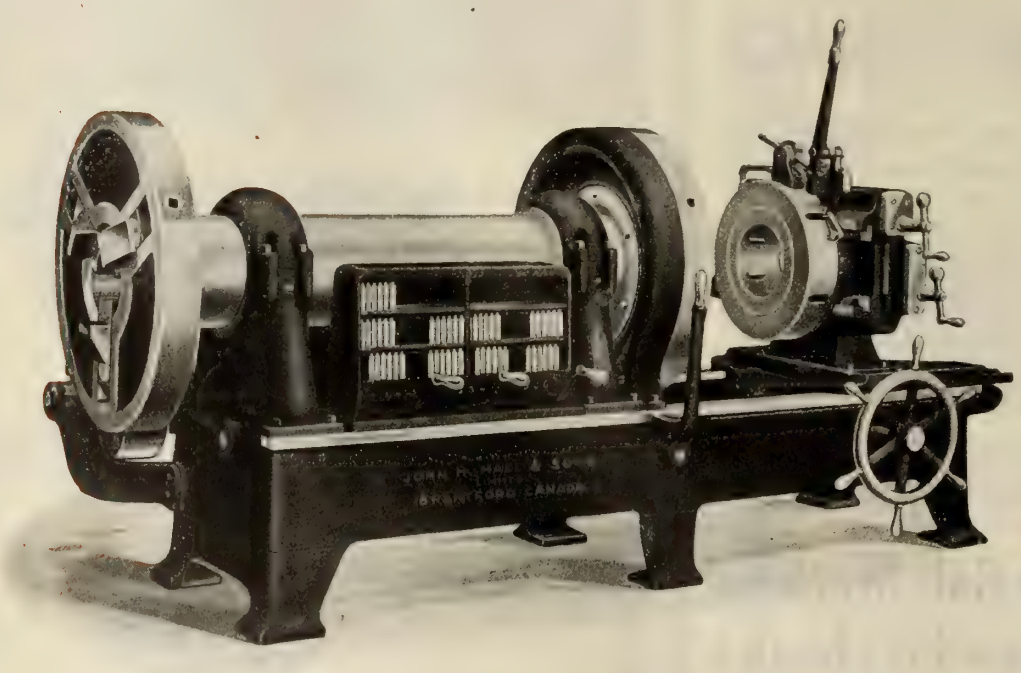
Whether it's 1-8 inch or 16 inch pipe or any of the sizes in between, there's a Williams machine just right for the job. Built in eight sizes and each size especially designed to meet the requirements of the case. And remember, each Williams machine is backed by the combined features, experience and service of Hall of Canada and Williams of the United States, each a firmly established leader in its field.

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Open Hearth and Electric Furnace Alloy Steel for Railroads, Automobiles, Edged Tools and Agricultural Implements.



Toncan Metal for Safety and Long Service

Toncan Metal is anti-corrosive and, therefore, it was used for the roofing and flue work for the famous Chateau Frontenac Hotel, Quebec, because its long life makes it most economical. It has served here since 1915 and is still in excellent condition. Thousands of installations both in Canada and the United States testify to Toncan Metal's lasting qualities. Those made over twelve years ago are still good.

TONCAN METAL

The Iron that Endures and Insures

Where atmospheric conditions are severe specify anti-corrosive Toncan Metal. It endures. Also has superior forming and welding qualities. Write for complete information. A few well-known uses for Toncan are:

Roofing	Cornices	Culverts
Siding	Skylights	Tanks
Eaves Trough	Window Frames	Lath
Conductor Pipe	Smoke Pipes	Refrigerators
Flashing	Water Pans	Washing Machines
Valleys	Ventilators	Enameled Products

CORP'N, CANTON, OHIO, U.S.A.

In Canada: Toncan Metal is Galvanized by Dominion Sheet Metal Corp'n, Ltd., Hamilton, Ont., Fabricated by The Pedlar People, Ltd., Oshawa, Ont.

THERE is as much difference in the various makes of High Speed Steel as there is in men—

The practice and methods of manufacturers differ widely in every mill and anyone who is at all familiar with the manufacture of High Speed Steel thoroughly understands this

"Red Cut Superior"

The Nationally Known—First Quality

HIGH SPEED STEEL

is the best for all Machine Work

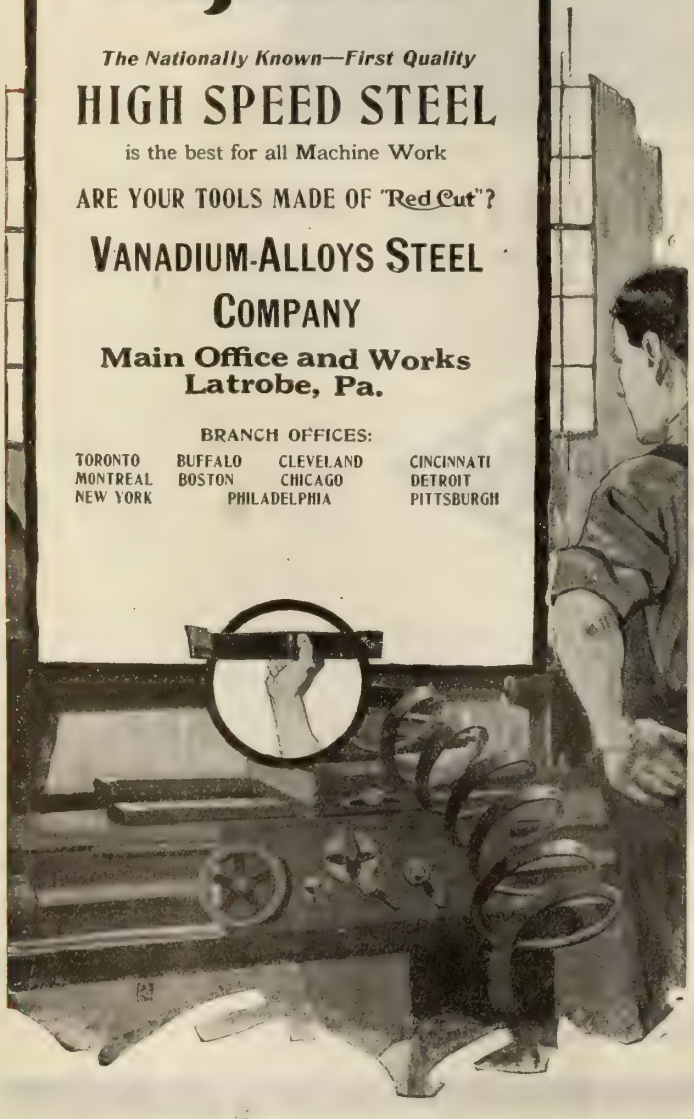
ARE YOUR TOOLS MADE OF "Red Cut"?

VANADIUM-ALLOYS STEEL COMPANY

Main Office and Works
Latrobe, Pa.

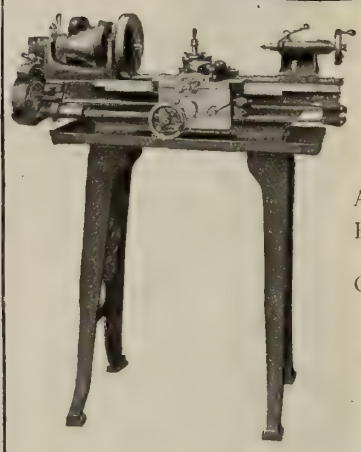
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"DALTON SIX"

The Small Lathe for the Big Job



Type B-6

	Inches
Actual Swing	8¼
Between Centers	18½
Collet Capacity	¾

Send for Bulletin BC-651

Dalton Manufacturing Corp'n
Sound Beach, Connecticut, U. S. A.
Cable Address - - "Aledal Stamford"

Also Manufacturers of Type B-4 Lathes



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Are sometimes cheaper than castings—Always far superior.

DROP FORGINGS

One of the Largest and Best Equipped Plants anywhere.

F&SCo. Quality & Service

Consult us as to your requirements.

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TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
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VERTICAL BORING and TURNING MILLS
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With Adjustable Cutters
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For Time Recording in Factories
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QUICK DELIVERIES

High Carbon Steel
Manganese Steel
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QUALITY GUARANTEED

Sizes—½ lb. to 5,000 lbs. each

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Price does not determine the worth of a tool. It is Service Rendered that Counts.

MORSE DRILLS do what they are designed to do—that is, **Render Absolutely Reliable Service.**



Morse Twist Drill & Machine Co.
New Bedford, Mass.
U.S.A.

Butterfield Adjustable Dies

--for fast and accurate work--finely adjustable



Are you a user of Butterfield Drills, Reamers or Milling Cutters? Then you are acquainted with the excellent cutting qualities of Butterfield tools. The same high grade of material that goes into the construction of Butterfield Drills, Reamers and Milling Cutters is also apparent in Butterfield DIES—for fast and accurate production of work and ease and fineness of adjustment Butterfield Dies are without a peer.

Export orders given prompt and efficient attention.

"The Tools you buy again"



BUTTERFIELD & COMPANY DIVISION

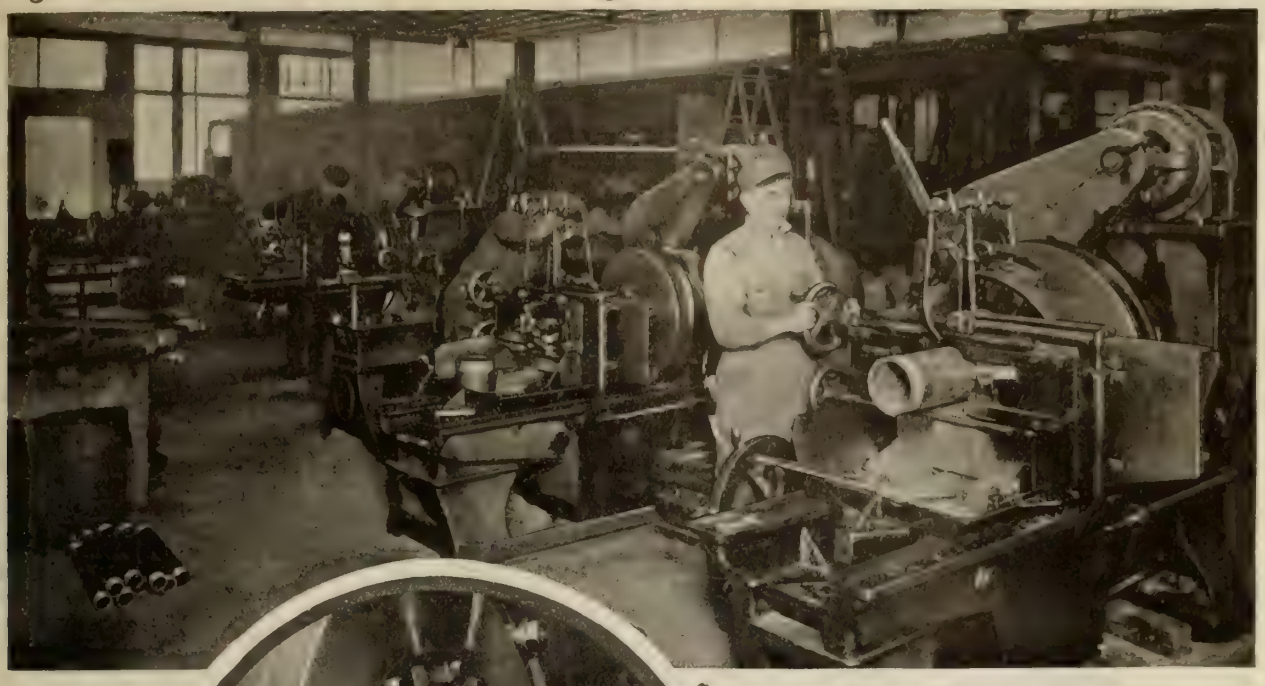
UNION TWIST DRILL CO.

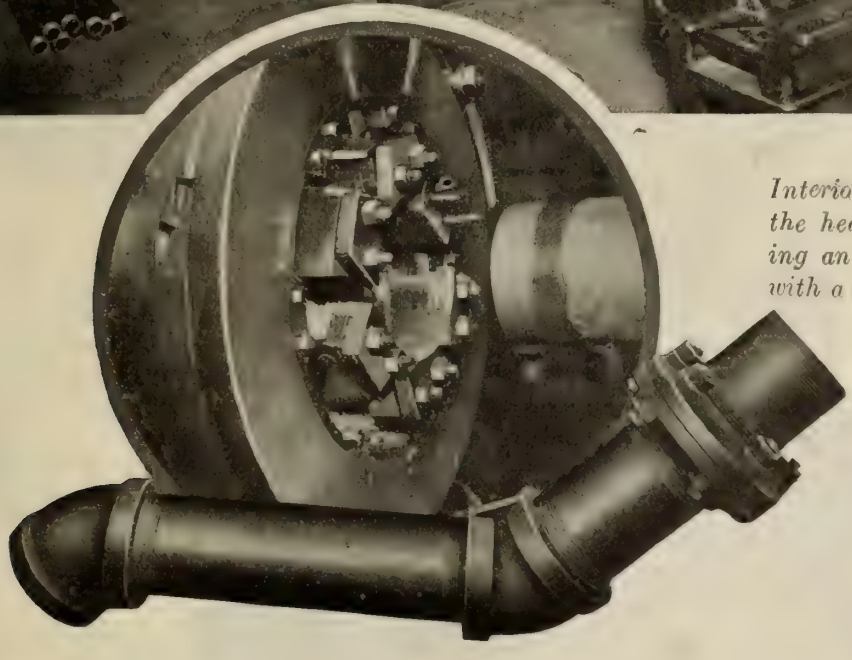
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131 St. Paul Street West, Montreal.

AGENTS:—D. Philip, 138 Portage Ave., Winnipeg, Man.
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Interior of the shop and to the left the head of one of the pipe threading and cutting machines (together with a typical pipe assembly).

MAKING good five times at once, these Landis pipe threading and cutting machines and pipe and nipple threading machines are producing typical Landis results.

LANDIS PIPE THREADING MACHINES

They are up against the hardest kind of work here in the Shipley Construction and Supply Company plant in Brooklyn. Threading cast, wrought and malleable iron pipe in all sizes, in constant operation and after two years service—the Superintendent says to-day that in his opinion *Landis Machines are far ahead of any other threading machines on the market.*

The variable rake angle of the Landis chaser is responsible for the good threads obtained on the cast, wrought and malleable iron pipe. This feature permits the chaser to be ground to suit the material being threaded. Landis chasers have many other distinctive features which are reasons why Landis stands for good threads, high production and low maintenance cost.

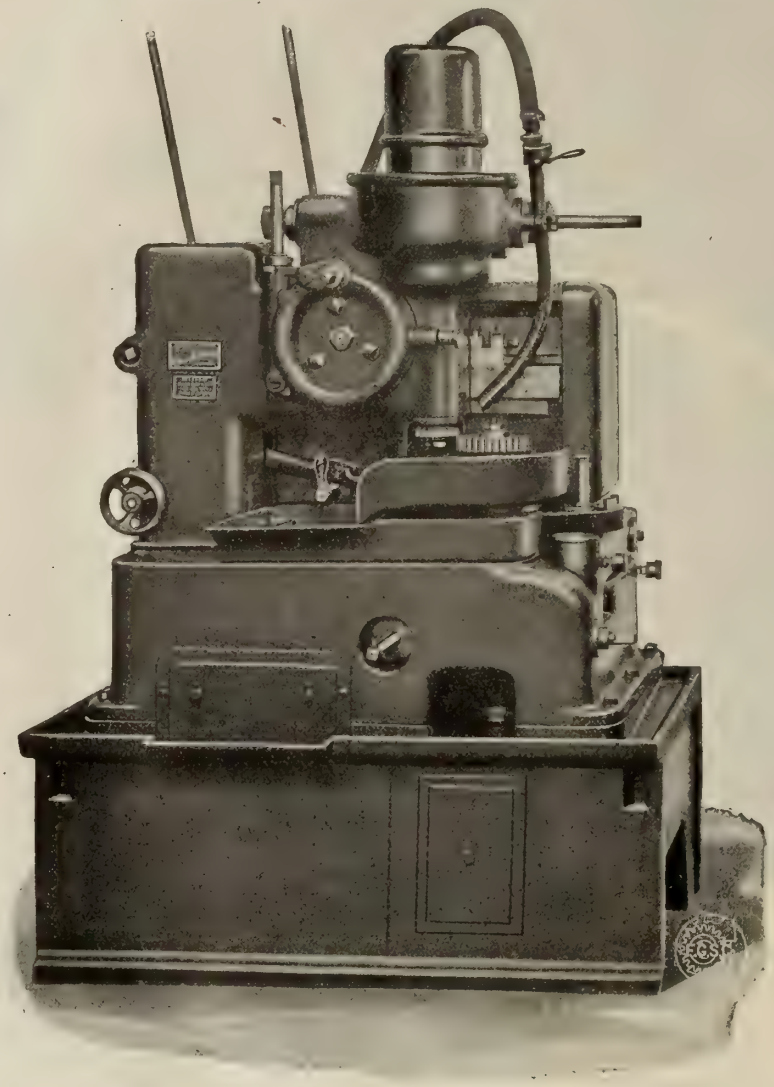
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LANDIS MACHINE COMPANY, INC.,

Waynesboro, Pa., U. S. A.

LANDIS

CUT GEAR COSTS
WITH THE
New Production Gear Shaper



The new production Gear Shaper, illustrated, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result, and still one of the outstanding features of the Gear Shaper principle—accuracy—has been maintained.
It is designed to cut one gear at a time and at a speed which eclipses all other methods.
All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines.
It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.
See illustrated article in all technical magazines.
Send for our booklet, "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now.

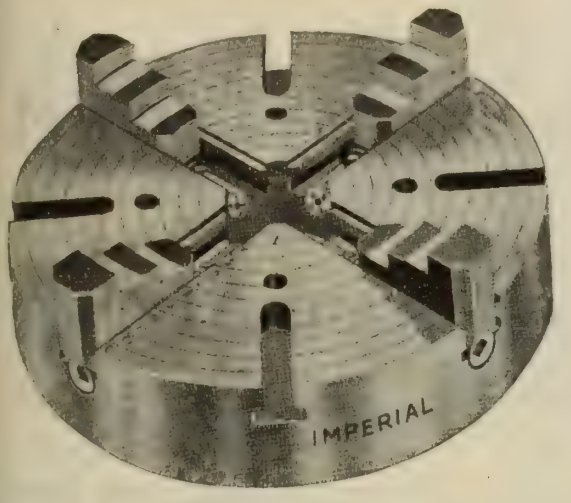
THE FELLOWS GEAR SHAPER COMPANY,
SPRINGFIELD, VERMONT, U.S.A.

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Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere.
Specify them in your next order.



Ker & Goodwin Machinery Co.
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Using these three Babbitts, could get the Irish Free State moving without friction.

Some Job!



IMPERIAL GENUINE



For Heavy Engines and Extraordinary Hard Work

HARRIS HEAVY PRESSURE

THE COPPER COATED CAKE

For Donkey Engines, Saw Carriages, Small Motors, Transmission Line Shafting and all steady heavy pressure duty.



Matchless

Suitable For Slow-Moving Bearings
Write For Prices

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TORONTO HAMILTON MONTREAL
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Hull Iron and Steel Foundries, Limited *Hull, Quebec*

Steel, Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.



Machine-Moulded Gears

"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products



"Little Giant" Tap and Die Assortment (Screwplate)



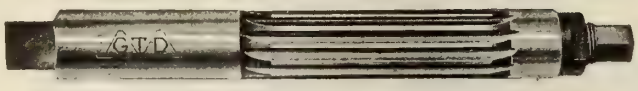
GTD Hand Tap



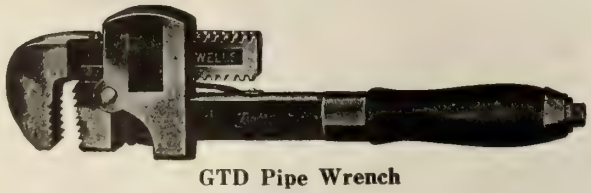
GTD Round Adjustable Threading Die



GTD Twist Drill



GTD Expansion Hand Reamer



GTD Pipe Wrench

Like the "Sterling" Mark on Silver

Everybody Can Get Costs— You Want Savings

Every single one of these tools have real points of superiority. These points mean *saving*. We urge you to investigate your small tool production very closely. Examine the tools. Look for the GTD trade mark. That trade mark is a guarantee to you that the tool will "deliver the goods."

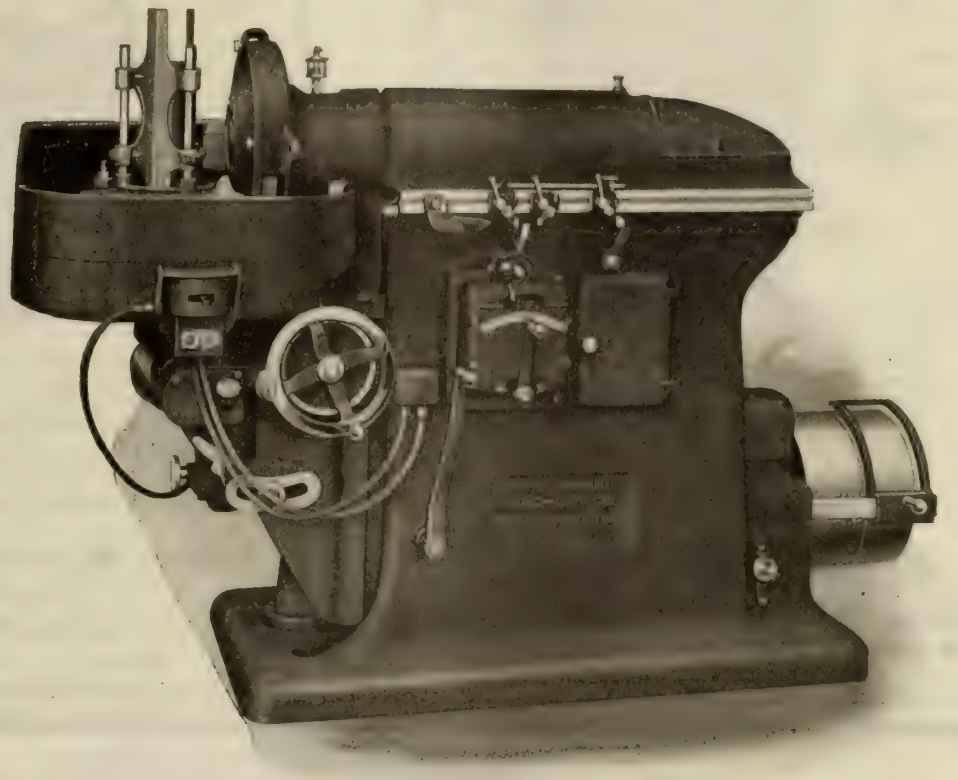
These Screw Plates, Taps, Drills, etc., are only a few of the complete line of Small Tools in the GTD family. We base our claims for GTD Small Tools on their performance, and our engineers are ready to co-operate in effecting a typical production in costs. Write today.

GREENFIELD TAP AND DIE CORPORATION
OF CANADA, LIMITED GALT, ONTARIO

Just Fill the Magazine and Take Away the Finished Work

HEALD

Style No. 25



For Grinding

Piston Rings
Ball Bearings
Roller Bearings
Collars
Gears, etc.

With the arrival of this new automatic ring grinding machine, the chucking by hand of such work as rings, ball races, collars, washers, gears, etc., will soon be entirely obsolete. Considering that it only requires filling the magazine and taking away the finished product, no concern can compete, using hand operation, for so many human equations enter when the work is handled by this method that the production in a day's time is decidedly low and uncertain compared to that obtained mechanically which gives absolute results at a fixed production day after day.

This machine has been designed and built for large production, all of its units being extremely heavy and rigid with moving parts carefully guarded.

The slide is driven by an extremely simple hydraulic arrangement operated by oil which makes it possible to get any speed from nothing up to the maximum.

The automatic feeding arrangement is made up of a feeding plate with five holes which can be bushed to take rings up to 5″ in diameter. As the plate indexes, a ring is moved from the magazine to the center of the chuck, ground, and then slid off. This arrangement is covered by basic patents owned by this Company and will be protected to the fullest extent.

A two-step cone on the main drive shaft gives two speeds to the wheel which enables the operator to maintain an efficient surface speed throughout the entire life of the wheel.

The chuck spindle housing is absolutely tight which makes it possible to fill it with oil, thus immersing the bearings and gears which drive the chuck spindle.

The diamond which is located on the chuck pan can be readily adjusted to true the wheel to give the desired thickness for the ring.

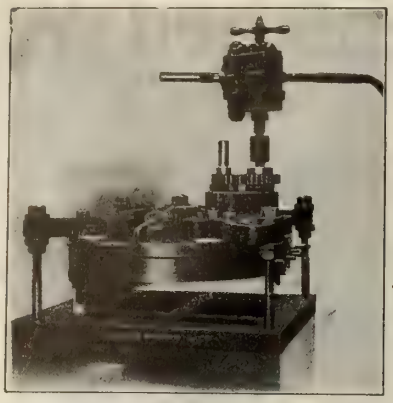
There are many other unique ideas and units which we will be glad to explain by mail or personally.

THE HEALD MACHINE COMPANY

51 New Bond St. - Worcester, Mass.

Portable Valve Seat Planer

Constructed to Stand Heavy Work



Our latest Portable Valve Seat Planer is of a rigid construction capable of withstanding heavy work without spring or strain. It will easily plane as heavy a cut as is required for valve seat work—facing off, at one cut, deeply worn valve seats.

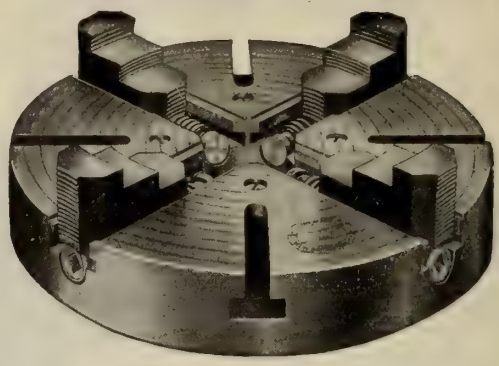
Full particulars of this and any other Underwood machines will gladly be forwarded upon request.

H. B. UNDERWOOD CORPORATION
1025 Hamilton St., - Philadelphia, Pa., U. S. A.

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INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

Union Manufacturing Company
New Britain, Conn.
New York Office: 26 Cortlandt Street
Makers of a complete line of chucks

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Machine Bolts **Blank Bolts** **End Spring Bolts**
Carriage Bolts **Stud Bolts** **Cant Dog Bolts**
Plow Bolts **Bridge Bolts** **Coupling Bolts**

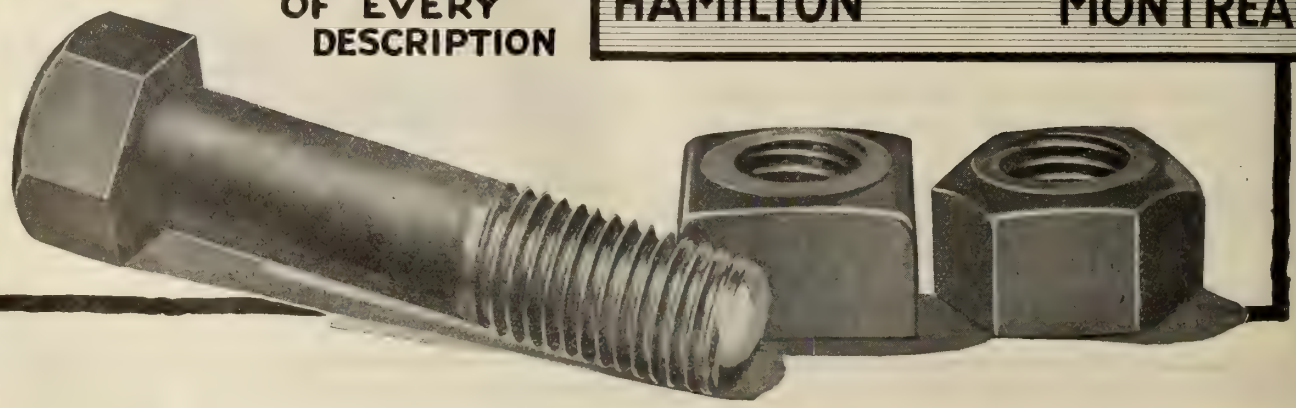
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OF EVERY DESCRIPTION

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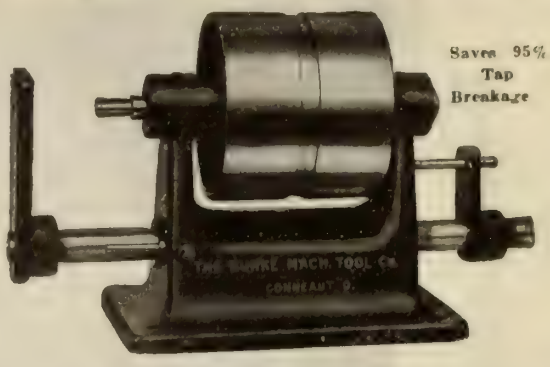
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Saves 95% Tap Breakage

Friction-Driven Tapping Machine

Inexperienced labor can tap holes rapidly with this cost saver. Eliminates all shock to the tap, thus reducing tap breakage to a minimum.

Built in three sizes: 3-16" at $25; 3/8" at $45; 5/8" at $60.

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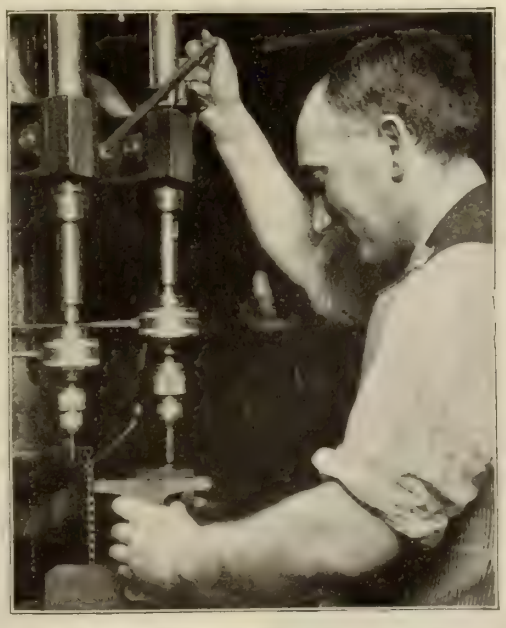
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Safety Tapping Attachments

Speed up Work of Instrument Making

A prominent Instrument Company of New York decided to try the "PROCUNIER" in the important and delicate work of instrument making. It **was a success from the start.**

Here is a "PROCUNIER" Tapping **Attachment** tapping a scleroscope clamp for a 5-16" screw. The Safety Friction allows the Operator to run the tap right to the bottom and use the bottom of the hole for a stop without fear of breakage. It is easy to operate and a revelation in efficiency.



No matter what your job is you can **speed up** by adopting the "PROCUNIER" Tapping Attachments, Safety Tapping Chucks and Tap Holders. Our patented "DOUBLE JAW" Chucks reduce costs. Get our details and let us prove it.

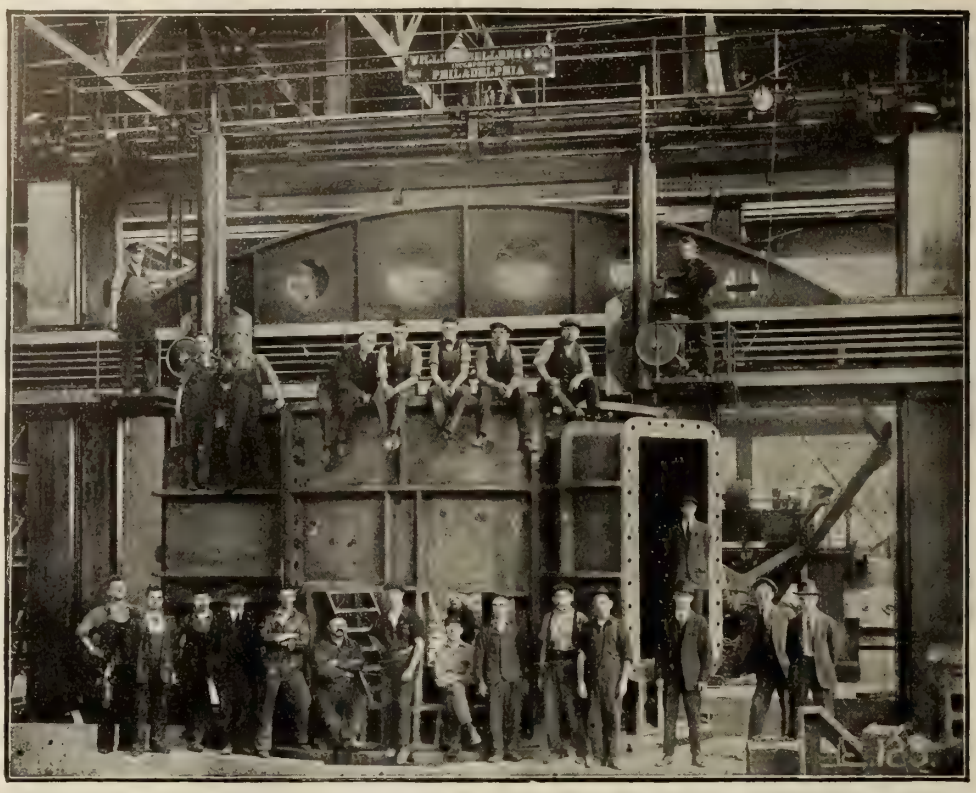


No lost time with a "PROCUNIER." It reverses at TWICE the forward speed. The only device on the market having a **balanced** reversing mechanism which eliminates all torque.

Note the Patented Hand Adjusted Safety Friction. Also the Patented "DOUBLE-JAW" Chuck: for use on non-reversing drill presses

WILLIAM L. PROCUNIER
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ORGANIZATION - EXPERIENCE - EQUIPMENT

enable us to render exceptional service where large, difficult Foundry and Machine Work are required. We can handle pieces up to 75 tons weight in Grey Iron or Semi-Steel.

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We are sole builders of I. P. Morris Hydraulic Turbines in Canada, under license including export to any part of the British Empire.

Turbine contracts filled or under construction the past year total over 100,000 H. P. Smallest unit, 1,500 H. P., largest, 41,000 H. P.

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We build fast-running modern Fourdrinier Paper Machines, also Cylinder and Wet Machines, Millspaugh Suction Rolls, Stuff Pumps of Fan or Plunger Types, Spangenberg Screens, Granite Press Rolls, etc.

Existing Paper Machines re-modelled on modern lines.

Inquiries are welcomed and will receive prompt response, with estimates and specifications when desired.

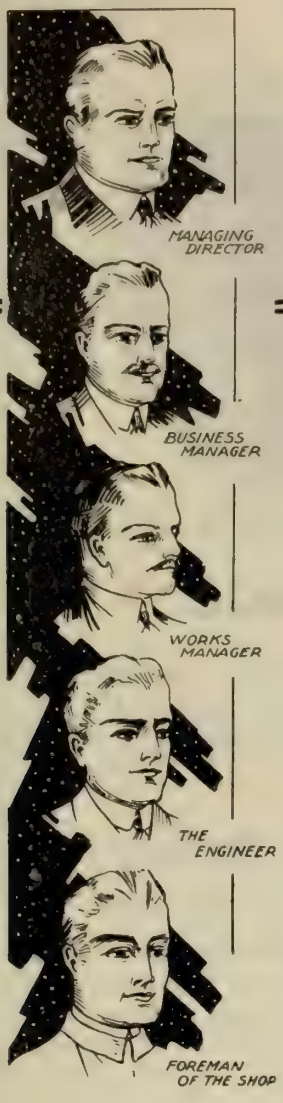
Dominion Engineering Works, Limited

Montreal, Canada

Telephone :
Melrose 700

Cable Address :
"Domworks," Montreal

R. F. MATHER, Western Representative, London Building, Vancouver, B.C.



ACME
NUT TAPPING MACHINES

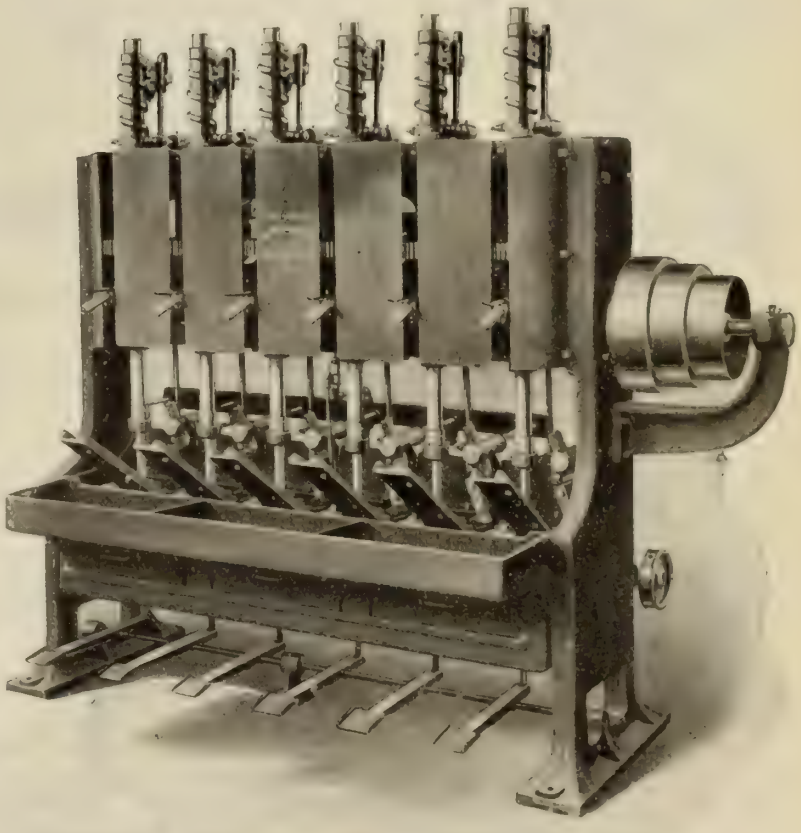
"Our production costs are much too high. We've got to cut down somewhere." —*The Managing Director*

"I unfortunately know that and I've taken it up with the Works Manager." —*The Business Manager*

"I've spoken to the Engineer and he recommends Acme Tapping Machines." —*The Works Manager*

Here's what the Engineer said:
"One plant I know has been averaging 15,000 threaded nuts per nine hour day with Acme Nut Tappers. We need them here."

"I'm with you," says the foreman, "so I think there is satisfaction all round."



Acme Nut Tapping Machines most profitably meet to-day's demand because they are high-speed producers and capable of precision work under the most severe service. According to one leading manufacturer, "We get a spindle speed of 100 r.p.m. which is the limit of the tap endurance on the tough material used." **Wouldn't it interest you to know more?**

Illustrated Catalog on Request

It gives complete and up to the minute information about Acme Bolt, Nut, Rivet, Upsetting and Forging Machinery. Write for a copy.

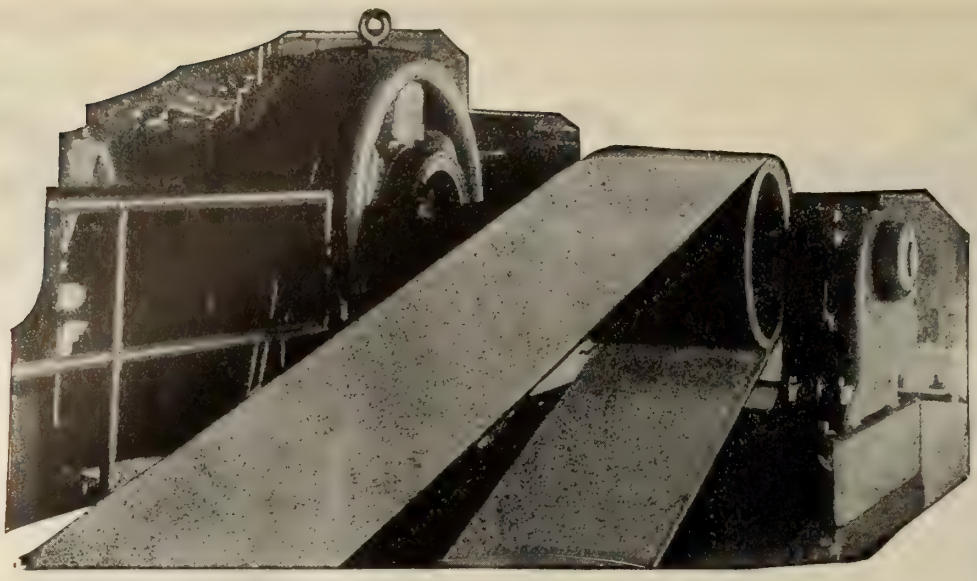
The Acme Machinery Co.

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Are your drives insured against belt unreliability? Power economy in machine shops and power plants is gained only by transmission efficiency. The highest efficiency is reached with

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—properly installed—because it represents the skill and experience of the largest manufacturers in Canada.
One of our belting men, from our nearest Service Branch, will gladly inspect conditions in your plant and submit recommendations for your approval.

Dominion Rubber System

Service Branches:

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DOMINION RUBBER SYSTEM PRODUCTS

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Transmission: "Dominion," "Keewatin," "Para."
Conveyor: "Rockproof," "Canadian," "Hibeat"
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Grain Elevator: "Metcalf Standard," "Grain King."

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Water: "Indestructible," "Para," "Kushion Kover," "Star."
Suction: "Para," "Star," "Trade."
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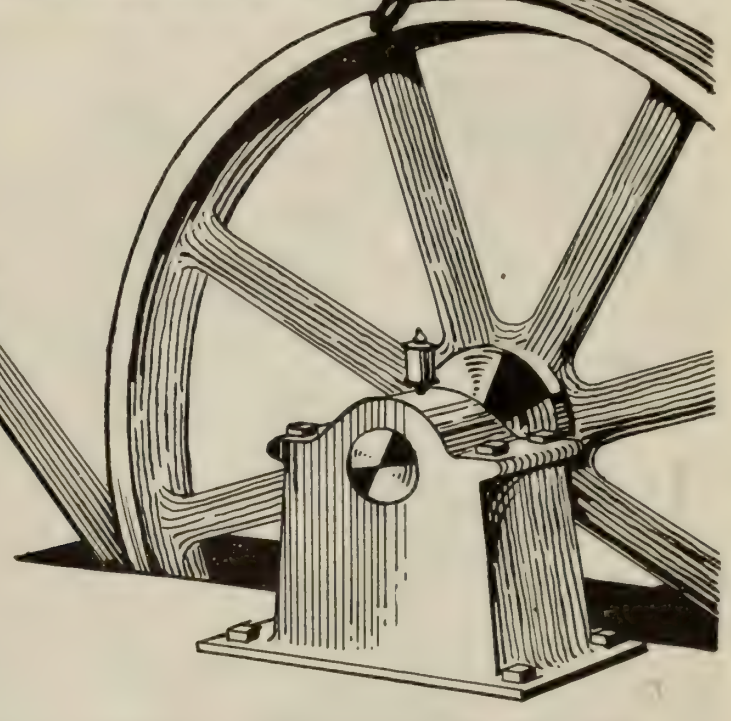
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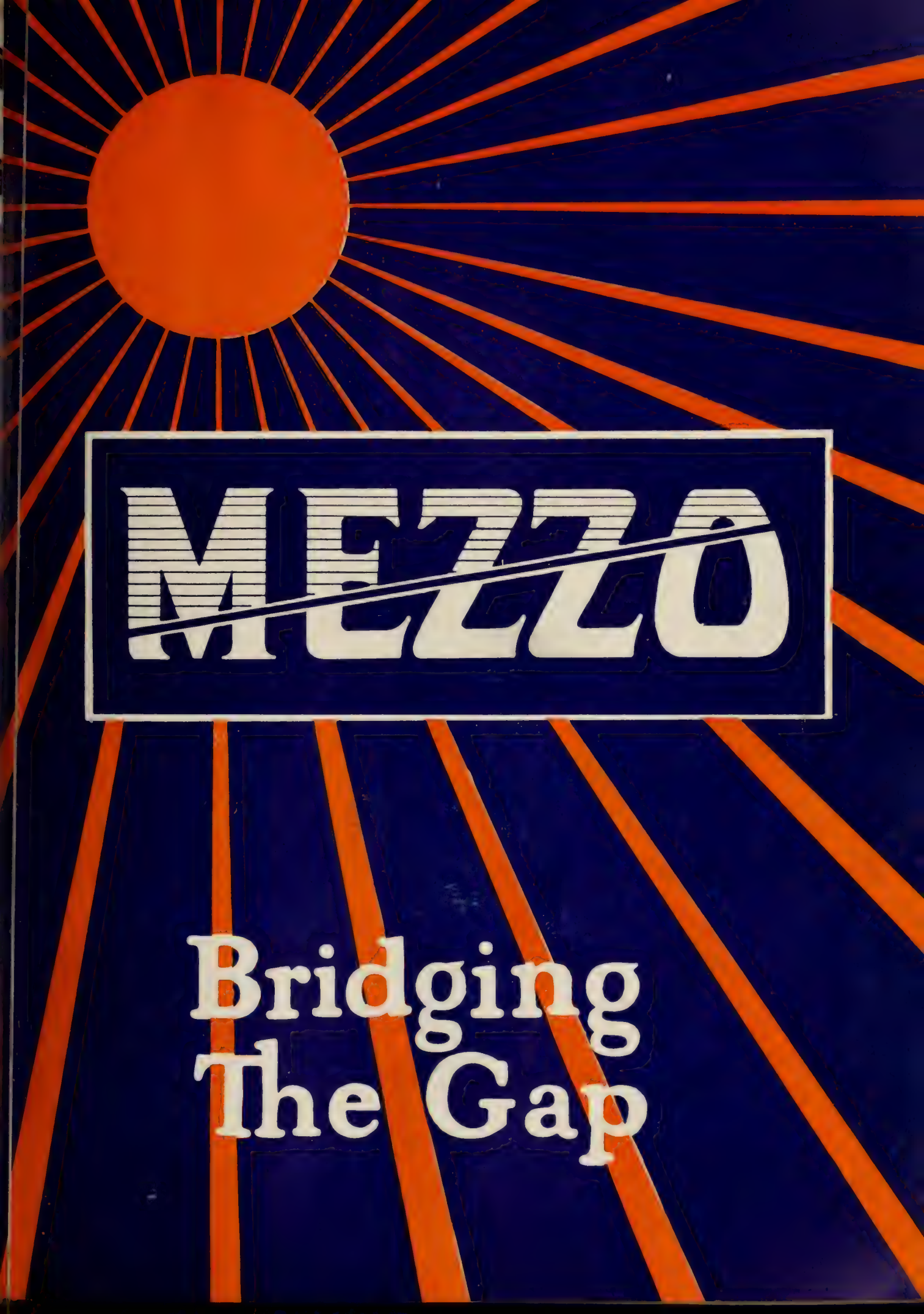
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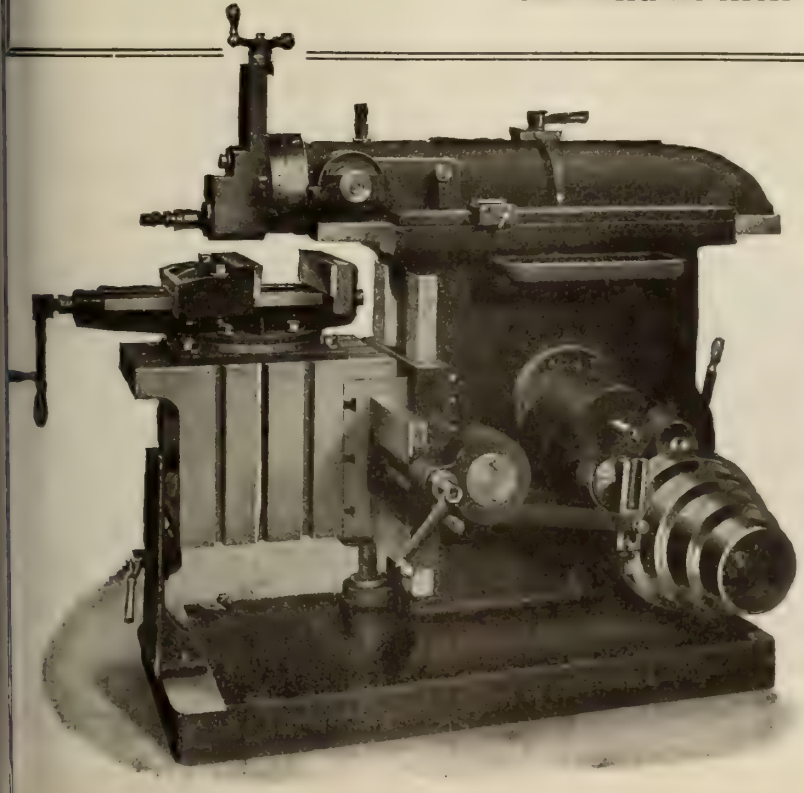
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII, No. 5. FEBRUARY 2, 1922

Points to Watch in Packing Goods for Export

Benefit of Standardizing Type of Boxes—Rules Which Have Proved Useful—Make Cases to Fit Product—Value of Proper Packing and Material List — Avoid Loose Pieces

By J. H. MOORE

THE COMPLETION of a well made product is a natural cause for pride to any factory. Once the nished article reaches the shipping oom, some executives are inclined to ipe their hands of further responsiility, but this department is where the tmost care and vigilance should be xercised. A first class article can rapdly lose its reputation through poor acking. This is especially true if the oods are being boxed for export trade. No matter what the distance, a product hould be packed carefully if there is he slightest danger of damage in any ay. In export shipping, special care required, owing to the length of the urney. The damages caused by poor acking are already well known, and et, year after year, we find goods arving at their destination in poor shape. uckily, all manufacturers are not alike, ith the result that many firms have ade a study of their export packing roblems, reducing it almost to a science. hen this is done we find very litt.e rouble, shipments are prompt, customers are satisfied, business expands, and the firm spending the extra money on careful packing comes out on top. Any extra cost incurred in the shipping room is a wise investment

Work to Rules

Take for example, the Browne and Sharpe Co., Providence, R. I. They are very strict regarding packing, and have four rules to which they strictly adhere.

First, they prevent breakage by so boxing and bracing as to protect against not only ordinary handling, but also rough usage. Seondly, they see that their product is thoroughly protected against rust, and thirdly, they so arrange their packing as to ensure protection against thieving. Last, but not least, they are very particular regarding invoicing and marking, and at all times aim to meet the many varying requirements of countries to which their goods are shipped.

In boxing heavy machinery there are certain principles which shou.d be remembered. First, the platform and skids should be strong enough to support the entire machine, and the platform should be attached to the skids by using heavy spikes toed in on a slant both ways to keep the boards from lifting up when barring.

2. The size of the box should be such that when squared up for length, width, and height, there will be a clearance of at least half an inch.

3. The machine should be so blocked in position that if tipped over the weight will be supported, and all delicate parts protected. All blocking should be placed lengthwise of the grain so as to be less affected by swelling and shrinkage.

4. The top should be sufficiently strong, so as to support any crushing strain which comes on account of the use of a sling in handling when loading on vessels, etc.

5. All small parts, such as wrenches, etc., should be packed in smaller boxes, and attached to the main box in a substantial manner.

Never make the case too spacious for the contents. If you do, any heavy ma-



Every year sees added export trade leaving the port of Montreal.

terial will flop from side to side, and if the parts have delicate portions, or fine adjustments, look out for trouble. In fact pieces such as slides, glass plates, reflectors, etc., should be packed in separate boxes. Excelsior, or the many other forms of packing, are cheap alongside of broken tools, and shattered reputations.

When building a case, make it of sufficiently heavy material. Remember that a box containing a valuable machine of great precision is of no more interest to the laborer or longshoreman handling it, than would be a box of rough building material. Some claim if you mark the case "Handle with Care" that it is assured of careful treatment. As a general rule, little if any attention is paid to such a marking, no matter how prominently it is displayed, or in what language. Use paper between the blocking and painted surfaces in order to avoid, as far as possible, bruising of the paint. Cover all ways of sliding surfaces with waterproof burlap paper, and wrap all shafts in paper of similar nature. Protect all holes, if practical, with wooden plugs, and always place under the top cover a layer of burlap waterproofed paper. Of course, no matter how careful you may be, accidents can happen, but if protective measures are adopted the damage will be reduced to almost nil.

Loose Parts Dangerous

All loose parts which might become unmanageable should be wired in position, or if deemed wise, packed separately. If a machine has a cupboard, it is a good plan to use it for packing small parts. Make sure all finished pieces are flushed or painted with some good nonrust compound or lubricating grease. Brace every part liable to be strained, should the vessel roll, or a longshoreman become careless. Think of the worst not of the best conditions.

Should you have grinding wheels to pack, use lots of sawdust, and on any box where the removal of the cover would cause damage, substitute screws instead of ordinary wire nails. Small boxes, containing miscellaneous parts of a machine, should be so located that they can be removed without disturbing other portions of the packing. Thus, should machines be ordered without certain accessories, the crate, or large box, can remain standard, yet the small box can be eliminated. In other words, make each box a separate unit as far as possible.

Importance Of Checking

Have a careful check placed on all packing work. Make sure that everything is in its place, thus avoiding disappointment and annoyance when the goods arrive at their destination. Standardize the method of making boxes, and have everything so arranged that a new man can, within a very short time, be capable of handling the work. Where a box is liable to stand rough treatment, metal strapping bands help to strengthen it considerably.

The big secret in making export business a success, in the opinion of the Ford-Smith Machine Co., Hamilton, Ont., is to thoroughly understand what you are undertaking. Every country has its own peculiar requirements as to methods of shipping, and these should be carefully studied.

Stencil Plainly

"We make an unfailing practice," says this company, "of stenciling the cases on all four sides, that is, the two sides, and the ends. On every order we get some sort of a simple shipping mark to go by, and in one particular case this took the form of the letters A D S inside of a diamond shaped frame. This shipping mark is easily remembered, and the loaders at the boat can quickly pick it out.

"It pays to spend a bit of thought on how to pack your product. Personally, we devoted considerable study to the matter, with the result that we have our boxes standardized. In these cases every part is well braced. Nothing can rock or chafe on another part with the result that the machine arrives in perfect condition. We paint all polished and machined surfaces with a special rust preventative, and, of course, use waterproof paper inside the case before the outside boards go on.

"Provision has also been made for hoisting hook rings to go through the cases and we do this on all our miller boxes. We have a material list which states all particulars as to size, etc. This means that even a new worker can be sure of preparing a perfect package. We always place band irons around the outside of our export cases."

Without going further into the question of packing, how about the unpacking of a case. Is this important?

Be Careful When Unpacking

To our mind it is, and the more thoroughly a machine is packed, the more care is needed in unpacking, to see that none of the parts are lost.

A case in point. A certain firm wrote a machine tool manufacturer complaining that several parts mentioned on his packing list were missing. After considerable correspondence the parties receiving the machine decided to look at the portions of the case, to make dead sure the missing parts were not there. A search in the boiler room, where the boxing had been burned, disclosed the remnants of the missing parts which had been through the fire. The portions under discussion were shafts packed in a long box, and which were mistaken for blocking timber.

In another case the foreman of a pack-



A British cargo liner—This type is common in almost every port.

ing department traveled quite a distance to prove that the parts which were claimed to be missing had actually been sent. It was treated rather as a joke that he should imagine he could discover the parts after all the search that had been made, but he did just the same, among some packing from another machine.

It pays to have a good packing list at the factory, checked by an inspector who can be depended upon. Then, should complaints come in, you can write the party concerned with confidence, stating he must have overlooked the missing parts while unpacking. In the case of very small pieces, it is sometimes the practice to make the box larger than the size of the parts in order to draw attention to them. The box has even been painted red in some cases in order to attract attention. The more a machine is dismantled in shipping, the greater the danger of parts being lost, or of difficulty in assembling.

Always get proper information as to the conditions and requirements of the country to which you are shipping. By doing so you will avoid both expense and delay. In packing goods for export, remember the long and rough journey ahead of them. If you were going on a journey you would make all due preparations to arrive at your destination in good condition. How much more so then should you see to it that your product, which is after all a part of you, should be so packed as to arrive in perfect condition.

The Buyers' Wishes Should be Carried Out

Based on an interview with F. W. FIELD, British Trade Commissioner in Ontario.

"PACKING GOODS for export is, as experienced manufacturers know, one of the most important factors in the conduct of successful export trade." In this way F. W. Field, British Trade Commissioner in Ontario, summed up the matter during an interview with Canadian Machinery.

"I believe," he continued, "that exporters may with advantage use to a greater extent than at present, the facilities offered them by trade commissioners and other government officers, whose principal duties in the various markets, is to render assistance to manufacturers who desire to cultivate trade in foreign markets. Much useful information as to packing is available in their offices and other data desired can be secured upon application.

"I was told some months ago, of a Canadian government trade commissioner in another Dominion, who made a practice of watching shipments from Canada unloaded at his port, particularly with a view to noting the condition of packages on arrival. In one instance, for example, he found a shipment from Toronto had arrived in broken packages, the damage to the goods being serious. He made a full report to the Toronto firm suggesting certain changes in their packing methods in order to meet the requirements of the ocean voyage and the general handling of their goods. These suggestions were adopted, thus ensuring the receipt by buyers abroad of merchandise in good condition and preventing disputes and claims for damage.

Avoid Damaged Goods

"Complaints are sometimes heard that United Kingdom manufacturers charge for their packages, but it should be remembered that British exported goods, as a general rule, are among the best packed in the world. It is far better to pay a little more for adequate packing, than to have damaged goods. It is sometimes said that certain foreign firms do not charge for their packing. Generally, however, a packing charge is included in their price. British firms frequently state their packing charge in addition to the price of the goods.

"I have seen foreign goods landed in Canada, the manufacturers having stated that no packing charge is being made. The recipients, however, have often wished, upon viewing the damaged condition in which the goods have arrived, that a packing charge had been made and the goods had been properly packed for export.

"During the past winter, I made an official tour of five months' duration, to many of the principal industrial centres of the United Kingdom. A number of plants were visited where I saw the packing of British goods. Considerable care is given to packing by manufacturers and shippers there. This remark applies to both small packages for display in wholesale and retail establishments, and to packages in a large way for export trade. Motor trucks were being packed at plants I visited in a manner which would satisfy every possible demand of ocean and rail journey. Overseas importers may rest assured that the experience of reputable firms in the United Kingdom in packing will guarantee the arrival of goods in excellent condition, and that condition is a great asset to an exporter.

Please The Buyer

"The desires of local importers as to the methods of packing goods should be carried out as far as possible. A chinaware importer, for example, may wish many of the dinner sets purchased to be twelve sets to a withy crate, each set being packed separately, so that the outer crate may be broken and the sets shipped individually from the local establishment without repacking. His wishes should be carried out, otherwise another firm may secure the business.

"Considerable pilferage from packages continues. It is a matter of opinion as to where this happens, but in some cases it is thought to have occurred on board ship. It has been suggested that manufacturers of goods which attract pilferers, who gradually learn the character of merchandise contained in cases of certain markings, should periodically change their markings. Whether the possible saving justifies the trouble involved, or whether other steps can be taken to reduce the losses from this cause, is for manufacturers and shippers to determine.

"The packing and shipping room is one of the most important branches of the exporter's business Upon the extent of the care taken in that room by those responsible for packing the manufacturers goods for foreign markets, depends very largely the success in building up his export trade."

BENEFIT OF CAREFUL PACKING

Mr. Norman Holland of the Holland Varnish Co., Montreal, made a very interesting and instructive statement at a recent meeting of the Canadian Railway Club, when the subject of freight claims was under discussion. Mr. Holland states that his firm, some twelve years ago, decided to pack all their outgoing shipments in the best kind of containers. Their package and box costs are from 60% to 75% higher than most firms shipping similar lines, but the result is that for twelve years they have never had an outgoing freight claim. They further inaugurated the idea of refusing to purchase from firms that did not use the highest grade of packages, the result in this case being that their claims arising from incoming freight have been steadily decreasing until in 1919 they had only one claim. In 1920 and 1921 they had none whatever. These statements may carry more weight when it is understood that the volume of the business handled by this firm has been steadily increasing, until in 1921 it amounted to over one and one quarter million dollars.

MOVABLE HIGHWAY BRIDGES

It is not generally known that fifty movable highway bridges are maintained by the city of Chicago, the different types being as follows: Twenty-four trunnion bascule bridges, twelve centre bearing swing bridges, twelve rolling lift bascule bridges, one vertical lift bridge and one pontoon bridge. Of the trunnion bascule bridges, twenty-two are of the type developed by the city and the others are of the Strauss and Page & Schnable types.

Rapid Holding and Releasing of Gear Blanks

Eliminate Slow Removal of Clamps—Give Cutters and Tools Sufficient Clearance—Holding With Spring Collets of External or Internal Type—Use of the Draw-Back Rod

By FRED HORNER

AMONGST the items that go to make for increased production in gear-cutting is that of the rapid fixing and release of the blanks. The smaller the amount of cutting done per unit, or the greater the tooling is speeded up, so also must the fixing be hastened in order to gain the full advantages from the scheme. Any slow and laborious undoing of bolts, screws, removal of clamps, and the inevitable wiping and cleaning upon their replacement has to be eliminated, and is

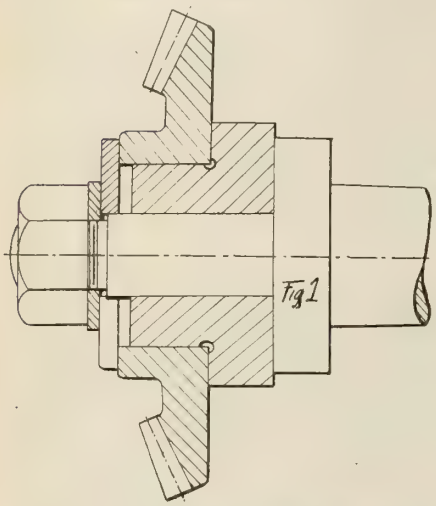


Fig. 1 — Slip washer on ordinary arbor.

only permissible in the case of gears difficult to clamp, or which consume a comparattvery long period in the cutting.

Very often the modified methods introduced with a view to time saving also add to convenience in other ways, such as affording better clearance for the cutters or tools; frequently also, the expenditure of muscular effort is reduced materially, and less damage is done to the holding parts. This latter means a longer life and state of accuracy, ensuring better gears, and less time wasted in rectifying damaged arbors, nuts, threads, washers and bushings. The following notes relate to diverse methods applied to differently-shaped blanks.

The nut and washer mode of holding a blank on a plain arbor not the quickest device, but is of course commonly adopted. A slip washer fitment is not practical unless the blank bore is large enough to pass over a good-sized nut, as in Fig. 1, and then the slotted washer admits of instant placement and removal without troubling to remove the nut and washer. On large ring fixtures for holding gears with a continuous circular clamp, or several oblong ones clearance openings in the one instance, Fig. 2, or slots of sufficient length in the other, Fig. 3, afford freedom for a part rotation to lift the ring clamp off, or to slide the oblong one backwards.

Application of Slip Washer

The most effective application of the slip washer in the case of small diameter gears occurs in collaboration with a handwheel operated drawback mechanism. The projection at the nose of the gear is thus reduced to the minimum, while a powerful tightening effort proceeds from a strong screw located elsewhere. In the Gleason bevel-gear machines, for example, a handwheel with pilot projections is situated at the tail of the spindle, and turns a nut encircling a screw that is prolonged into a drawback plunger. The end of this has a recess turned to receive the slip washer, and so the blank is firmly held, Fig. 4 A. Three variations are also shown, including the flange rear washer B, to square the recessed blank by its back surface, a cone slip-washer C for a small pinion, and a screw nut D for a very tiny size. Although a nut is

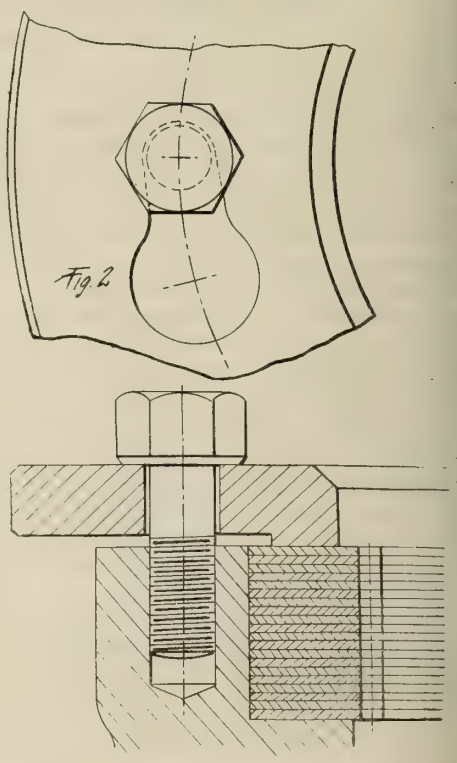


Fig. 2.—Bolt clearance holes in clamping ring.

employed here, it is useless for binding purposes, the tightening being accomplished as before by the pull-back rod.

A considerable proportion of holding is done by spring collets of internal

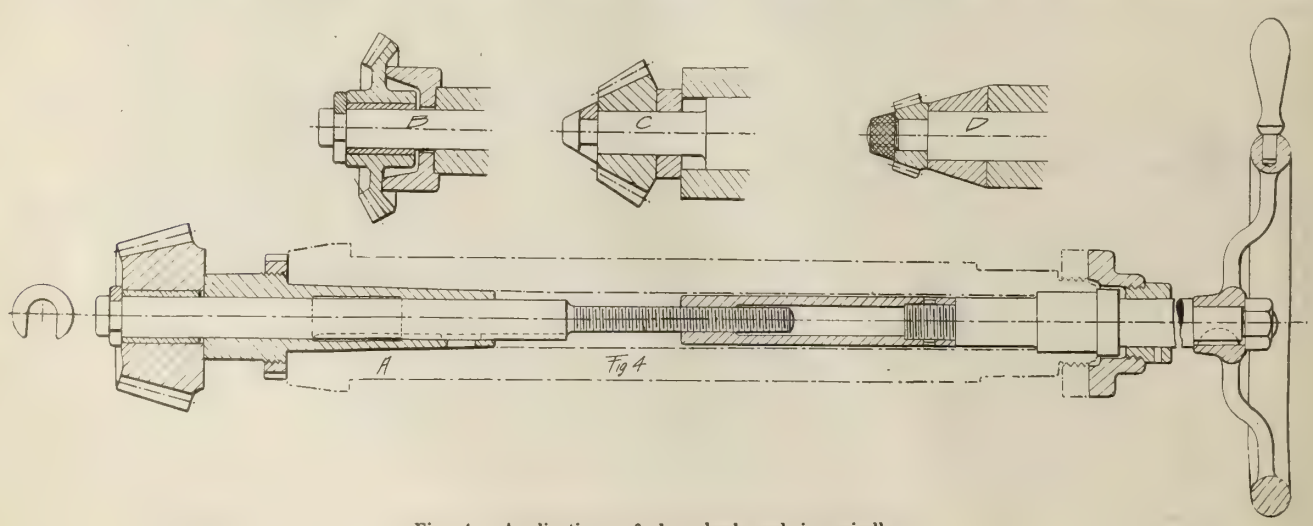


Fig. 4 — Applications of draw-back rod in spindle.

or external type. These, if made and used properly, have the advantage of concentric holding, and a better grip is obtained than that from an arbor or a hole which is not a correct fit for the gear aperture, or its stem as the case may be. Some of the Brown & Sharpe gear cutters are provided with expansion arbors incorporated into the construction of the spindle, after the manner of Fig. 5, and turning the handwheel forces the taper end of the arbor into the split bushing A, and expands the latter in the bore of the blank.

Two other devices for producing expansion, the one with a draw-back rod, Fig. 6, and the other with a nut from the front, Fig. 7, show alternative possibilities, the second idea being applicable to any loose arbor.

Fig. 8 illustrates a lay-out for producing a powerful expansive effect from means located behind the gear, so leaving the front clear for the extension of the arbor into a supporting stem. A similar principle, but applied to gripping the stem end of a gear, is represented by Fig. 9. Accurate centering and a powerful clamping grip are ensured. If a draw-back rod is passed through the spindle, or arbor, a simple fitting like Fig. 10 becomes possible.

Certain machines used for cutting pinions integral with their shafts or for milling worms similarly made, embody in their spindle arrangements a strong collet chuck, with draw-back or push-rod or tube to chuck the shafts accurately. An interesting design of a special character may be noted in this connection, from a worm miller constructed by Messrs. David Brown & Sons, Ltd., Huddersfield (England). One end of the worm blank is gripped by the collet chuck, while the other end runs in a roller steady.

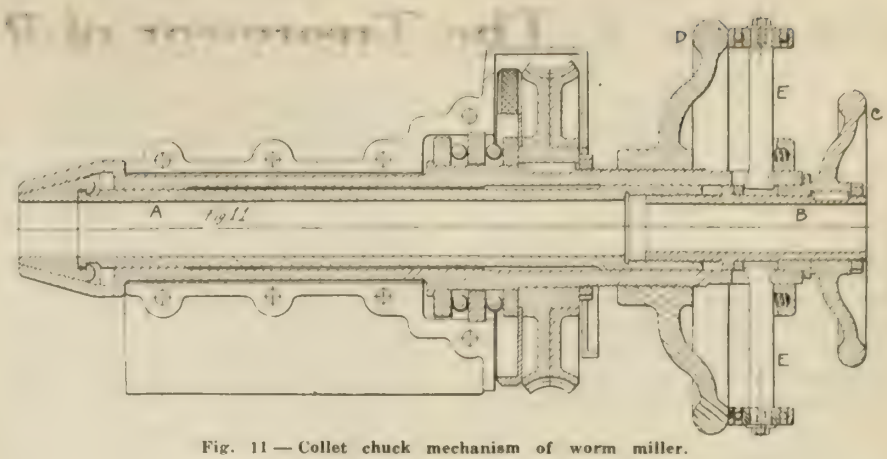


Fig. 11 — Collet chuck mechanism of worm miller.

The collet is contracted by end movement of the tube A, forced along by the rotation of the operating sleeve B, turned by handwheel C. Then a great increase of pressure is given by turning wheel D, which screws its way along and actuates two toggle levers E, E, the lower ends of which press against a hardened steel collar which transmits the pressure to the sleeve B. Ball collars on the ends of the toggle levers provide for the tightening taking place with the least friction.

To a moderate extent the principle of simultaneous tightening has been utilised, that is, several spindles contain draw-back rods or contractile collet de-

(Continued on page 46)

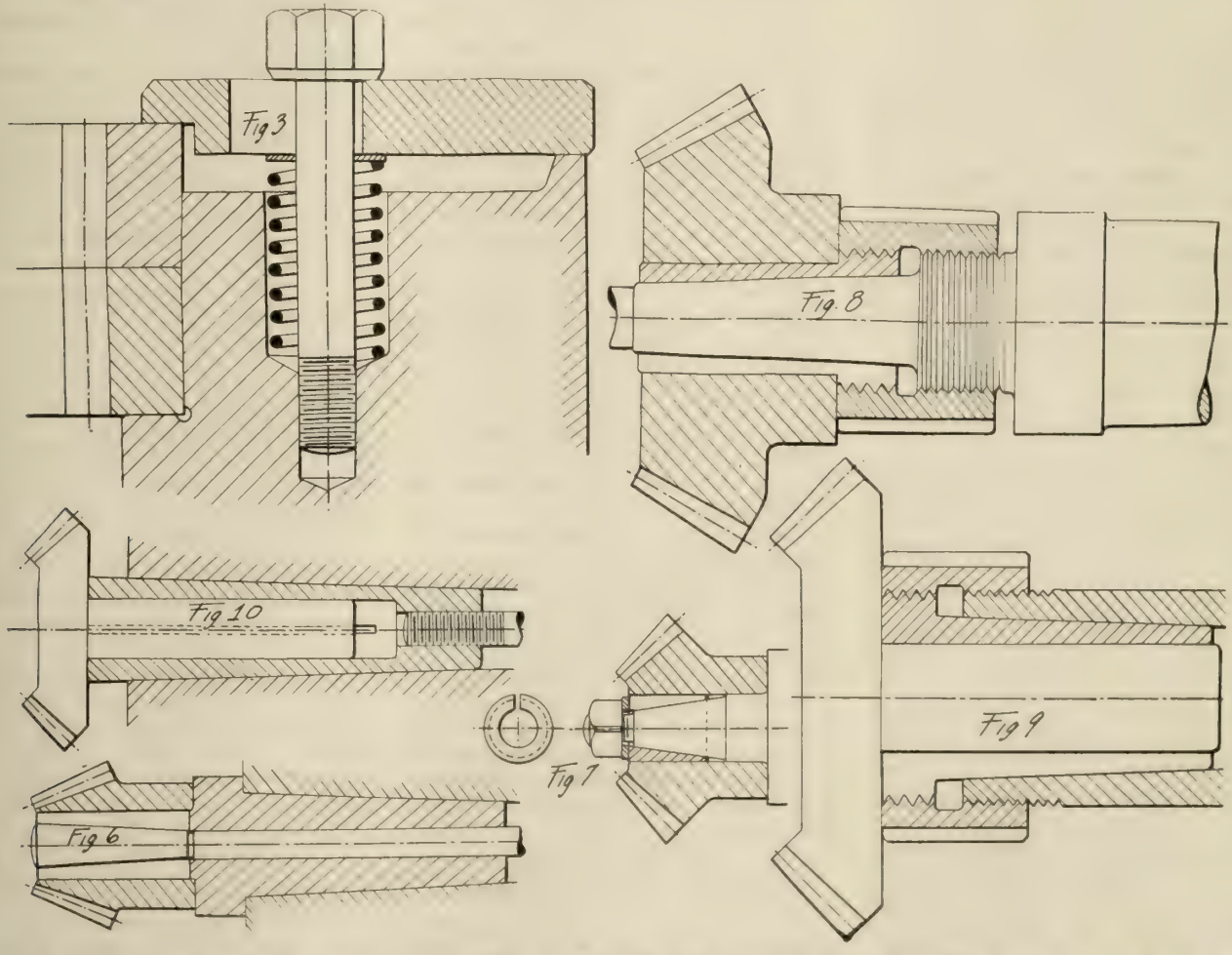


Fig. 3 — Sliding clamp for holding internal gears. Fig. 8 — Expanding bush operated from behind blank. Fig. 10 — Collet contracted with draw-in rod. Fig. 6 — Split arbor and draw-back rod. Fig. 7 — Expansion bushing. Fig. 9 — Collet actuated from rear of blank.

The Treatment of Refined Oil Distillate

Removing Wax by Cooling—Treating Lubricating Oils—Making Pitches and Asphalts—Production of Still Gas—Storage—Protection Against Fire—Machine Equipment Necessary

By C. D. DEAN, A.M.E.I.C.

IN the Jan. 26 issue, we discussed the selection of refinery site, style of boiler plant used, and power requirements. Then came the first distillation process, the cooling of oils, treatment of distillates, and so on. Next we will proceed to go into further treatment necessary.

Treatment of Refined Oil

The treating of refined oil distillate is similar to that for naphthas, except that this is always batch in a loose top cone bottom agitator. The reason for this is that the oil has some viscosity and it is difficult to get an intimate mix of chemicals and oil without violent agitation. This agitation is secured either by blowing with air or by circulating through a pump. Blowing with air means large losses; circulation with a pump means longer time and therefore large investment, but at the present time, both systems are in use. If, however, the oil contains large quantities of sulphur, blowing must be resorted to in order to get efficient chemical action.

After treatment and neutralization, the kerosene distillate is charged continuously to a battery of re-run stills which are, as in the case of crude stills, of about 1000 barrels capacity each using bottom steam. With these stills use is made of vapour heat exchangers and towers, as well as oil heat exchangers and coolers for the residual bottoms. The condensation in the vapour heat exchanger and the tower is removed through separate cooling coils, while the vapours passing the tower are conducted into a worm. From these stills is taken a gasoline cut and refined oil as well as what is known as a re-run cut for a retreatment and re-distillation and the bottoms go to fuel oil.

There are many specifications for gasoline and refined oil, but in operating in the refinery the former is run for boling points, while the latter is run for flash and viscosity which in a measure are imperfectly related.

The lubricating distillate contains the waxes or at least most of them, and before it is ready for finishing and treating, this wax must be removed. Present day practice involves the cooling by refrigeration of the whole distillate to between 32° F. and 0° F. and forcing the distillate under about 1000 pounds per square inch through filter presses where the wax crystallizes out and allows the oil to drip through. In cooling the distillate, it is fed through chilling machines, which are a series of long pipes, in which screw conveyors work to prevent the wax from adhering, and around which the brine is circulated. It requires a press for every 200 to 250 barrels of distillate and about 25 tons of refrigeration per press. After the press is full of wax, the filter plates are loosened and the slack wax drops into a hopper with a conveyor in the bottom, where it is broken up into small blocks and discharged into rundown tanks. In the rundown tanks the wax is melted and heated to quite a high temperature when it is pumped to the wax sweaters.

Slack Wax

The slack wax contains about 50 per cent of its volume as oil, which must be removed before the wax is ready for treating and finishing into commercial articles. Wax sweaters consist of two sets each, consisting of a series, usually 12 to 24 shallow pans, one above the other carried on a frame work and enclosed within a brick or concrete building. The building has no windows, but both ends are almost completely doors, and the roof has ample adjustable ventilating openings, while the sidewalls are covered with steam coils.

In each pan is installed a closed coil on top of which is a screen of about ¼ inch mesh, although coarse sand is sometimes used. Each pan is filled with cold water up to the screen, and on top of this is pumped the hot slack wax, after which cold water is circulated through the coils if necessary to cool and solidify the wax. After the wax has become solid enough the water is run from each pan to the sewers and the doors and ventilators are shut, after which the steam is turned on in the building which heats the air and allows the wax to soften sufficiently to allow the entrained oil to filter through to a pipe line that carries it to the pressed oil tank where the oil, which escaped from the presses when the wax was being pressed out, is stored preparatory to being transferred for further treatment.

After the oil has been sweated out steam is turned on in the coils within the pans which melts the wax and allows it to run down a separate line into what is known as a rundown tank building, which is plentifully supplied with steam coils. From this building the wax is fed to the wax treating plant, where it is filtered through Florida clay to eliminate the colouring matter and is then sent to the candle works where it is moulded into candles and other shapes for consumption.

Reducing Department

The oil from the wax presses is delivered to the reducing department, where it is distilled in reducing stills either continuously or batch. These stills are never run down to coke and all the overhead distillates are closely fractioned into the various grades of lubricating stocks. The oils all carry considerable viscosity and they are allowed to issue quite warm from the ends of the worms, from 125° F. on up, depending on the viscosity. The bottom is the very high viscosity oils which at temperatures little below boiling temperature would flow very sluggishly, and it is termed a bottom product. As cracking, which destroys viscosity, is to be eliminated, great quantities of steam are used, about one pound for each pound of oil overhead, which must be disposed of and in order not to make it necessary to install too large a worm the steam is withdrawn from the worm after the oil has become liquid by a light suction induced by a jet of water.

When the stills run continuously, an effort is made to conserve heat by creating a suction through an exchanger, where the steam gives up some of its heat to the ingoing charge.

The lubricating distillates, including the bottoms, are transferred to the treating plant where they are treated to remove objectionable matters of various kinds which are due to the insaturated compounds.

The treating is done in agitators which are equipped with closed coils running up and down adjoining the interior of the shell vertically. After charging, the steam is turned on and the batch is heated up to reduce viscosity and the acid dumped in successive doses, while the whole is agitated violently for some hours by an excess of air. The acid heat and the heat from the coils serves to allow the sludge to settle out, when it is drawn from the cone bottom of the agitator into either an acid coke pit or cooking kettle.

Treatment of lubricating oils sometimes necessitates as much as 50 pounds of acid per barrel of oil and there is a great deal of sulphuric acid left in the sludge and in a sludge coke pit; this is allowed to fester and drop out as coke, which can readily be handled and burned. With a cooking kettle, however, live steam is turned in the mass which separates the uncombined acid and the coke and this uncombined acid is pumped to the acid restoring plant and the coke, which is much less in amount in this case, can be handled and burned.

The treated oil in the agitator is now transferred to a wash tank, which is about double the capacity of the agitator, and which is jacketed and equipped with both open and closed steam coils. Here the oil is thoroughly washed with hot water about 180 degrees F. and as the oil has been heavily treated, larger quantities must be used. After treating and washing the oil is neutralized

with a soda solution and again washed with large quantities of hot water. The batch is then left in the wash tank and is maintained at a high temperature by the steam coils to permit the water to settle to the bottom. After all the water has settled out that can be eliminated in this way, the oil is transferred to a bleacher which is a tank, contained within a building, and in which is a large steam coil as well as air blowing coils. In the bleacher the oils are blown bright, i.e. the moisture is all eliminated, and are then transferred to the stock tanks, either for shipment or for filtering through clay to remove soapy substances that attract moisture and that in certain services would be deleterious.

Pitches and Paving Asphalts

One of the modern developments in the art of refining, which is growing enormously, is the production of pitches and paving asphalts from asphaltic base crudes, which in America come from California, Texas or Mexico.

This distillation is conducted batch in 1000 barrel stills, the condensers of which have large worm capacity. For certain crudes comparatively low in asphalt or pitch content, the stills are equipped with one or more towers for fractionation, but when the asphalt content is comparatively high these are not used. Mexican crude is the only one that the writer knows of that is used in Canada for the production of asphalts.

The various light oils come over successively and depending on their boiling points comparatively close fractionation can be arranged in the tail house on the basis of gravities. The present practice is to produce asphalts as a bottom product, that is they are not driven overhead, on account of the high temperature necessary to do this. The steam serves the purpose of preventing the rise of temperature and thereby prevents the cracking of the bottoms, and asphalts can be produced that will have a minimum of carbon content.

The steam is drawn from the worms beyond the point where the oil has condensed and is condensed with a water jet in a sealed chamber from which the still gas escaping with the steam is pulled by exhausters and burned beneath the stills. In order to cheapen the cost of operation, insofar as the use of bottom steam is concerned, some California refineries use vacuum stills operating at from 24 to 26 inches of vacuum, and in addition introduce small quantities of steam which if properly distributed facilitates circulation and thereby prevents local heating.

High melting asphalts are produced by blowing air through the bottom, as it lies in the still and a slow fire is maintained beneath. It is claimed that the effect of the air is to oxidize some of the hydrogen in the chemical structure of the pitches producing the higher in the series with consequent raising of the melting point and the other physical characteristics that go with this. It may be mentioned that about 500 cubic feet of free air is required per minute per still for oxidizing purposes.

Distillation under Pressure

In the early days of petroleum refining the effort was made to produce all the refined oil, fuel and lubricating stocks that the crude would yield and waste the light fractions, now in such demand, and a good crude was considered to be one in which the percentage of fractions lighter than those permissible in refined oil was low. The development of the motor car, truck and tractor has radically changed the situation and crude oils are now valued, very largely on the basis of their gasoline and lubricating oil content. It was quite natural to expect that with a knowledge of the fact that crude oil can be cracked at atmospheric pressures in a coking still, an effort would be made to see what advantage would lie with distillation under pressure.

Several patents in this direction were secured very early when the demand for gasoline showed evidence of exceeding the supply, and there are a few that are being commercially used on a large scale by big refineries in the United States and Canada. There is an immeasurable host of patents of this kind appearing every month, but they are mostly mechanical deviations from the existing apparatus and depend for success on the same principles on which all are based.

The first principle is that oils suffer a redistribution of molecular structure when raised to their critical temperatures and the heavier fractions have critical temperatures lower than those for the lighter fractions.

The second principle is that as pressure is made use of to get the higher temperatures it is necessary to produce a fixed gas as well as condensible vapours in the still in order to hold pressure.

Probably the most successful apparatus in use is that covered by the Burton patents now owned by the Standard Oil Co. (of Indiana) and licensed to various companies in the United States and Canada. The stills use a gas or fuel oil of 30 to 35 gravity, as charging stock which contains comparatively heavy fractions, having little or no lubricating properties and which would ordinarily reach the market as fuel oils. They are charged batch and run semi-continuously at about 96 pounds gauge pressure and have a capacity varying between one and two hundred barrels each per day. Approximately 50 per cent. of 50 gravity distillate is taken off overhead and the bottoms are about 22 to 26 gravity. There is a loss of about 3-½ per cent. in operating which is nearly all gas. These stills sometimes have quite complicated overhead fractionating equipment to knock down for recracking the heavier vapors as there is a rise in still temperature occurs of about 100 degrees F. during a run as the gravity of the bottom increases.

The fuel consumption is about 1-8 of the charge if liquid fuel and the fixed gas produced is around seventy-five cubic feet under standard conditions per barrel charged. The still temperatures vary from about 640 degrees to 740 F. and the flue temperatures are around 1200 degrees F. The latest practice is to install steam superheaters in the flues to supply superheated steam to the various continuous and reducing stills using bottom steam.

The distillate is treated either continuously or batch, similar to the method of finishing crude naphtha and is then distilled continuously either in fire stills or steam stills and yields gasoline, refined oil and a residual bottom which is gas oil.

The general refinery production of still gas, which will average probably about a hundred thousand feet per 1000 barrels per day, is usually burned in the refinery although instances in the United States are not rare where it is sold to gas companies direct as enrichment for water, gas, etc. In refineries a very elaborate system of exhausters and gas lines is installed to dispose of it and when the production is large with wide fluctuations in the rates of production, as sometimes occurs, gasometers are used to prevent loss.

The still gas is usually found to have a heating value from 1000 B. T. U.'s per cubic foot to as high as 1800 B. T. U's per cubic foot, depending on the amount of gasoline vapour carried. Modern practice now calls for absorbers to extract the vapours from the gas which is usually done by forcing the gas after cooling, under low pressure through towers in which a menstruum of gas oil or any other similar heavy oil—the initial boiling point of which is considerably higher than the final boiling point of the absorbed naphtha can be—is trickling. It is ordinarily found that the menstruum will absorb about 10 to 11 per cent of its volume as naphtha and a gas that will yield one Imperial gallon per 1000 cubic feet is considered to pay for the extraction. The menstruum with entrapped naphtha is steam stilled under about 15 pound gauge pressure and the recovered naphtha, after treatment, is mixed with the current production of naphtha. On steam stilling, it is found that a loss of about 5 per cent. of the volume of the menstruum occurs, i.e. this amount goes overhead with the naphtha.

Storage

Practically everything including waxes and asphalts—but of course not coke—is stored in tankage and handled by pumping. The tankage is all steel and varies in size from 5 ft. diameter by 10 ft. high, having a capcity of 35 barrels to 120 ft. diameter by 40 ft. high, having a capacity of 80,000 barrels.

The tanks are designed for a stress of 20,000 pounds per square inch on the net area of the shell, when full of water, but no plate in the shell or bottom is less than ¼ inch thick, generally speaking.

the bottom is made of 3-8 inch steel and the roof plates of 3-16 inch material. The roof is designed to carry a wind and snow of 30 pounds per square foot and while the practice of a few years ago was to install truss roofs quite extensively, the present practice is to use I beam supports, bolted at one end and free to slide on the other to take care of tank distortion, due to settlement of the foundation or varying elongation of the materials with differing oil heights.

Tanks varying in capacity from 20,000 barrels to 80,000 barrels weigh about 9 pounds per barrel, while for tanks from 10,000 barrels to 20,000 barrels the weight of steel per barrel is about 10-¼ pounds and for tanks from 5,000 to 10,000 barrels the weight is about 12-½ pounds per barrel.

The space occupied per tank is quite variable, but very roughly follows the plan of allowing one square foot of ground per barrel capacity. The deviations from this rule are frequent however, depending on the shape of the tank lot and local regulations, if there are any. As far as possible, for light products, i.e. gasoline, refined oil, fuel oil and crude, the tanks are surrounded by dykes—built high enough to hold the contents of the tank should disaster occur, but there is a rule restricting the height of the dykes to 6 feet, and it is adhered to quite religiously on account of the need for accessibility for hose reels, etc.

For certain heavy products, such as heavy crude oils, fuel oils, lubricating oils, waxes and asphalts, the tanks are equipped with very elaborate heating coils, the surface of which is designed on the basis of the highest expected pumping rate, and in addition, certain lubricating tanks and all wax and asphalt tanks are jacketed with four inch hollow tile jackets to conserve heat and assist in maintaining high temperature. Every tank is equipped with two or more water draw-offs, in the shell near the bottom, which are arranged so as to remain full of oil after the water has been withdrawn from the tank. In tanks 25 ft. in diameter and larger, two manholes are provided, one on the roof and one on the shell near the bottom.

The oil lines are connected through the shell either at the top or the bottom. The top connection is favored by some people, as line breakage does not involve the loss of the contents. It does, however, mean a continuous maximum pumping head and the bottom connection on this account is generally used. To safe-guard as much as possible against loss from line breakage, the line inside the tank is on a swing either by using a specially constructed valve or by using two wells so that the entrance of the pipe can be raised above the oil level.

The oil lines are all screwed steel pipe and are made large enough to give a total head for a refinery on level ground of from 65 to 75 ft., i.e. when centrifugal pumps are used, but for asphalts, waxes, etc. the pumping heads vary, although initial starting pressures greater than 100 lbs. per square inch are not favored. In general for all important inter-refinery process pumping, no line is made less than 6 inch. Process pumps, motor driven, are either centrifugal driven by constant speed motors, or triplex single or double acting, or some of the patented positive displacement pumps driven by variable speed motors. In pump-houses, which are located in carefully selected locations and are as few in number as possible, the pumps and motors are separated by brick walls as an additional protection against fire. For certain purposes, such as pumping waxes and asphalts, etc., no motor driven apparatus can be used, because the power required at starting is several times that required after the volume of oil in the line gets moving, and it is usual to put in a high ratio duplex steam pump for this work, as the exhaust steam need not be wasted.

Fire Protection

Fire protection is an important consideration in an oil refinery and large expenditures are made to provide fire fighting facilities on an elaborate scale. All tanks are equipped with 2 in. steam fire lines, which enter in two places on a diameter near the top and which during thunder storms are opened. If steam enters a tank and displaces the air, the risk of fire is nil, but after an explosion if the roof blows off, and it nearly always does, steam is comparatively useless. During the past five years a new system of fighting oil fires has been developed known as chemical foam and there are three commercial foam formulas in use now.

The foams are mixed right at the tank in a mixing chamber either within or without and when discharged on the surface of burning oil act as a blanket. The protection required per tank is difficult to estimate and is usually based on judgment. A conservative figure is that about three feet of foam per tank will be needed which is equivalent to about three gallons of solutions per square foot.

Current practice does not call for the installation of foam storage, totalling the whole risk, and it is customary to provide storage for, roughly, 10 per cent. of the tank risk. The foam making solutions are kept in separate tanks until required. In all the foam making formulas, the acid solution consists principally of 10½ to 12 per cent. by weight of aluminum sulphate and 85½ to 89 per cent. of water. The soda solution consists of about 8 per cent. of sodium bicarbonate and 89 to 91½ per cent. of water. These produce the carbon dioxide and the other ingredients to produce the bubble for containing the gas, differ.

In the first one, glue, glucose and arsenous oxide are added to the soda solution. In the second, foam powdered extract of licorice is added to the acid solution, while in the third foamite is added to the soda solution. The first two are not used much for new installations, as the bubble material deteriorates rapidly. In all cases, the expansion by mixing is about eight to one when fresh solutions are used, but ordinarilly refinery storage solutions will give an increase of about 6½ to 1.

To cover a refinery risk means quite an extensive network of lines, as well as powerful pumping equipment, and it may be noted that foam hydrants are located at strategic points to permit the use of foam an other risks besides tanks.

Probably the most expensive fire fighting apparatus consists of the usual water protection. This consists of the well known hub and spigot pipe which in refinery work is all class "C" and powerful pumping equipment with boosters wherever necessary. It is the aim to provide for at least 12 standard 2½ inch hose at the farthest point in the fire lines. The use of water in oil fires is simply to keep surrounding apparatus and tanks, buildings, etc. cool during the progress of a fire to prevent, insofar as this means will, the widening of the fire area.

Railway Trackage and Wharf Facilities

The amount of trackage required at a refinery varies considerably and depends on the percentage of the crude and finished products that will be moved by rail, as well as the amount of tank car storage space desired for seasonal variations in the movement of finished products. A rough figure of trackage requirements is about a half mile per 1000 barrels of crude daily, but for plants located on water it will be very much less than this.

Tank cars for use in the transportation of oil are built in accordance with the American Railway Association's specifications for carrying inflammable liquids, whose vapour pressure does not exceed 10 gauge at 100 degrees F. If however casinghead naphtha is to be moved, Class IV tank cars must be used.

Wharfage facilities for plants erected on navigable waters, are, as far as possible, pile structures with deep water surface, approximately 400 ft. long and arranged for a boat draft of 20 feet in fresh waters and 30 feet at low tide in sea waters.

The deck loading is figured at about 400 pounds per square foot. For certain sea locations, particularly in South America loading and discharge of steamers is done through undersea lines, which sometimes are laid a mile out before sufficient depth of water for boat draft is reached. The end of the pipe line is either a hose supported on an anchored float or a small deck protected by pile dolphins. Such lines have a life of about four years.

Repair Shop Equipment

As mentioned previously, a very large part of the expense of refinery operation is due to the excessive repair work necessitated by the severe punishment that distilling

Continued on page 46

Grain or Flesh Side for Leather Belting?

Tests Made to Ascertain Transmission Efficiency—Horse Power Reading Taken While Running—Stretch May be Annoyance But It Protects Both Belt and Machine—Grain Side Favored

THE QUESTION of whether a leather belt should be run with the grain or flesh side next to the pulley has been, until quite recently, in the same category as the old saw: "How old is Ann?" From the time when leather belts were first used for power transmission until the present, men have argued the matter pro and con without having any definite facts upon which to base their opinions or any more really concrete evidence than that of individual observation. The very natural result has been as many opinions on the matter as there were men to voice them.

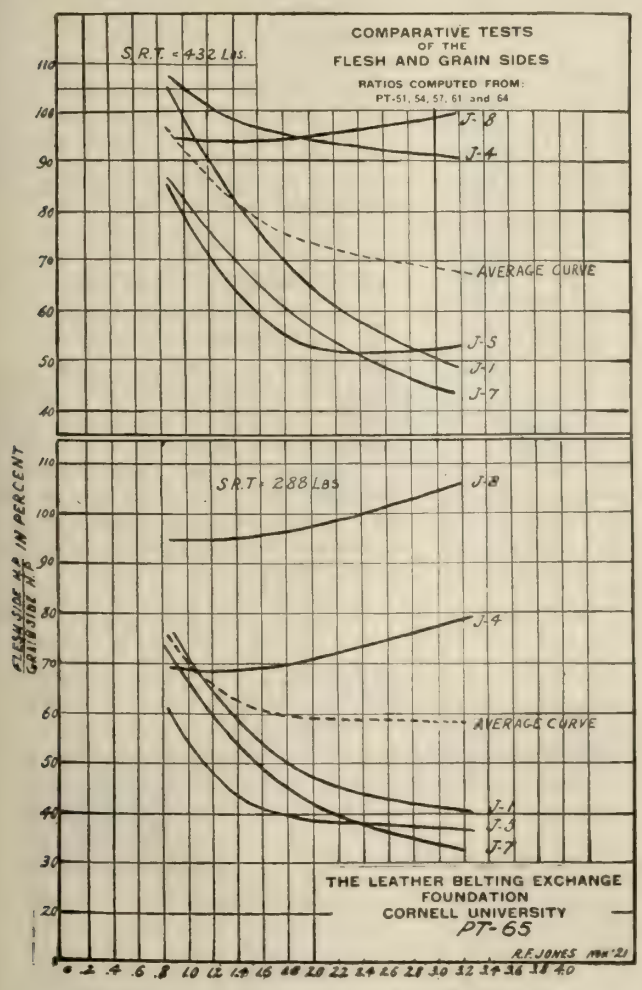
It appeared to some men that a closer contact with the pulley could be had by putting the grain side of the belt next to it. Others have contended with equal conviction that the flesh side, being tougher, was better able to withstand friction. And still others have gone into the realm of metaphysics for their argument, maintaining stoutly that a wise Providence had placed the flesh side of leather next to the animal deliberately and it was not for man to reverse that order on a pulley. But speculation on the matter is at an end; scientific experimental evidence has been obtained to settle the controversy once for all.

During the latter part of the past summer, tests of the capacity of the grain and flesh sides of leather belts were begun by the Leather Belting Exchange in its research laboratory at Cornell University. They were under the direction of Mr. R. F. Jones, director of the laboratory. Covering a period of more than two months' continuous tests were run on the testing apparatus belonging to the exchange, which is being operated under the supervision of Cornell University, using five 4-inch single belts, 30 feet long, of different manufacture. They weighed from 16 to 18 ounces. Every effort was made throughout the tests to standardize conditions and to reduce the probable error to a minimum, and this unquestionably was accomplished. All five belts were run long enough previous to the experiments to have been thoroughly "run-in," and had reached a condition of constant capacity when the records were taken.

Method of Testing

The method of procedure was to take horsepower readings from the belts first when running on the grain sides, and then when running on the flesh, the power being gradually increased until about 4 per cent. slip had been reached.

In considering the results, it must be remembered that a leather belt is at its lowest point of capacity when new, largely because of the elasticity of the leather and the newness of its surface. Leather belts are well stretched in the process of manufacture, so that when the belt is put on the pulley there may be as little stretch as possible consistent with thorough lubrication and retaining the natural life or elasticity, which is such a valuable property of the leather belt. When a new leather belt is placed on the pulleys, however tightly, it will elongate under load. But after the tension of the load has been removed it returns very nearly to its original



This chart shows curves computed from different ratios.

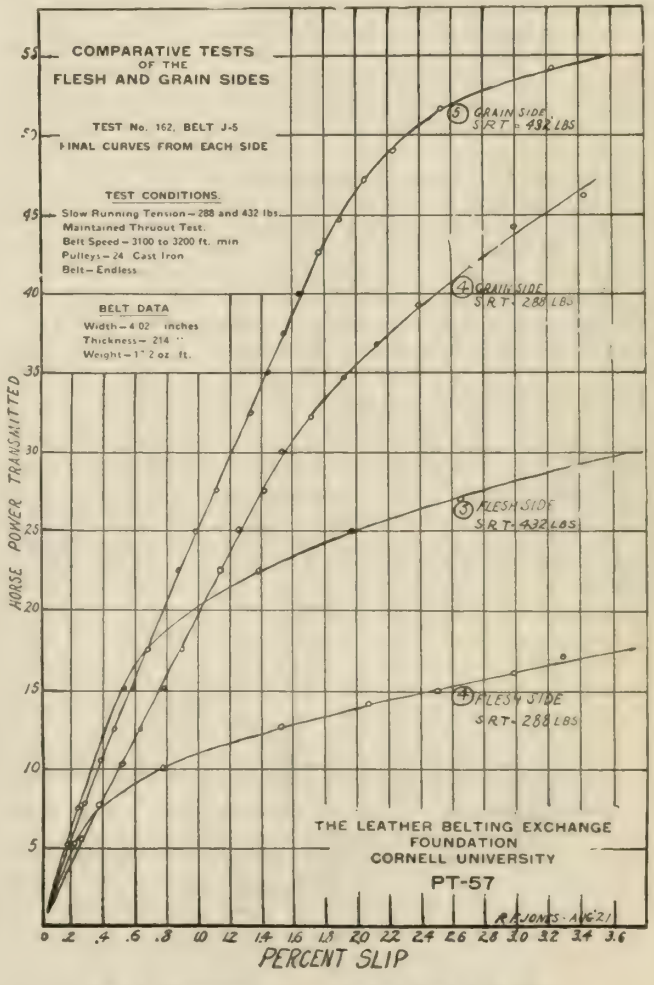


Fig. 1.—Showing the final curves from each side.

length. This stretch is an annoyance when installing a new belt, but it is of the nature of a safety valve, protecting both belt and machinery.

The newness of the surface, however, makes it necessary to "run in" the belt when testing it. That is, to run it for a sufficient time to permit the belt to attain its maximum capacity in transmission. As an illustration, one belt under test at the laboratory transmitted 12 h.p. when first put on the pulley at a slip of 1.2 per cent. After five hours running it reached 19 h.p. with the same percentage of slip and the same tension. At the end of 13 hours it transmitted 24 h.p., and reached 31 h.p. after 20 hours with a slip of 1.6 per cent. According to horsepower tables, its scheduled transmission should have been 26 h. p.

Summary of Results

Inasmuch as the belts in these tests seemed to be typical, and the apparatus at hand was such as to give the most accurate readings of performance, it is safe to conclude that the results are scientifically acceptable. To review the details of each individual test would require more space than is here available. Suffice it to say that a summary of all of the results is clearly in favor of the grain side from the standpoint of power transmission. In fact, it may be concluded from it that under reasonable shop tension, the flesh side will average only 50 to 60 per cent. as much horsepower as the grain side. At higher tensions the flesh side will do better, averaging from 50 to 100 per cent. as much power as the grain, depending upon the belt, the tension and the conditions of service.

A curve plotted from the readings taken when the belts were running on the flesh side is similar both in shape and capacity to that given by many of the leather belt substitutes. All that can be said of the test belts run on the flesh side is that the data obtained from them were more uniform than that taken when they were running on the grain.

Using the horsepower transmitted and the percentage of slippage as the coordinates, on chart at Fig. 1, which is representative, the grain tests showed an almost curveless gain in horsepower up to 53, when the slip reached about 3 per cent for belts running at a slow running tension of 432 pounds. In the case of the test belts operated at a slow running tension of 288 pounds, the 3 per cent. slippage was reached at about 44 h.p. With the belts running on the flesh side, however, the 3 per cent. slippage mark was reached at 28 h.p. when operated at a slow running tension of 432 pounds, and at 16 h.p. when the tension was 288 pounds.

In short, the evidence produced from the mass of data obtained leaves no reasonable doubt but that there are distinct advantages in power transmission to be had from running leather belts on the grain side. It is simply another case where scientifically obtained evidence must outweigh arbitrary opinions held usually by reason of personal and, oftentimes, inaccurate observation. It would seem to indicate that all those who have held the flesh side in favor in years past would do well to readjust their opinons, and if there be any alive today who are still determined to bring Providence into the discussion, they must find some providential reason for putting the flesh side of leather next to the animal and the grain side next to the pulley.

TREATMENT OF OIL

(Continued from page 44)

and treating apparatus receives in service. On this account, mechanical shops, having carpenter, machine, boiler, blacksmith and pipe departments are a regular installation.

The customary equipment for the carpenter shop is a bandsaw and planer, and for pattern work a wood lathe is useful. The machine shop equipment preferably consists of two lathes, a planer, two drills, a tool grinder and bolt cutter, as well as the miscellaneous small tools, incidental to a well equipped machine shop, plate rolls to handle plates up to 16 feet wide are used, although some situations can be cared for by 12 ft. rolls. In addition, a power operated punch with at least a 36 inch throat and fitted with a shearing device is a necessity, as well as a full complement of air drills, hammers, etc. The blacksmith shop should have a steam hammer, as well as the usual hand forges, etc. The pipe shop should be equipped with two pipe machines, one to cut and thread pipe from ½ inch to 4 inch and one to handle up to 16 inch O. D. pipe, and in addition, the usual complement of hand tools for cutting and threading up to 4 inch pipe should be available for use outside the shop.

Tank cars require regular repairs, and these together with the repairs incident to refining necessitate a storehouse of ample capacity, fully stocked with standard hardware and equipment specialities, as well as brick, lime, cement, etc.

It is rather difficult in an article of this kind to cover matters in as great detail as perhaps the importance of the subject justifies and in case anyone is further interested in petroleum refining and wishes to read an authentic publication, no better selection can be made at the present time than Bacon and Hamor's American Petroleum Industry.

DRILLING AND BORING MACHINE

The Manufacturers' Consulting Engineers of Syracuse, N. Y. have designed a machine that simultaneously drills three holes and bores a fourth in each end of an automobile crank case at one time. This machine, in one operation, does the work formerly accomplished in three, and the bed is supported on floor legs and carries its own electric motor. Two sliding heads are provided, each carrying three drills and a boring head. The number of drills and the tooling can be altered to suit the job in hand. The heads are located at opposite ends of the bed, the work clamped between them. One lever actuates both heads, and by means of this lever the heads are fed towards the work, the arrangement of feeding being somewhat similar to that of a sensitive drill.

RAPID HOLDING AND RELEASING OF GEAR BLANKS

(Continued from page 41)

vices, and a single lever motion operates the set with one movement. Another inception imitates the continuous millers, there being a turret base to hold sa two batches of four blanks, one batch being cut while the other set is swung out and removed, and fresh blanks put on. Thus there need be no interruption to the cutting.

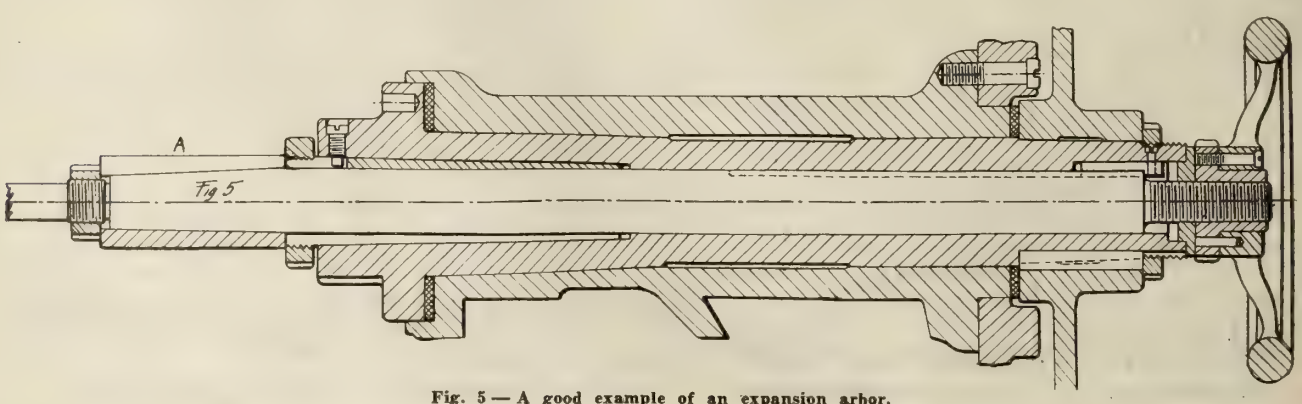


Fig. 5 — A good example of an expansion arbor.

Economy, Conservatism and Efficiency Needed

Trend is Towards More Stable and Active Conditions—Improvement Will be Gradual—Mercantile Business in Better Shape—Obstacles in Reducing Costs of Production

By HERBERT P. HOWELL
Vice-President of National Bank of Commerce.

THE PRESENT business situation is distinctly a two-sided proposition. There is much in it to be encouraged about. There is also much to be regarded seriously. Either an optimist or a pessimist can cite plenty of facts to support his case. We have had many exponents of both schools making out plausible cases. One may study the situation and find grounds for declaring that no great financial problems remain to cause anxiety. The other may look at events from his point of view and find justification for his fears that grave difficulties still confront business.

Both are partly right. But I have no hesitation in asserting the conviction that the favorable factors outweigh unfavorable ones. We are not going to have another great and rapid revival of business such as the optimist might feel justified in hoping for. But we can unhesitatingly count on a continued gradual trend of developments toward more stable and more active business conditions.

Business was in far better shape at the end of 1921 than at the beginning. It will be in better shape at the end of 1922 than it is now. In net results 1922 will be a better year than 1921. We might qualify this statement by saying 1922 will be better, provided business men as a whole continue to act sensibly. We might say that developments will be favorable if economy, conservatism and efficiency rule in business, rather than efforts at stimulation and expansion.

Business Not Speculation

But it is not necessary to make that qualification in words. It is inherent in the facts of the situation. Conditions are such that economy, conservatism and efficiency will prevail in business because the pressure of circumstance compels observance of these measures. Business that tries to run ahead of the conservative progress of the times toward normal will be liable to disaster. Efforts to spread out will bring disappointment and failure. Lucky individuals may run ahead of the game for special reasons. But as a rule 1922 will be a good year for remembering above all that business is business and not speculation. During the boom, business had to speculate despite itself due to the rapid change of circumstances. Rising markets often made it unsafe not to go long without materials. Failure to expand under conditions then existing seemed like turning one's back on opportunity. But that is not true for 1922. Undue stimulation and expansion simply will not work this year. The market will not take them.

Profits can be made and success can be established during 1922. But they must be built up by means of economy and efficiency within the bounds of conservative business operations. A lower turnover is inevitable. There is a rigid price resistance from the ultimate consumer that must be accepted. Therefore, profit margins in business must be effected by economies in production costs. There are definite reasons for the statement that the improvement in business during 1922 will be gradual. Enough favorable aspects are obvious in business to encourage confidence, but not to warrant any relaxation in vigilance and care.

Banking Situation

Foremost among favorable factors in the general situation is the condition of banking. Fear need not be felt regarding the ability of worthy businesses to command adequate banking facilities and at reasonable rates. The banking situation is strong because the underlying conditions upon which the structure rests have been strengthened. At the opening of the year 1921 bank credit was characterized by inflation, nonliquidity and widespread insecurity. During the course of the year there has been a material reduction of nonliquid and unsound credits.

There has also been considerable reduction in the total volume of credit in keeping with the progress of liquidation, falling prices and reduced business activity. There is more gold than the country needs as a basis for its credit structure, and there must be no disposition to inflate credit on the basis of this gold. The high reserve ratios caused by the presence of this huge gold supply must not lead us into easy credit and unsound money policies. The very bulk of our gold reserves emphasizes the warning that the operations of sound business, not the ratio of gold reserves, must remain the basis consideration in credit extensions. The more healthy conditions in the investment money market make it possible for commercial banking to adhere to strictly commercial business. Investment funds are available for long time requirements. The banks are free to take care of current needs as is their function. Thus in all major aspects the nation's banking system is in an unusually strong condition.

Inventory Valuations

We can also feel that mercantile business is in far better shape at the end of the year than at the opening of 1921. There has been a widespread adjustment of inventory valuations. During the boom many ill-conceived businesses sprang up and flourished due to easy conditions for success. A horde of speculative middlemen came into being. The more rigid competitive conditions of the period of reaction have eliminated many of these various classes of business units. It has not been a pleasant process and while not complete, it has created a stronger mercantile business situation. It has also resulted in the removal of many obstacles to the establishment of fairer prices for the consumer.

In industrial business also, conditions are sounder at the end of the year than at the beginning. The general inventory position has been improved. There has been a return to a greater degree of corporate economy. There has been, as a result of unemployment and competition for work, a development of greater man power efficiency. Wage reductions have contributed to the bringing down of production costs.

Price Situation

The price situation is also better. The period of avalanche price declines is over. This movement was still in progress at the opening of 1921. After a period of business activity for nearly twenty years with rising prices it was a new experience for business to have prices start downgrade. The present generation scarcely knew how to do business under such circumstances. Although many prices will continue to recede, business and banking are now better schooled to cope with that situation. We need hardly fear a general price demoralization.

The attitude of the public in respect to buying is now a more calculable business factor. In the first place any thought that the public will buy at almost any price can be eliminated from business calculations. It can be set down as definite that the public has become thrifty and discriminating in buying. Decreased purchasing power and unemployment have made it so. People are willing to buy what they require so far as they are able and where they can find fair prices. A thrifty public, in the long run, is better for business than is an extravagant public.

With all these facts of betterment, why should the decision not be rendered in favor of the optimist? Because on the other side of the picture there are certain serious elements of maladjustment that cannot be ignored. There are impediments to the healthy functioning of the markets and difficulties in the way of a complete readjustment of the costs of production and distribution. These obstacles must be overcome before anything like a fundamentally normal business situation can be re-established.

Cost of Production

Among the obstacles to reducing the

costs of production and distribution are certain classes of wages. Mining, transportation and building labor must be further readjusted. The effects of these still relatively high wages permeate all kinds of business. There can be no thoroughgoing completion of general readjustment until these sources of high production and distribution costs have been dealt with.

Similarly, on the cost side of doing business, is the burden of taxation. The country's obligations must be met by taxes. Relief in this situation must be worked out through the difficult process of reducing current government expenditures and through shifting the burden of necessary taxation so as to reduce as much as possible its hampering effects upon productive enterprises. The new tax law and reduced aggregate tax levy are encouraging features.

Again on the cost side of business are the debts created by the extensive funding of current obligations following the boom. This has created interest and amortization charges against present and future earnings. Also, the burden of high overhead charges from extensive, over-built or idle plant equipment has to be reckoned with.

These various sources of special production and distributing costs add to the difficulties of doing business, of reducing prices and, therefore, to the slowness of recovery. While they are operative they must be met by economies in other directions. It can be said that never before in modern industrial history has there been such a pressing need for economy, never before such an imperative necessity to reduce wastes and increase efficiency.

On the cost side of business must be cited the high-priced inventories still to be reduced. Despite the general progress made in inventory readjustment, there are many lines yet carrying a heavy burden here. Impaired buying power made impossible in many cases the distribution of stocks at prices covering production costs. It seems inevitable that some further losses must be taken on this account. Here again there appears to be no alternative but to offset these losses by unusual economies in the total activities involved in handling such stocks.

On the marketing side of business we are confronted with a choppy condition of prices. Many prices have gone much further toward the prewar basis than others. This has made impossible, for instance, the absorption by the agricultural communities of normal volumes of retail goods whose prices have not fallen to so great an extent as have prices for farm products.

Further Changes Expected

Again, as to market conditions, although some prices have apparently reached comparatively stable levels and no general collapse is to be feared, nevertheless there are some prices where further changes are to be expected. This is true where excess stocks of raw products are overhanging the market because of over-production or impeded distribution. Further downward movements may be expected here. On the other hand, there are undoubtedly some prices which will be driven temporarily upward in cases where there has been too great a curtailment of production. As existing stocks are absorbed shortages may develop. In general, the price situation is characterized by a number of inconsistencies.

There is the effect of the situation in the world markets upon domestic industry and commerce. America is a quantity-production country. It must therefore have world markets. This is broadly true in respect to agricultural products. It is also true in respect to many of our manufacturing industries. The consumption demands of America alone are not sufficient to absorb the total outputs of such productive interests at prices to keep them fully employed on a satisfactory basis. Excess production must be sold in the markets of the world. While the world markets are in their present demoralized condition, the marketing of such surpluses will be a problem.

We have the resources and are equipped to do a tremendous business, both in the domestic field and in the foreign field. But the markets, both in the domestic field and the foreign field, are still greatly out of gear. Business cannot go ahead with the full swing of confidence and prosperity until these are brought back into gear. In the foregoing I have attempted to picture the structural framework of the present business situation. It is obvious that further drastic readjustments must be made. These readjustments, looked at in detail and detached from broad considerations, may seem in some instances to imply adverse effects upon one class in the community as distinguished from others. This is a narrow view to take of them. It is perhaps the natural human view. The human element in business is a factor to be considered as well as the foregoing more technical aspects.

Standard of Living

For instance, in the case of wage readjustments, there is nothing in that suggestion inimical to the interests of labor. Arbitrary money wage scales are obviously not the fundamental consideration in the best interests of the worker. Business activity, steady employment and maximum purchasing power of wages are really what give labor the standard of living it demands. In so far as reduced wages help restore business activity, bring about steady employment and reduce the cost of living, the interests of labor, business and the general public are absolutely identical. It is a hopeful sign of the times that most classes of labor have accepted this viewpoint.

Again, the requisite further reduction of retail prices may seem to imply a readjustment bearing more heavily upon one business element than another. But the case is not different in essentials from that of labor. What the retail business men obviously want are volume and steadiness in business. It is, generally speaking, immaterial to them what price levels prevail so long as there is a fair margin between selling and buying prices. As general living costs go down a narrower net profit gives as much purchasing power as would a greater profit when general living costs were up.

Lower retail prices will benefit the public and benefit the merchant by stimulating his sales. It is an impulse for better business activity that will flow back to the ultimate sources of production. It will help in the clearing up of difficulties of all stages. These instances of wages and price readjustments are cited to emphasize the community of interest that all elements have. The cases named are not different from others that might be mentioned.

What Deflation Means

It is not the carrying out of these movements that causes injustice. No business element can expect to see corrections in other phases of business and avoid a similar process in respect to its own. No class in the community can expect to enjoy the benefits of deflation without sharing the burdens. Deflation, if it means anything, means a reduction of incomes as well as expenditures. It means a reduction of consumers' as well as producers' prices. It means a reduction of wages and salaries as well as profits and dividends. But it need not mean a reduction in general standards of living if these various reductions proceed to a state of equilibrium.

There can be no equilibrium if any element in the community by resisting readjustment seeks to establish higher real wages or higher purchasing power for the fruits of its efforts than are justified by economic relationships with other phases of industry, commerce and finance. Fortunately we can rely upon economic forces to go forward impartially. They are no respecters of persons. In the long run they will not permit any class, to intrench itself permanently, as a result of war and postwar conditions, in a more favored position than the intrinsic value of its services to the community as a whole warrants. The market will determine these values. The year that lies ahead, I am confident, will see a progressive smoothing out of the inequitable conditions now prevalent in business.

There perhaps has been a suggestion of business fatalism in what has been said. The outlook for the year, it may have seemingly been implied, is that business men will be subject to economic forces beyond their control. It has been said that economy, conservatism and efficiency will prevail because there is no alternative. It has also been said that economic forces will control the course of events.

Effective Ways Being Found

I am no fatalist. In the past, with recurrent eras of prosperity and depres-

(Continued on page 52)

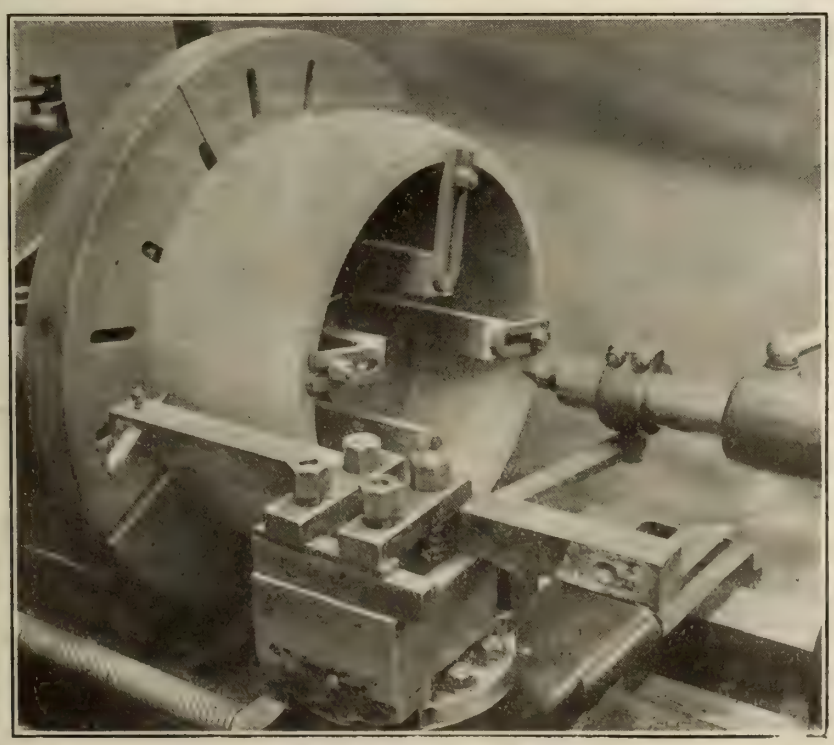
Fig.

A radius bar . . .
tres of the pivoting holes being drilled to the exact distance of 15¾ inches, this being the radius of spherical surface desired. After disengaging the nut and screw in the cross slide, one end of this bar was pivoted to the bracket, securely clamped to the tail stock spindle, and the other end located on a shouldered stud and screwed into the top slide of the tool rest.

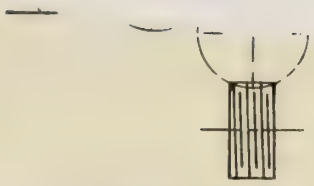
It was of course necessary to ensure that the tool point was located on a line parallel with the lathe ways, and running through the centre of the pivotal stud in the tool rest. Setting the tool point on the centre line of the job, the tailstock barrel was wound out until the radius bar registered parallel with the ways of the cross slide.

It only remains then to wind in the cut and traverse the saddle backwards, an appr. . .
duced in the or. . .
large variation in the rim
while in the handwheel turning lathe to be described they were turned out quite uniform and at a greatly increased rate.

It should be stated that the maximum diameter of handwheel used is 18 inches and the minimum 6 inches. The lathe is built from standard 16 in. swing lathe patterns. The bed is straight, 7 ft. long and carried on two shallow cabinet legs. The standard driving headstock and tailstock are utilized but these are mounted on raising blocks on the bed which gives a distance of 16 ins. from the lathe centres to the bed top or a swing of 32 ins. over the bed. The driving headstock is fitted with a three speed driving cone and duplex back gears which in combination with a two speed countershaft gives 18 turning speeds. In designing the lathe. it was arranged to use same for turning up pulleys if the output of handwheels was satisfactory. For this purpose a special 4 tool turning rest is provided and the usual hand and automatic sliding and surfacing traverses but no screw-cutting motion.



Showing method of producing special surface.



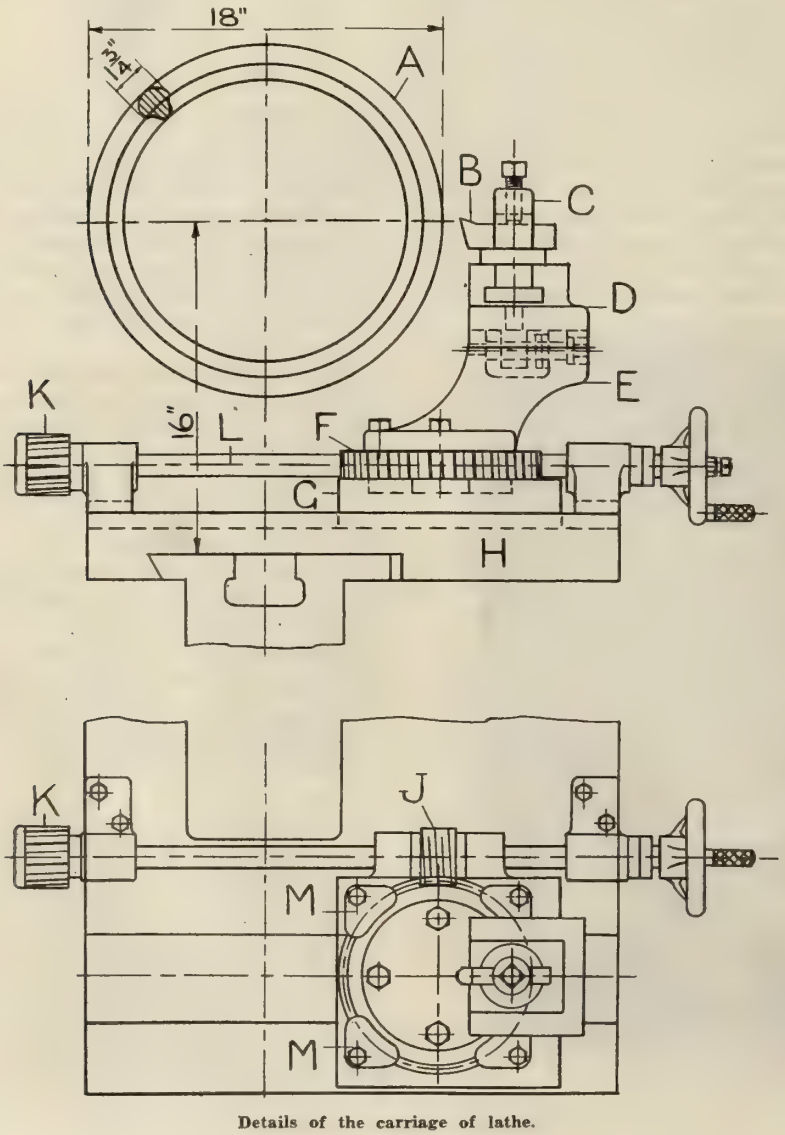
End view of tool post

The principal feature of the lathe is of course, the tool rest and carriage and three views of these are shown in the accompanying line drawings. "A" is the handwheel to be machined and the cross-section of the rim shows that the portion to be turned is rather more than a semi-circle. "B" is the cutting tool mounted in a round steel toolholder "C" and secured by a set screw. The top slide "D" has a slight adjustment on the main rest "E" in order that the tool may be readily set in position. It will be seen that this rest is shaped away to clear the largest handwheels, and it is secured at the base by set screws to a worm wheel "F," having 60 teeth, ½ in. pitch.

This worm wheel is recessed into a square slide "G" which has the usual adjustment across the carriage "H" by a surfacing screw. The worm wheel is operated by a 4 ins. diameter right hand double thread worm "J" which receives its motion from the usual train of lathe feed shaft gears, pinion "K" and worm shaft "L." The worm shaft is hollow and a friction rod passes right through the same to the front enabling

...ration un-
... shop got the work as
... best equipped, though no one locally
had ever attempted a job even half as
large as this one, therefore the methods
followed may be of value to others in
similar breakdowns.

...rim ... this lathe has been worked by both girl and boy labor, and the output with regard to both quality



Details of the carriage of lathe.

...ve up
...rnative was a better scheme anyway; a piece of 1-16in. sheet iron was cut the size of the face of the shell, concaved through the centre to a slightly smaller radius than the journal, and secured to the shell by "C" clamps. Then the shell was turned on end. Pouring such a bearing on end always leaves a denser, cleaner lining of the kind that shows up free from lines and holes when bored.

No ladles were available larger than the small hand type that hold about 50 cub. in. of metal, and we had to provide eight times that amount. An ordinary household iron kettle of the kind whose diameter about equals its depth, and having, besides a good bail, a ring on one side for tipping, took the place of a ladle.

The metal was heated in the forge, near which was placed the shell standing on the concrete floor and having a good riser built up on top. A more perfect job than this equipment turned out would be hard to find. Before the babbitt had entirely cooled, workmen started to peen it, going over the entire surface and hammering the metal to a greater density and making it tighter than ever in its grip on the undercuts.

Boring Operation

Boring was the most particular of the jobs involved. We had a lathe with flaring wings on the carriage. These were "T" slotted, and we had "T" slotted paral'els that we bolted to these wings to form a work table for various boring jobs. A 3in. boring bar was available, though we had to make a special tool to reach the large diameter.

It was decided that a better job would result if the three other parts of the bearing were skimmed out at the same time, removing just enough material to clean the surface. In setting up, the bottom shell was first lined up with the bar and placed at the correct height and clamped. Then angle plates were bolted to the parallels at each side of the bottom shell, forming a skeleton opening similar to that in the engine

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Horizontal Drilling, Milling, Facing Machine

By H. A. WILSON

IN DISCUSSING portable and stationary tools, at first consideration, one is liable to imagine there is a distinct line drawn between the two classifications. However, in the machine described in this article, we find a stationary tool that has many of the advantages of the portable type.

By referring to the illustration, it will be seen that the tool is used to machine very large pieces. The casting shown is one half of a head cover for a 11,300 h.p. turbine for the Cedar Rapids power development. The complete turbine is being built at the Dominion Engineering works, Lachine, P. Q. and the casting was produced in their foundry.

The remarkable part of the story of ths machine is that it is not a product of any one machine tool builder. It was devised, partly manufactured, and assembled in the Lachine plant, and a great variety of work is being constantly taken care of by this machine. Practically all work is of a heavy nature which will perhaps better explain some of the reasons for several unusual features in the design.

Details of Design

The bed of the machine consists of two old lathe beds which have been bolted together. These beds are not of the modern design having "V" ways, but have the old fashioned, flat type of way. The combined length of the two lathe beds, makes a bed for the machine which is nearly fifty feet long. There are two columns mounted on these ways, each carrying a horizontal gun-boring arbor mounted on a head complete with all feeds actuated by power. The columns were designed and built at the plant.

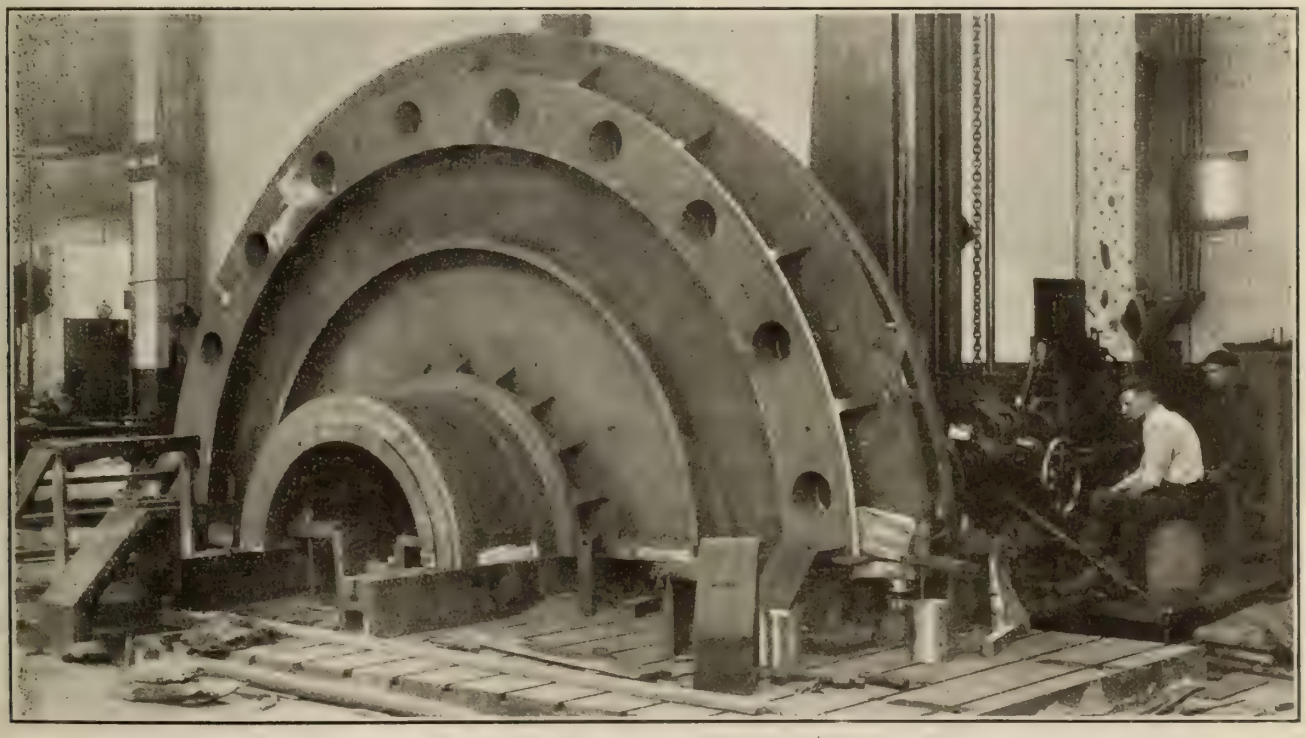
The bases of the columns are machined to fit the lathe bed ways, in such a manner that they permit the columns to slide along these ways. Of course, the bases of the columns are rather wider and longer than the cross section of the columns to permit of a large bearing surface on the bed. The columns can be locked to the bed in any desired position, and at the base of each column on a machined flanged projection is located the head of a Jones and Lamson flat turret lathe. The constant speed driving pulleys of these heads are connected by belts to electric motors each mounted on a bracket on its respective column some five feet above the heads.

Instead of a face plate, or chuck, on the live spindle there is located a cut tooth sprocket wheel. This sprocket wheel drives by chain a second sprocket wheel on a brass nut which is located on a feed screw extending from end to end of the bed. Thrust washers are placed each side of the brass nut, (separating it from the two column lugs, one on each side of the nut,) which, when operated by the turret head lathe moves the column along the ways. The clamping studs are always slacked off before moving the column. The full range of speeds, originally intended to be spindle speeds, are available for feeding the column along the ways.

Feeding the Boring Bar

A second motor is located on the top of the column for driving and feeding the boring bar and moving the head up and down the column. Electricity is supplied to these two motors from live wires located below the top of the bed, (and therefore, below the floor level) and a set of sliding contacts for each column. The columns have vertical ways machined to fit the heads carrying the boring bars. The heads are counterweighted, the counterweights being hung inside the hollow columns.

A switchboard controlling the top motor is located on one side of the head within easy access of the operator standing in his normal position. An operator's platform is attached to the boring head and when the head is raised up the column, the platform wth the operator is also carried up. Gear boxes giving a full range of speeds and feeds are incorporated in the design of the



This view shows clearly the capacity of the machine.

head, and this, together with the electric control board, gives a very concentrated control system. One man can operate all the control but owing to the size of the machine and the large castings machined, it takes two to handle the work, as one man must be practically constantly observing the action of the tool, not only when locating and placing same in the work, but as it continues cutting.

Then too, when the column is being fed along the ways longitudinally, the control of this feed being largely in the turret lathe head, one man must be available to operate them. A large machined floor plate cast in sections, having numerous parallel "T" slots cut in it, extends along the whole length of the ways. On this floor plate all work is set up, and in these set ups a large number of parallel bars, angle pieces, "V" blocks, etc., are used.

Among the commoner operations performed are the following:—drilling, tapping, reaming, milling, facing and boring. In the drilling operation the column is always locked on the ways and the proper speed and feed selected for the diameter of drill to be used and the material which is being drilled. Of course, in locating the drill the column is moved along the ways and the head travelled to the proper elevation on the column. A hand wheel is provided to rapidly bring the drill up to the work before throwing in the automatic feed. In reaming much the same procedure is followed. In tapping operations special fixtures are necessitated in order that the tap may take its proper lead after it has been once entered.

The milling operations with a face mill, or a side and face mill are usually confined to milling keyways in large turbine shafts and similar work. The facing of various surfaces is done largely with large diameter cutters having inserted blades. End mills are used to cut keyways in certain shafts. On the whole the application of a milling cutter to this machine enables a wide variety of jobs to be undertaken. Boring operations can also be accomplished in a multitude of ways.

Usually the large castings are placed on the floor plate after being marked and laid off. They are then clamped in position and remain in the one position until all operations possible are completed. Thus, some of the fundamental ideas of a portable tool, (that of bringing the tool to the work,) are embodied in this machine; which is really classified as a stationary tool.

The power of the motors installed is more than ample to drive large diameter drills, and large inserted tooth milling cutters, as well as take care of the feeds. The main screw, extending along the whole length of the bed and placed centrally between the ways, does not revolve. There are several interlocking and more or less complex reasons for this feature among which is the dual reason, that as it was primarily decided to use solid feed nuts which were positively connected to the turret lathe heads, it was the only method that could be employed which would enable the two heads to be operated independently of one another, and secondly, it compactly placed all moving parts at the column, where they were directly under the observation and control of the operator and his helper.

The tool is one that is rarely idle, and more often than not, both boring bars are operating. The work passing through this particular shop is so large that it would be very costly to have to reset these castings several times to accomplish work that is accomplished at one setting on this machine. Another reason responsible for a certain volume of work being handled on this too, is that the engineering department design many pieces, and route them via this machine, knowing full well its versatile qualities and its ability to get through many ticklish jobs.

ECONOMY AND EFFICIENCY

(Continued from page 48)

sion, it has sometimes seemed as though business were subject to the coming and going of inexorable tides. In the present situation, too, the war set forces in motion that have seemed overwhelming. But I am confident that effective ways are being found to diminish these conditions.

Never before was there a greater demand for individual initiative in business, never before a greater need for penetrating judgment. Recognition of the larger principles controlling business conditions does not mean an admission of helplessness. These principles are guide-posts to success, not barriers to individual achievement. To say that the times require to an unusually high degree the practice of conservatism, economy and efficiency is only to say that they require the intensive application of the methods by which, in the long run, the lasting and substantial progress of the world has been built. The full fruits of brilliant pioneering enterprise, in whatever field of endeavor, would never have been harvested had not discovery been followed by hard work.

There has developed at the end of the year just closed a remarkably general consensus among those qualified to pass judgment on business conditions that the worst is over and better times lie ahead. In this judgment I heartily concur. The year 1922 may not be one of great realizations and fulfilments, but it will be one of laying the strong foundations for better businesss in years to come.

AUTOMATIC ARC WELDING

Just as the increased use of resistance welding quickly brought into use automatic devices for increasing speed and reliability of product, so the automatic electric arc welding machine promises to find an important place in this form of welding. This type of machine will weld at a rate of from two to six times the rate possible by skilled operators welding by hand, due to the stability of welding conditions and the elimination of the necessity for changing electrodes. The characteristics of practically all electric arc weld machines premise that current and voltage are interrelated, an increase in one causing a corresponding decrease in the other. The automatic arc welding machine utilises the arc voltage as a basis for regulating the equipment. A shunt-wound motor having the armature connected across the welding arc will vary in speed as the arc lengthens or shortens, due to the variation of the arc voltage. "Now," continues W. E. Rudder, in the journal of the Franklin Institute, "if this motor is connected through suitable gearing to the electrode wire, the wire will be fed into the arc at a rate depending upon the arc voltage it is desired to maintain.

"A vibratory relay is also connected across the circuit in such a way that the relay contacts open when the voltage increases. This cuts resistance into the field circuit of the feed motor, still further tending to increase the feeding speed. As a result, the wire is continuously fed into the arc at an almost constant rate, and the electrical conditions, as indicated on the switchboard instruments, are very steady. As is the case with other automatic machines, the principal field for the automatic arc welder is one where a considerable amount of welding is required calling for a continuous repetition of duplicate welds, building up pulleys, shafts or worn bearings."

ELECTRICAL ACCIDENTS IN FACTORIES

A practical point in factory administration is the procedure to be adopted in cases of electric shock.

The rules are generally to be found exhibited in most factories, but there seems to be much ignorance as to what to do when a person is rendered unconscious by an electric shock, and the charge is made not only against employes and employers, but also against ambulance men, and even doctors. The importance of commencing artificial respiration at once, and keeping it up for at least two hours, cannot be overemphasized.

RENEWING BEARING

(Continued from Page 50)

frame. The quarter blocks having been shimmed and bolted, the cap was clamped on and boring commenced.

Little remains to be told. Chipping the oil grooves was the most tedious job of all. A splendid fit and equal alignment were obtained. Three days after the parts were laid down on our floor, the work was finished. Probably the factory wouldn't have bettered this much. The babbitt used was purchased from the street railway, of a grade put out for motor bearings, and seemed well adapted for this other work.

sell wire and nails to customers in Cleveland at 10 cents per 100 lb. over the Pittsburgh basis, when the material is made in Cleveland, instead of at the Pittsburgh price plus the rail freight Pittsburgh to Cleveland. While in various products there have been divergences from the "Pittsburgh plus" system of quoting delivered prices, even by the Steel Corporation, it is a new thing for the corporation to do this openly in wire products.

Mill Operations

The official report on steel ingot production in January is awaited with unusual interest, as mill operations have been so irregular that it is difficult to make a very close estimate as to just what they have been doing. Last July steel ingot production was at the rate of 11,000,000 tons a year, the rate increasing until in October and November it averaged 23,000,000 tons. During December production declined, averaging about 20,000,000 tons a year during the month, but being at probably no more than 18,000,000 tons towards the close of the month. The rate in January probably averaged around 18,000,000 or 20,000,000 tons, whereas a quick return after January 1, to the 23,000,000 ton rate was expected, with further improvement as spring approached.

Pig Iron and Coke

A Pittsburgh district steel interest inquired for 1,000 tons of basic iron and drew quotations from valley furnaces at $18, furnace, against the former nominal market of $18.25. The purchase, however, was made on the basis of $17.75, valley, a middle interest offering some resale iron at this figure. The identity of the iron is not known positively, but rumor has it that it is part of a large block of iron which a steel mill has due it and cannot use, the contract price of the iron being more than $10 a ton above the price now realized. The basic iron market becomes quotable at $18, valley.

Foundry iron is down 50 cents to $19, valley, on purchases of two lots of 500 tons each from valley producers by the Standard Sanitary Manufacturing Company, which has been running full for months, except for a short closing at holiday time. Bessemer is unchanged at $19.50, valley.

Connellsville coke continues in very poor demand, spot furnace coke being available at $2.75, or less than the cost of production. Foundry remains at $3.75 to $4.25 depending on brand.

The Pittsburgh district coal operators, who have had little business in recent months on account of the high wage scale of the United Mine Workers, running to April 1, as the business has been going to non-union fields such as Connellsville, have announced the wages they are prepared to pay beginning April 1. The scale is about 32 per cent. under the existing rate. Allowing for the difference in ease of mining it is in proportion to the rates now being paid in the Connellsville region, and the trade assumes that this means there will be no further reduction in wages in the Connellsville region.

POINTS IN WEEK'S MARKETING NOTES

Montreal says sheets have improved slightly but that merchant bars are still dull. Prices are weak, these being sometimes close to actual production cost.

The machine tool market is dull. Small tools and supplies are selling much better, non-ferrous metals are inactive, and scrap metal is also very quiet. No immediate improvement is looked for in the above lines mentioned as dull, although small tools look much stronger as the year proceeds.

The local market is stronger. A certain amount of equipment has been sold to the Durant Motors, but not nearly as much as originally planned. Other machine tool dealers report a fairly good week.

Steel dealers claim that January has been a fairly good month, but a typical January, which means hard work to bring the order total up to anything like a good figure. Competition is keen, and several reductions in price will be noted in this week's quotation sheets.

The looked for revival in steel products has not materialized, says Pittsburgh. Tin plate shows up best of all, the mills running at about 75 per cent. capacity. Some are looking for a new record in tin plate production this year.

Tubular goods are falling off in demand, oil country goods having eased off considerably. Bar demand is very spotty, and price shading is occurring in practically all lines, especially where the order is of decent proportions.

Plain wire and wire nails are selling at varied prices; 2.25 cents for the former, and $2.50 for the latter is about the average. One concern is selling in Cleveland at 10 cents per hundred pounds over the Pittsburg basis, when the material is made in Cleveland. This is a new practice to openly quote in this way.

Basic pig iron is quoted at $18.00 from valley furnaces, although a recent purchase was made at $17.75, this being on re-sale iron. Coke is in poor demand. Coal operators have announced their new wage scale which is about 32 per cent. under the existing rate.

Through the introduction of one-man street cars by the Saskatoon Street Railway, a decrease of $50,000 in the company's deficit for 1921 is shown in the annual report.

SMALL TOOLS STILL IN GOOD DEMAND

TORONTO, FEB. 1st.—The local market is rather spotty because while some dealers are securing satisfactory business, others are doing practically nothing. It would at first appear as if the dealers closing few orders must be resting on their oars, but this is not the case. Generally speaking, everyone is on their toes, exerting every possible effort to secure business.

Competition is keen, prices are being shaded, in fact in some cases are cut to the bone, with the result that the small fellow who cannot afford to drop to such a low level is left behind. This is not always the reason, but in many cases, price cutting is the deciding factor.

Steel Market

Activity on the steel market remains much about the same. No special line is featured. Iron and steel bars are listed on this week's quotation sheet at 2.90 but this price is often shaded to 2.75 when the order is tempting enough. However, as 2.90 seems to be the average, we placed it that way on the quotation sheet. Hoops are selling at 3.75, blue annealed sheets No. 10 gauge at 3.75, black sheets 28 gauge at 4.50, and galvanized sheets 28 gauge at 5.85. Cold rolled steel is quoted at 4.50 base, all the above prices being fair averages. As already stated, a large order usually brings further concessions.

To attempt to feature any one line is impossible in the present market. The demand is general and scattered. Dealers have to work much harder these days to bring the month's total sales up to snuff, because as a rule, orders received are for small quantities, therefore it takes more orders to bring the total up. About the best that can be said for the month just passed, is that it has been a typical January, with a few bright spots here and there.

Machine Tools

The machine tool business continues to be spotty. For example, last week a certain dealer told us business was very poor, but he had several good enquiries out which looked as if they were going to break. This week he tells us three of his prospects gave him orders, with the result he is quite elated, as they were all fairly good orders. In fact three different lines of machinery were purchased.

Not far from this dealer, we visited another who felt things had gone to the dogs. "This has been a very poor month," he said, etc., etc., Next week this same man may have landed some good orders, and tell us that the corner has been turned.

Buyers are walking warily and any purchases they make are considered very carefully. Take for example the Durant Motor Co. This concern had a very large list of machinery planned, yet cut their plans drastically some time ago. The first batch of this new list was

sold by a local dealer a few days ago in the face of keen competition. Further machinery will be purchased, but not at present, according to our informant.

Another machine tool dealer says that although January has not been an exceptionally good month he cannot complain, as he feels he is getting his fair share of what is going. Thus, we have a varied condition, which in many ways depends upon close following up of prospects, plus the right kind of price, viz., a low one.

Metal Market

Iron and steel scrap is fairly active, but only in a restricted way. Mills and foundries are picking up somewhat, this in turn creating a demand for scrap. Of course, the call is light. Hamilton is taking heavy melting steel, its price being somewhat lower, and foundries are beginning to show some interest in scrap, although prices have to be low to make them close.

Copper scrap is being sold at 10.50 to 11.00 cents, and brass mills seem to be running at a better rate. Yellow brass scrap is not in much demand, and white metals are still moving very slowly. The average order is of the hand to mouth variety, so that, although some improvement is noted, conditions have to improve quite a bit yet before dealers will be satisfied.

Small Tools

The small tool and supply market is holding its own. Orders and inquiries are still coming in, and viewed as a complete month, January is a decided improvement over December 1921. Dealers expect still better business in February, and feel that manufacturers are getting more confidence in existing prices. The market in its entirety is stronger and more stable than last week, and from present outlook, should continue to go upward.

SMALL TOOLS AND SUPPLIES THE ONLY LINE SHOWING ANY ACTIVITY

MONTREAL, Feb. 1.—General conditions have not shown much improvement locally in the last week. The movement of steel has not yet increased to any great extent. Sheets have shown a little improvement, while merchant bars are not exhibiting any signs of increased activity. The season of the year is not one where any great improvement in structural steel conditions can be looked for. Business in this line has been fairly active throughout the fall months, and there is a really large programme of building planned for the spring. Plates are fairly active but are not moving quite as satisfactorily as sheets.

Prices throughout are rather weak, and are at present down to a point very nearly as low as the points reached in periods of depression existing in the years just previous to the war. This in spite of the higher manufacturing costs that exist to-day. Interviewing some of the men connected with the bigger interests, there seems to exist a faith in the future that is very strong. At the same time they feel that the present depression is peculiar in the fact that its causes and effects are so interlocked that time is one of the principal elements which must enter into the measures that will prove effective in removing the undesirable conditions. Therefore these interests are awaiting the change for the better with a great deal of patience. It must be fully appreciated that this patience is not of an indifferent nature but one of keen interest.

Artificial standards and conditions set up during the last few years cannot be legislated out of existence. Liquidation has been a great evil, and although it has been considered that the iron working industries had passed through this trying period, for some time back, there appears, from unexpected sources, results of this evil at very trying and irritating times.

No Change

In the pig iron field matters have not changed a great deal. The present low scale of prices is not bringing forth any more business than would have been presented had the prices not been reduced. The fact still remains that the volume of work being done by the machine shops is still small, and the call for castings is very limited indeed. Very few shops locally are working on full time. The producers are quite satisfied not to book any large amount of business at the present prices, as these do not admit of a fair profit and the producer is lucky if he breaks even. Thus, industrial conditions in a general way will have to improve before any great demand for pig iron will be evident.

The machine tool market is still very dull. Dealers do not expect that any great improvement will manifest itself on short notice. Inquiries from varied sources keep coming in, but are not to be taken as any barometer indicating the amount of trade actually moving. Sales of new tools are few and far between. Only a single machine moves and usually it is of a small size.

This Branch Stronger

The small tool business is faring better perhaps, than any other branch of the tool business. These sales, together with supplies, represent practically the whole turnover of the machine tool and supply houses these days. Prices in these lines have been rather steady, but now are gradually going down. This gradual decline is not to be interpreted as weakness, but rather that the competition and the increasing demand, force the manufacturers to give the consumer at least a portion of any reduction in manufacturing costs. The tendency of both material and labor is downward so that from time to time slight reductions are announced.

The non-ferrous metals are very inactive and the prices have weakened in many instances. The business being taken care of by the local houses is all in small lots. No orders of any size have been received for a long time. The present prices are quite as low as the point touched some months ago. At that time it was hoped by all dealers that such low prices would not be seen again. The outlook as far as can be viewed at present is not bright. However, the non-ferrous metal markets are very temperamental and are influenced by factors in all parts of the world. Thus conditions often alter overnight.

Scrap metal conditions are rather quiet. As the markets for metals in semi-manufactured states is weak, it is only natural to see the scrap metal market listless. Quotations are made for each inquiry and these quotations are usually so low that if the scrap is required it will be purchased. The conditions in this market will not likely improve to any great extent until general industrial conditions become better and metals in all their various state of manufacture are in better demand.

GRADUAL RECOVERY LIKELY TO RESULT

Speaking on the economic position in the United Kingdom, Trade Commissioner Harrison Watson says in a recent issue of the Commercial Intelligence Journal, that the new year has opened with a general feeling of uncertainty as to the future, tinged, however, with a considerable amount of optimism.

"Business remains dull and almost featureless," he said, "but it is thought that both trade and industry in the U. K. have touched the lowest level, and that now that the worst is known, gradual recovery is likely to result from the systematic writing down of prices, provision for bad debts, and similar drastic measures which have characterized recent reports and balance sheets of almost every public company in the country. Favourable features are, moreover, the considerable advance in the value of the £1 sterling in America during the past year, amounting to something like 20 per cent, the steady reduction in the prices of commodities amounting to nearly 40 per cent since last January, and the knowledge that the bulk of the Government accumulation of stores has at length been disposed of.

"Upon the other side, there is the knowledge that the financial and economic conditions in a number of European countries are worse than ever, and that the drastic cleansing of the Augean stables which has taken place in this country has still to be faced, which gives rise to the apprehension that the purchasing power of many of the country's best customers must remain seriously restricted for a long time to come."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 25
Toronto price:—	
Silicon, 2.25% to 2.75%	27 15

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 2 90
Steel bars, base, Toronto	2 90
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	78
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 25
Castings, copper	17 00	17 00
Tin	36 00	34 50
Spelter	7 10	7 50
Lead	6 50	6 75
Antimony	6 50	8 00
Aluminum	24 50	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.08	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.59	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.

4½-in. and larger, 40 per cent.

4-in. and under, running thread, 30%.

Standard couplings, 4-in. and under, 30%

Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and less	55
Coch and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, fl. and rd. hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	$1.25
Nuts, hex., tapped off net list	75c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 90
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	0 87
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	57
Class B	22	32
Class C	14	22

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 50
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 50	....
Galvanized sheets, No. 28		5 85
Queen's Head, 28 B.W.G.	7 50	....
Fleur-de-Lis, 28 B.W.G.	7 00	....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	...
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz	6 50	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13; 5-16, $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.20; ¾ in., $9.30; ⅞ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	75.6
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ⅛ in. to 1 in. rod	30
Brass sheets, 24 gauge and heavier, base	38
Brass tubing, seamless	42
Copper tubing, seamless	44

WASTE

XXX Extra	16½	Atlas	18
Peerless	21	X Empire	13
XX Grand	15½	Ideal	18
Superior	20	X Press	11½
X L C R	14½		

Colored

Lion	12	Popular	9
Standard	10½	Keen	7½
No. 1	13	Fancy	13½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored.13
Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

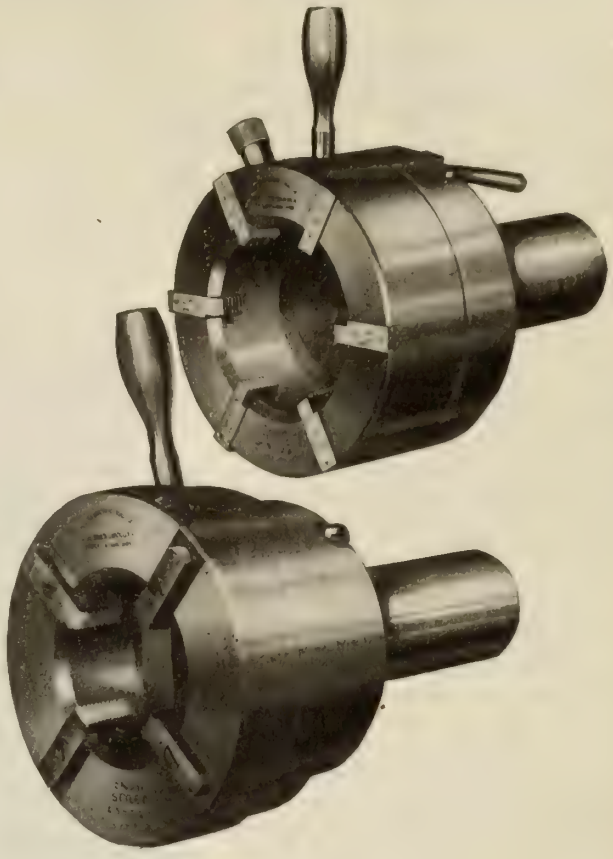
Geometric
Screw Cutting Tools

Do the Work and Stand Up Through Long and Constant Service

Men long experienced in Screw Thread Cutting affirm they were the losers where they had been induced to try substitutes.

A Geometric Self-Opening Die Head of just the right construction for your work, and a set of Geometric Milled Chasers—Did you ever try to beat that combination on your Screw Machine or Turret Lathe?

A Geometric Collapsing Tap on your Screw Machine, Turret Lathe or live Spindle will prove if it is not the best possible investment.



Geometrics Give Highest Production and Maintain Quality

Right in the Lead

THE GEOMETRIC TOOL CO.
NEW HAVEN, CONN.

Canadian Agents:

Williams & Wilson, Ltd., Montreal
The A. R. Williams Machinery Co., Ltd., Toronto, Vancouver, B.C., St. John, N.B., and Halifax, N.S.

For any thread, any size, any pitch --- there's a Geometric Collapsing Tap or Self-Opening Die Head. Be assured there is one to meet your particular threading need---whatever it may be. Ask us.

Canada's production of asbestos and asbestic in 1920 amounted to 197,321 tons, the deposit of crude and milled fibre being 157,904 tons.

Production for Canadian newsprint mills for 1921 was 90% of that of 1920. The United States mills did not do so well, turning out only 76% of the 1920 record.

Plans have been completed for tunnelling operations on Hamilton, Ontario, mountain face. Work has also been started on the improvements to James St. incline.

London, Ont.—This city's healthy growth may be gleaned from the fact that the population increased from 37,976 in 1901 to 59,100 in 1920, and the value of taxable property in the same time from $25,151,000 to $46,013,550.

The Ford Motor Company of Canada will be in full time production on February 1st. This means that 2,500 employees, who have been working upon a four day-a-week basis since September 1st last year, will go back to the regular six day schedule. The present output of the factory is approximately 160 cars a day and will almost be doubled when the staff returns to full time production.

Preliminary work for the new Port Credit water works system will be rushed through in order that active work may be commenced as soon as the frost is out of the ground. It is hoped to have the plant in operation by next fall. The whole system is estimated to cost $110,000—$60,000 for the central plant, and $50,000 for the distribution system.

The Algoma Steel Plant, Sault Ste Marie, is running around 60 to 65 per cent. capacity, and according to W. C. Franz, vice-president, have orders enough for three months ahead. Mr. Franz believes business will pick up, and that it will come back more quickly in pig iron and steel, because of the need for building and railway construction. In his opinion, low prices have been reached for both iron and steel.

The total export of grain of all kinds from Montreal in the season was 119,602,189 bushels, the significance of which is realized when compared with the previous year's total of 53,143,305 and the previous record of 75,361,829 in 1914. Though wheat showed a substantial increase, the most remarkable development was in corn which from shipments of about half a million bushels in 1920 jumped to more than forty-three million bushels in 1921.

The Manitoba Power Company is building at the Winnipeg river at Great Falls a Hydro Electric plant which will have an ultimate rating of 168,000 H. P. The initial capacity of the plant will be 56,000 H. P. consisting of 28,000 H.P. units. The plant will operate under an effective head of 86 feet. The company is also building 17 miles of high tension lines from the Great Falls Plant to a connection with the existing lines from the Cinawa Hydro Electric Power plant of the Winnipeg Electric Railway Company to Winnipeg.

The Perfect Machine Co., Galt, are making final deliveries this week on the contract for 20 small lathes, 4' x 6" over all, for Toronto Technical School.

Mr. C. F. Rowland, Jr., manager of the Winnipeg plant of the Coco-Cola Co., has announced that work on the construction of a $300,000 plant on Logan Avenue, Weston, Ont., will be started this year.

A committee has been appointed by the Board of Education to undertake the erection of a new Collegiate Institute and vocational school at Guelph, Ontario, at a cost of approximately $300,000. The plans have already been approved by the Department of Education.

The Goldie & McCulloch Co., Galt, have the contract for installing extensions to Guelph waterworks equipment. These include three 9-inch pumps, two of which are auxiliary units, each of three million gallons daily capacity, and one booster pump for fire-fighting purposes.

A design for a viaduct to bridge the Don valley between the suburban districts of Todmorden and Leaside, in Toronto, was submitted to the county council by the county's engineer, Mr. Frank Barber, at a recent meeting. The bridge, with approaches, would be 1 mile and 20 ft. long. The length of the bridge proper would be 1,400 ft., height 130 ft. and width 56 feet. The estimated cost is $870,000.

While admitting that the volume of moving business was, of course, not to be compared with that of 1919, a Canadian manufacturer of machine tools states that he considers it a healthy condition, that his sales efforts are now concentrated on many enquiries that seem to presage a buying tendency. Some of these do not indicate large business, but nevertheless they mean a better tone than that of the uncertainty in the early part of 1921. The demand for woodworking machinery shows considerable improvement.

The Robb Engineering Co., Amherst, N.S., have decided to get their boilers and other type of plate work manufactured in the shop of the Dominion Bridge Company at Lachine, P.Q. The latter company has control of the Robb Engineering Works, and as the demand for boilers which this firm has been receiving is largely from Ontario and points in the vicinity of Montreal it has been decided that for the present, at least, this work could be carried on advantageously in Lachine. It saves the haul of raw materials from this part of the country to Amherst and the shipping back of the completed article. The work at Lachine is done under the direct supervision of the boiler shop superintendent and foremen of the Robb Works. The boiler shop at Amherst is one of the most up-to-date shops of its kind in Eastern Canada. It has in no way been dismantled and the engine works and other lines of activity will be continued as usual in the shops at Amherst.

The Railway Roller Bearing Company, Syracuse, N.Y., are re-organizing with the ultimate object of extending the scope of their enterprise.

Contracts for a steel smoke stack for factories costing $25,000 for the Red Arrow Tires Limited, 309 George Street, Peterboro, is awarded to the William Hamilton Co., of the same city.

In 1920 Canada exported to the United Kingdom, United States, Australia, France, Italy, Japan, Spain, and other countries, 152,740 tons of crude asbestos worth $11,521,536.

A report from Ingersoll states that in districts where timber is available there is much activity, a fact which is taken by many to indicate that there will be considerable building during the coming season. The saw-mills in the country are said to be running full capacity.

The draining of a large tract of land for fruit-growing purposes near Agassiz, B.C., is an engineering problem for which the Goldie & McCullough Co., Galt, have supplied considerable pumping equipment. Thirty-inch pumps are being employed at low head for transferring water from low lying land to levels at which it can be easily disposed of.

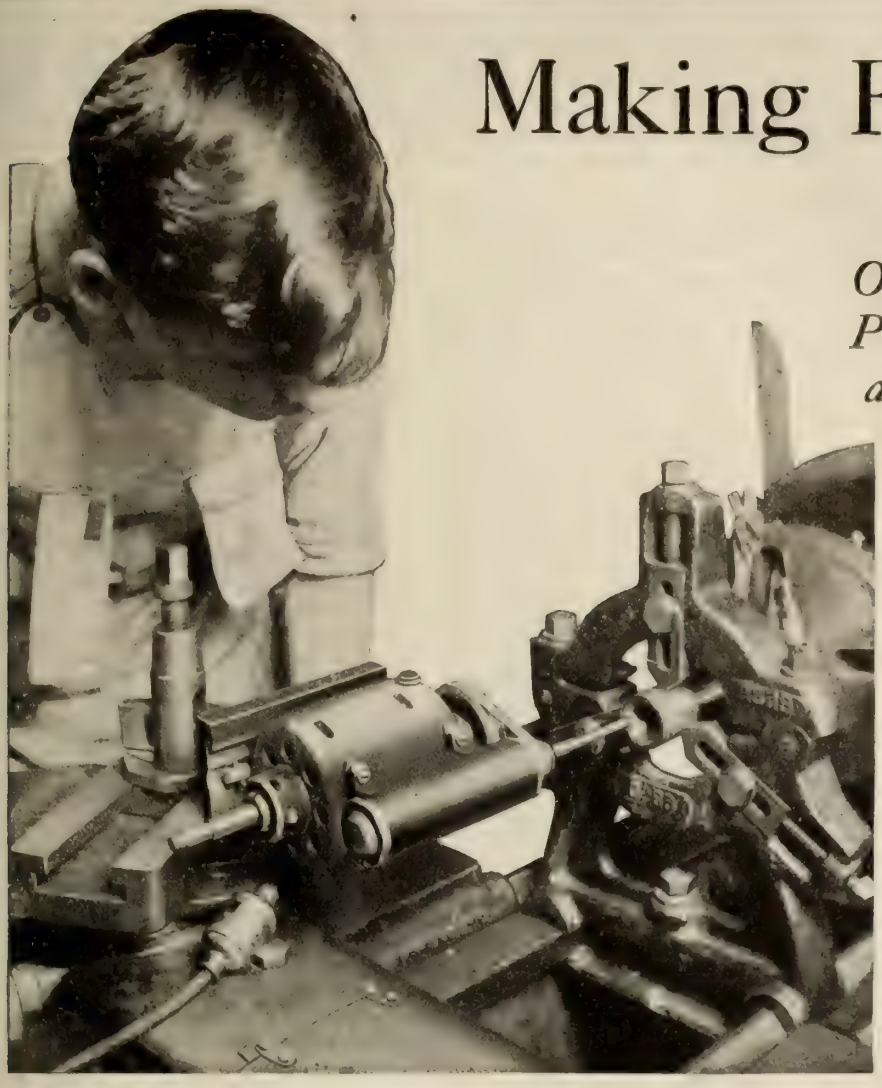
The $6,000,000 plant which the International Paper Co., has had in course of erection at Three Rivers, Quebec, for over a year past, will be started in February, according to a New York report. This plant has a present capacity of 240 tons a day, and the production at the outset will be 100 tons a day. It is the intention to gradually increase the output, and the plant will be ultimately doubled if the market warrants it, with an output of some 60,000 tons a year.

Mr. D. W. Clark has resigned his position as managing director of the Canadian B. K. Morton Co., whose head office is in Montreal, and will in future devote his time to the interests of the Anglo Canadian Wire Rope Co., of which company he is president and general manager. Mr. Clark is well known throughout the Dominion, having covered it for many years from the Atlantic to the Pacific in the interests of the brand of Sheffiield Tool Steels handled by Messrs. B. K. Morton & Co. of that city.

"It is quite feasible to use jackpine in the manufacture of newsprint," said Maurice Neilson of the Belgian Industrial Co., in a paper read before the technical section of the Canadian Pulp and Paper Association at its annual meeting held at Montreal recently. Mr. Neilson stated that his company had been carrying on extensive experiments of jackpine under both the sulphite and ground wood processes, and had met with considerable success. The point was brought out in discussion that available spruce from spruce forests was being rapidly consumed and that the consequence was longer hauls, more expensive wood, and higher priced lumber at the mill. Jackpine on the other hand, was plentiful, cheap, and attained commercial size forty years earlier than spruce.

Making Fine Tools

An Interesting Operation, Economically Performed by Means of a DUMORE Grinder



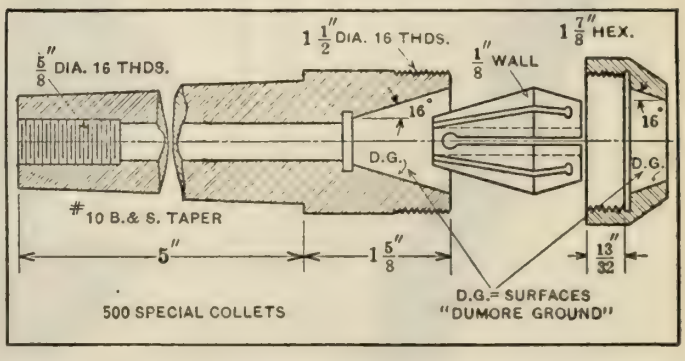
This photograph — taken at the City Engineering Company's (Dayton, Ohio) plant shows a Dumore Grinder finishing the main shank and head of a special draw-in collet. There were 500 put through in this special lot and the time for the operation shown averaged 8 minutes per piece.

The second operation; grinding the internal face of the collet nut, was also performed by this convenient precision tool.

Dumore Grinders are popular here as in every plant where fine tools are made. Their accuracy makes them useful for the finest finishing work; their simplicity and convenience make them practical for many difficult, almost inaccessible jobs.

Dumore Grinders transform any lathe into a precision grinder; they make fine finishing possible in every machine shop.

May we tell you more about them?



WISCONSIN ELECTRIC COMPANY

2941 SIXTEENTH STREET - - RACINE, WISCONSIN

DUMORE HIGH SPEED GRINDERS

Non Breaking

Simonds are the Best Hack Saw Blades on the market. They are fast-cutting and non-breaking, made for machine or hand use.



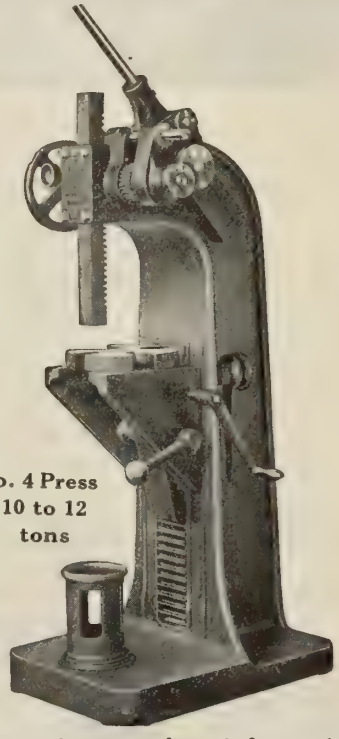
Hardened and tempered by Simonds Own Method these blades have the backbone to withstand hard service. If you require hack saws YOU'LL WANT SIMONDS.

Simonds Canada Saw Co., Ltd.
"The Saw Makers"
Montreal, Que.
St. John, N.B., Vancouver, B.C.

WATCHING THE DETAILS

"In order to realize the full possible return upon the investment in machine tool equipment it is necessary that the capacity of the machines and the tools be carefully balanced and that proper jigs be provided to facilitate their operation to the practical limit. It is also necessary that power in sufficient quantity and in suitable form be available," says Ernest Cordeal, in a recent issue of Industrial Management.

"The small factory cannot have individual motor drive on all of its machines, but it may have well arranged groups driven by motors; or where the line shaft cannot be dispensed with, the speed of the shaft and the ratio of pulleys may be so figured as to permit each machine to operate close to its most efficient rate. There is no possible economy in saving on power equipment at the expense of an efficient drive. Motors in the small factory very frequently carry a heavy over-load, adequate power and simultaneous operation of all units being impossible. Belting is another matter which requires constant and competent attention. Belts of insufficient size, run at improper tension or not effectively cared for may easily dissipate between source and use sufficient power to make up the difference between efficiency and inefficiency."



No. 4 Press
10 to 12
tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO.
330 N. Park St.
Kalamazoo, Mich., U.S.A,
Canadian Representatives:
Chas. A. Strelinger -- Windsor, Ont.

LUBRICATION OF DRIVING CHAINS

An effective way of lubricating roller chains working in the open, or where dust and dirt are likely to be harmful is to use a solid lubricant, such as tallow, or one can use any of the various mixtures of solidified oil and graphite at present on the market. The lubricant, whatever its constituents, must be stiff—the stiffer the better—but it must not crack and flake off when the chain is under load. Before the lubricant is applied, the chain should be thoroughly cleaned in paraffin. The lubricant should then be melted and rendered quite fluid, after which the chain, placed on it, should remain in the oil for an hour or more. "After having been removed from the oil and hung up to drain," concludes a writer in Pratical Engineer, "the chain must be used as soon as the lubricant has set. In operation the lubricant is gradually squeezed out from the joints, and removes any grit that may accumulate. When all the lubricant has thus been used, the chain should be treated again. The chains of motor wagons and commercial vehicles, to which the above process is particularly applicable, should be treated once a week if the vehicle is in use every day."

A NEW AEROPLANE ENGINE STARTER

As in the case of the motor car, the starting of an engine on an aeroplane is a minor problem by itself. A British firm has solved it in a very simple way in the case of engines having six or more cylinders and developing up to 500 h. p. The apparatus consists of a small air-cooled single cylinder motor coupled to a pumping cylinder which draws combustion mixture from a carburettor and delivers it under pressure to the main engine cylinders. The mechanism is so arranged that the gas passes into each of the main cylinders. This auxiliary motor will maintain a gas pressure of 140 lb. per square inch, which is sufficient to turn the most troublesome engine. The weight of the starting apparatus is 40 lbs. complete. After the main engine has been started, the motor can be run continuously for any driving auxiliaries.

CARGO CARRYING AEROPLANES

A novel type of aeroplane is being constructed by a British company under the auspices of the British Air Ministry. It is designed mainly with a view to carrying capacity, speed being sacrificed to some extent in order to give more scope for cargo. Careful experiments will be made to decide certain disputed points about the actual cost of carrying goods by air. Aircraft enthusiasts hold that for long distances the cost of carriage by air will be very little in excess of road motor charges. The capacity of the machine will be three tons.

Classified Opportunities

FOR SALE

FACTORIES FOR SALE — TWO DESIRABLE plants; one at Mount Forest, constructed of brick, floorage over 40,000 square feet, formerly operated by Weir Wardrobe Co.; and the other at Guelph, stone floorage over 50,000 square ft., formerly operated by Dominion Casket Co. Apply Box 777G, Canadian Machinery.

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (53)

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co. of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

POSITIONS WANTED

MECHANICAL DRAFTSMAN DESIRES A change; age 30; married. Experienced in tool, jig and machine design. If you are looking for a young man who by practical shop experience, knows his job from the drafting office to the shipping platform, arrange interview, at your convenience. Box 798, Canadian Machinery. (c1m)

MECHANICAL ENGINEER, COLLEGE GRADuate, twelve years' practical experience, able executive, thoroughly experienced in modern methods of production and management. Desires position as works manager or general superintendent with moderate sized concern where concentrated effort and ability would be appreciated. Moderate salary with percentage. Location immaterial. Box No. 800, Canadian Machinery.

MACHINERY WANTED

WANTED — A LATHE AND GEAR CUTTER. Must be in good condition. Advertiser desires to get in touch quickly with any person who is able to offer same. Apply Beaver Machine Shop, 1110 Center St., Calgary, Alberta. (c5mlg)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W.H. Sumbling Machinery Co., Toronto. (etfm)

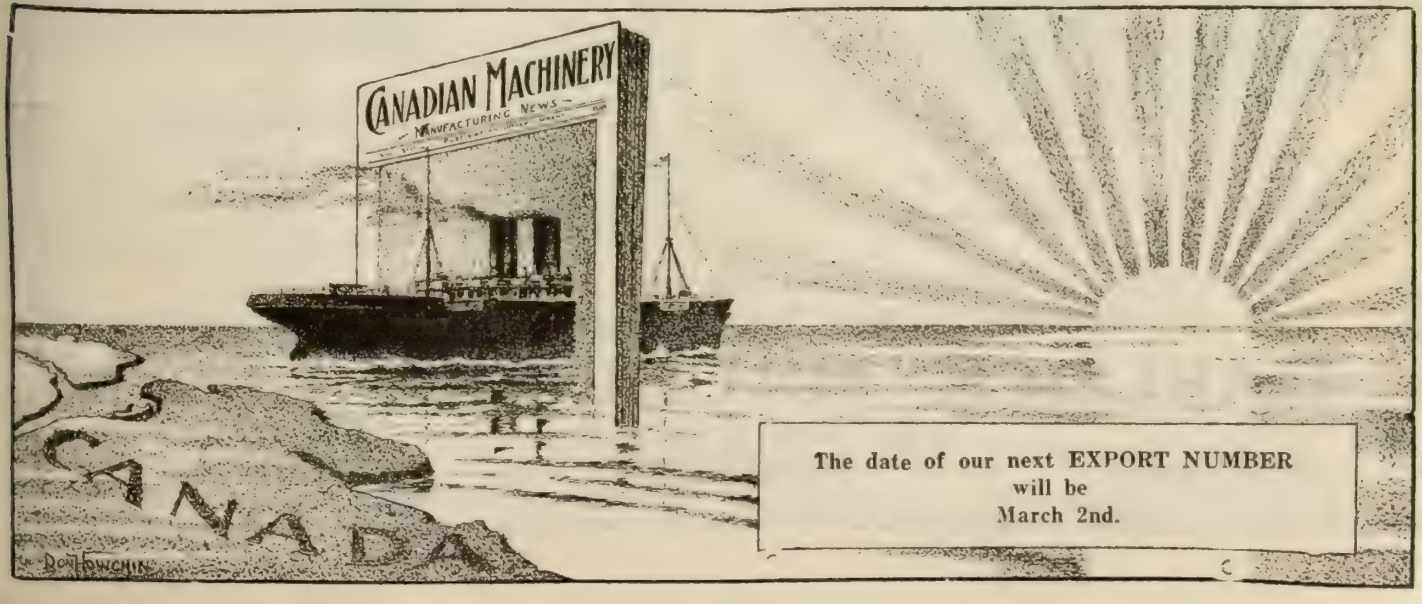
EQUIPMENT WANTED

CAFETERIA EQUIPMENT — RANGE, STEAM table, glass shelving, urns, Cash register, etc. Must be in first class condition. Give description and prices. State where may be inspected. Box No. 801L, Canadian Machinery.

CASTINGS

BRASS, BRONZE, ALUMINUM
Trolley Wheels, Closet Seat Hinges, Bronze Gears, etc. Jobbing Brass, Bronze and Aluminum Founders.

The Langley & Austin Brass Foundry
GALT, ONTARIO.



The date of our next EXPORT NUMBER will be March 2nd.

MACHINERY FOR SALE

Lathes

1—26" x 12' Pond Lathe, S.B.G., C.R., P.C.F.
1—24" x 12' New Haven Lathe, D.B.G., S-Q.C.G., C.R.
1—24" x 12' Can. Mach. Lathe, S.B.G., C.R., P.C.F.
1—21" x 10' London Lathe, S.B.G., C.R., P.C.F.
4—20" x 8' C.M.C. Lathes, D.B.G., S-Q.C.G., C.R.
1—18" x 8' C.M.C. Lathes, D.B.G., Q.C.G., C.R.
1—21" x 10' Butler Lathe, D.B.G., Q.C.G., C.R.
1—16" x 6' McDougall Lathe, S.B.G., S-Q.C.G., C.R.
1—18" x 8' C.M.C. Lathes, D.B.G., Q.C.G., C.R.

Shapers

1—24" Rockford Shaper.
1—12" Port Hope Shaper.
1—16" Hendey Friction Geared Shaper.

Drills

1—No. D-1 H.D. Colburn Drill.
2—No 24 H.D. Foote Burt Drills.
1—28" Barnes Drill, B.G., P.F.
1—22" Barnes Drill, B.G., P.F.
2—16" Back-geared Drill, lever feed only

Miscellaneous

2—2" x 26" Pratt & Whitney Turrets.
1—No. 2 Gardner Disc Grinder.
1—3" Acme Bolt Cutter.
1—No. 54 Perkins Sprue Cur.
1—No. 320 Brown-Boggs Pess.
1—10"x24" Plain Landis Grinder, self-contained.
Union Triplex Hydraulic Pump, 1¼"x"4

YEATES MACHINERY
HALE STREET
LONDON, ONT.

Hand Protection

Means Better Work



Mitten Style No. 681

Steel-Grip WORK MITTENS

and work gloves give complete hand **protection** plus hand **comfort.** The same reinforcement (small steel ribbons over strips of tough leather) that protects the hand also gives so much extra wear that these mittens and gloves last almost indefinitely. Sewed closed with steel thread, they are absolutely rip-proof. The steel reinforcement does not interfere with flexibility. Your workmen equipped with Steel-Grips will dig in with a will.

Write us to-day for suggestions on your hand protection problems. We can save you money on your work glove purchases.

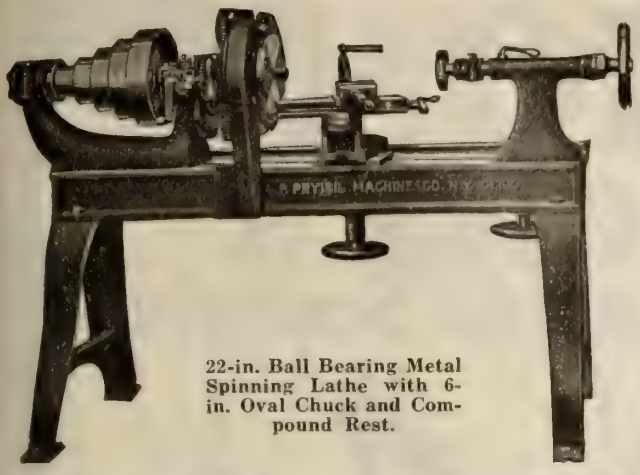
Industrial Gloves Corporation
424 Wellington St., W., Toronto

PARTIAL LIST OF NEW AND USED
METAL WORKING MACHINES ON HAND

1—Briggs' Miller, Type A, 22-in. traverse,
1—18x11½x8 Gas Furnace,
1—Edlund No. 2-B High Speed Drill,
Racine High Speed Hack Saw Blades,
3—Davis 24-in. Turret Lathes,
1—36x18 Putnam Engine Lathe,
1—18x8 Rae Engine Lathe,
1—16-in. Bardons & Oliver Turret Lathe,
1—18-in. Oliver Turret Lathe,
1—McKechnie-Bertram 20x12 Engine Lathe,
1—Racine No. 10 Hack Saw,
1—16x6 Lathe,
4—Woodward & Rogers Four Spindle Drills,
1—Canadian Allis-Chalmers 5 H.P. Motor,
1—Roots No. 1 Pressure Blower,
1—Perfect No. 3 Hack Saw,
1—12-in. Dividing Head for Ford-Smith Miller,
1—Plain Vise for Ford-Smith Miller,
1—Buffalo No. 3 Blower,
1—Champion 20-in. Drill,
1—Grant No. 80-B Riveter,
1—12-in. Three Jaw Universal Chuck,
1—Burke No. 1 Bench Drill,
1—Smart-Turner 4½x2¾x6-in. Pump,
1—Goldie-McCulloch Pump,
1—Greenerd No. 3½ Arbor Press, with Stand,
1—Landis 12x42 Plain Grinder,
1—Greenerd No. 3½ Arbor Press, without Stand,
1—Bellevue Double Oil Furnace,
1—Silver Three Spindle Gang Drill,
1—Silver 20-in. Drill,
1—Canadian Allis-Chalmers 5 H.P. Motor,
4—Speed Lathe Beds,
1—Air Compressor Stand,
1—No. 190 Brown-Boggs Press,
Chain Hoists,
Motors, varied H.P. and Current,
1—30-in. Straightening Roll,
1—30-in. Bending Roll,
I.R. Air Compressor with Tank,
Lot of Friction Rolls, Log Chains, Shafting, etc.
1—36-in. Back Geared Drill Press,
1—American 14x6 Double Back Geared Lathe,
1—16-in. Ohio Shaper,
1—Acetylene Welding Outfit on Truck, Portable,
1—Cataract No. 3 Bench Lathe,
No. 20 Rich Drills of various sizes.

If you don't see what you need here—write us—
We Desire to Serve You in Every Way Possible

GARLOCK MACHINERY LTD.
163 Dufferin Street
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22-in. Ball Bearing Metal Spinning Lathe with 6-in. Oval Chuck and Compound Rest.

Metal Spinning Lathes

Tools and Accessories

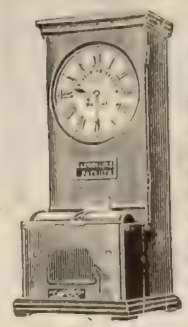
for Round and Oval work
from 15 to 60 inch swing

P. Pryibil Machine Company

New York City

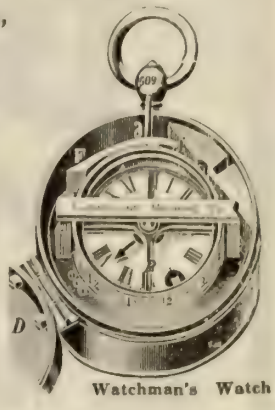
Established 1859

Time Checking Machines, Time Recorders, Watchman's Watches, Recorders for all purposes



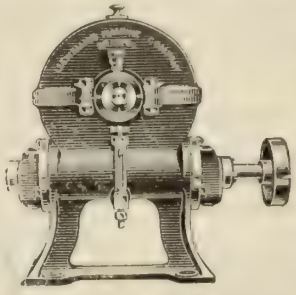
018 Class, Patent Card Recorder

Watches check the rounds of watchmen ensuring less risk from fire etc. with a consequent reduction in insurance premiums



Watchman's Watch

GEARS Machine Cut Machine Moulded Sizes and Descriptions



Totally enclosed Worm Reduction Gear.

Specialists in High Speed-Reducing and Accelerating Gears.



D.H. Stag Tooth Wheel & Pinion

Llewellin Machine Co., Bristol, Eng.

HEATING AND HANDLING OF SPRINGS

W. S. ROCKWELL CO. INDUSTRIAL FURNACES ESTABLISHED 1888 NEW YORK



AUTOMATIC SPRING TEMPERING FURNACE
Discharging End
Conveyor is adapted to the characteristics of the individual piece

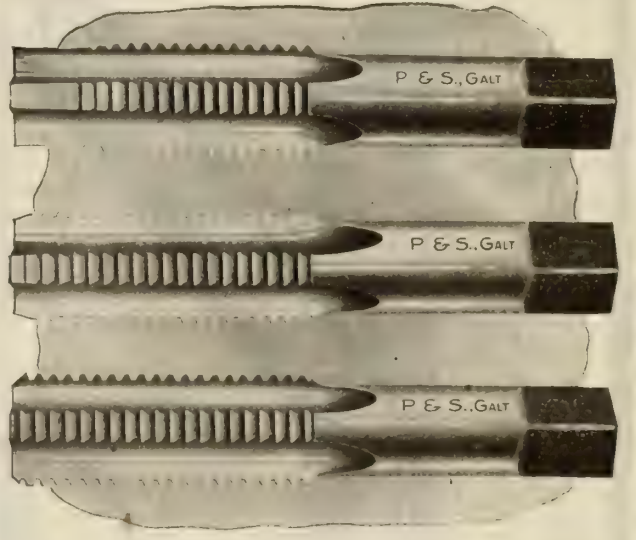
Interesting data on improved methods, with an outline of the factors governing the intelligent selection of equipment and fuel, are given in Bulletin 240.

Typical heating and handling problems are considered, with illustrations of stationary and continuous furnaces and a variety of handling equipment.

Write for Bulletin 240-T

W. S. ROCKWELL COMPANY

Furnace Engineers and Contractors
50 Church St., (Hudson Terminal Building) New York.
WE MAKE INDUSTRIAL HEATING FURNACES FOR EVERY REQUIREMENT
COAL—OIL—GAS—ELECTRICITY
"FURNACE AND FUEL TO SUIT CONDITIONS"
British Representative: Gibbons Bros., Ltd., Dudley, Worcester, England



Hand Tap Economy

It is always apparent in the longer life of a good tool. Hand Taps from 1/16" to 1½" diameter in stock. Our Taps, Dies and Thread-Cutting Tools are unconditionally guaranteed. Ask for catalogue.

Preston & Schwartz Limited

Galt, Ontario, Canada

BILLMONT WRENCHES

with Interchangeable Sockets

The "Master" Wrench

This wrench is a masterpiece among tools. With the strength of a pile driver, with its hooked nose and knurled hand grip, sliding handle, it is probably the most universal tool in the world.

No car, truck or tractor owner should be without one.

No farmer or mechanic should be without one. It is useful in every household.

This wrench gets in the most difficult places, where often you have to use a chisel and hammer to remove the nut. Hours of labor could be saved by having at hand the master wrench.



Ball and spring in cap keeps handle in place. The solid "T" bar handle which slides back and forth, in order to pass any obstruction, gives tremendous power.

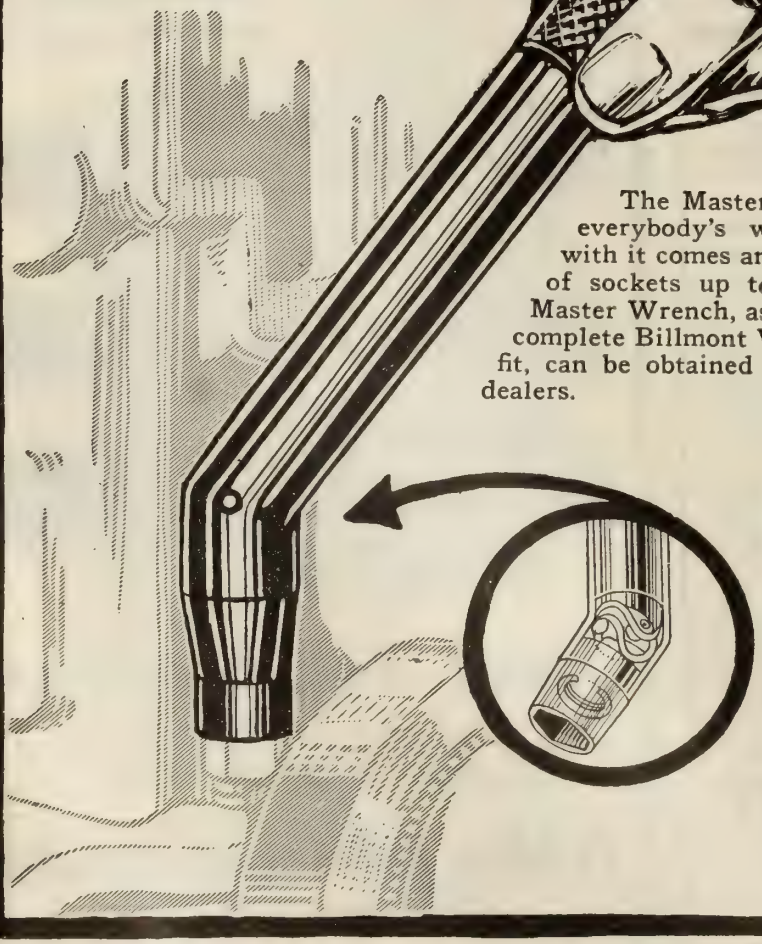
The Master Wrench is everybody's wrench, and with it comes an assortment of sockets up to 1″. This Master Wrench, as well as the complete Billmont Wrench outfit, can be obtained at all good dealers.

Ask your dealer or write us.

Russell Gear & Machine Co., Ltd.

1209 King St. West

Toronto - Ontario



The Universal Billmont Nose-Piece

The nose, turned at an angle at the end of a long, straight shank, makes it possible to reach places that would otherwise be hard to get at. The outer tube is stationary and offers a firm grip. The universal nose piece takes sockets of all sizes.

PARKER VISES

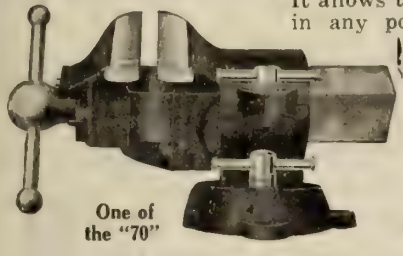


Have Renewable Jaws

They can be given a new "grip" on life in a few minutes, at a trifling cost. The jaws are of special tool steel, good for long service. But, if you should want to renew them, simply remove two pins and put in new jaws. This applies to nearly all Parker Vises, of which there are many styles.

They "GRIP LIKE A GRIZZLY"

Here's One With Double Swivel



One of the "70"

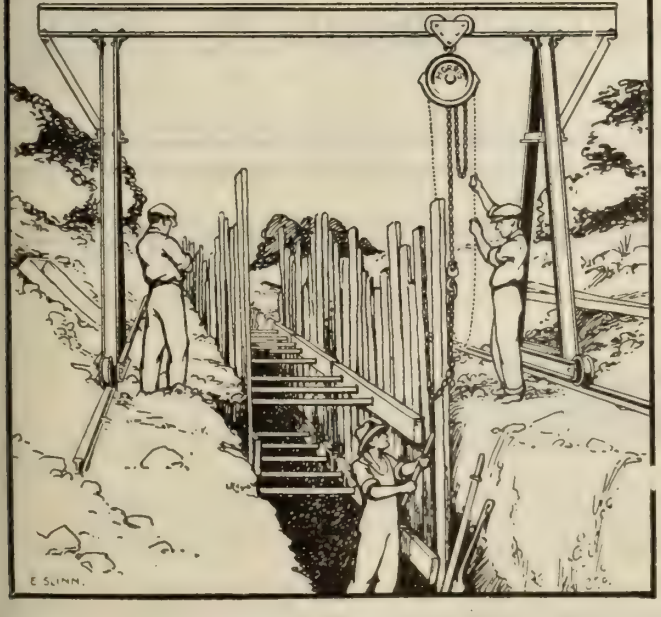
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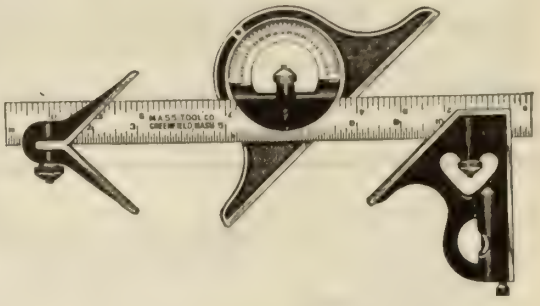
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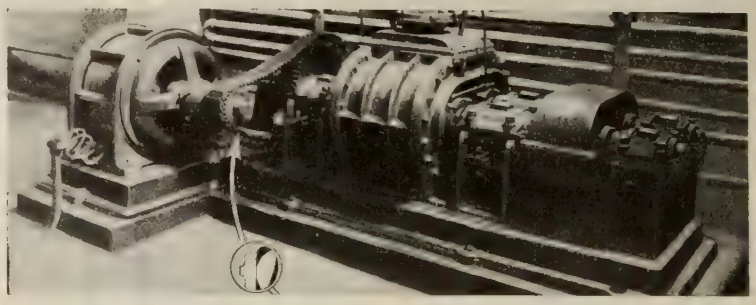
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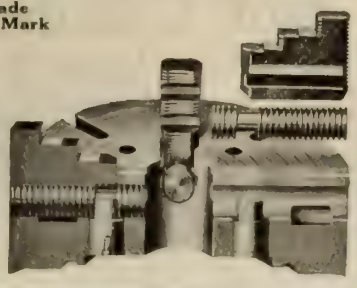
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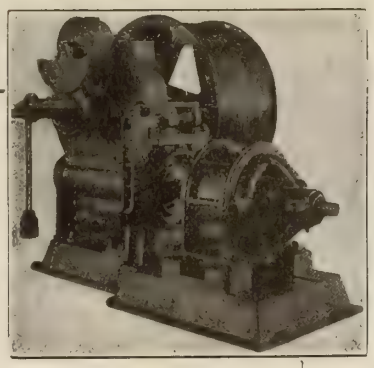


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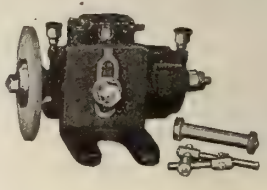
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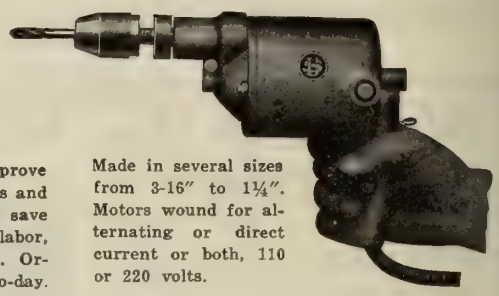
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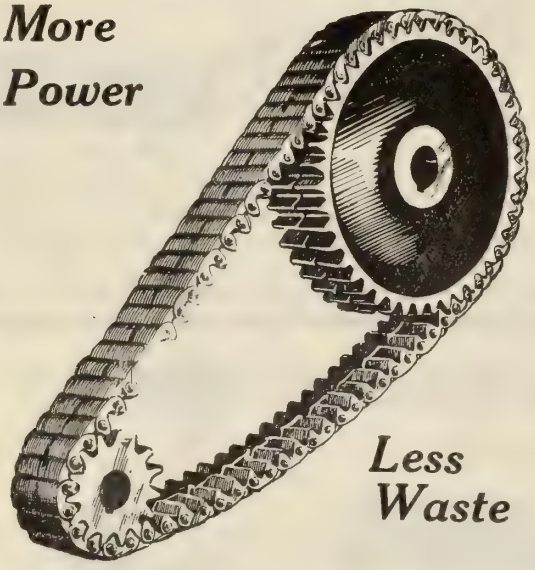
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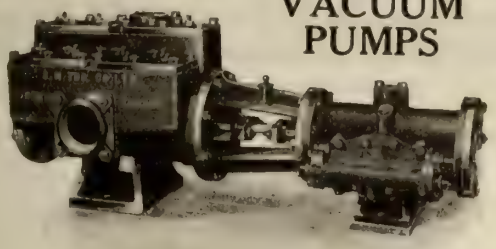
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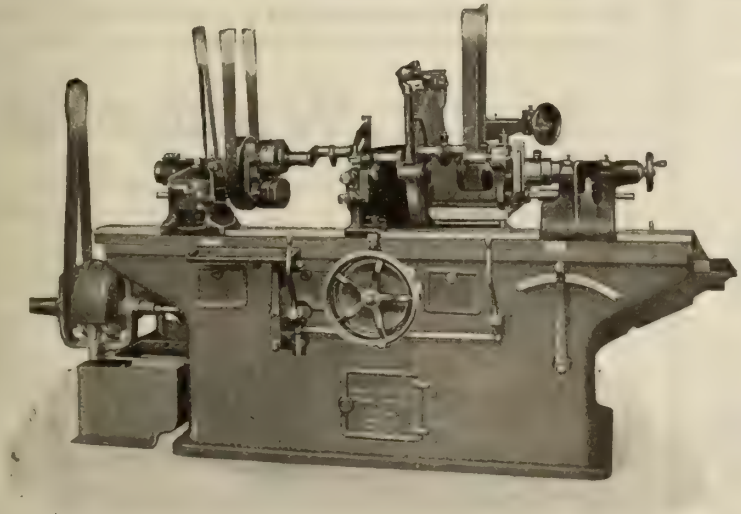
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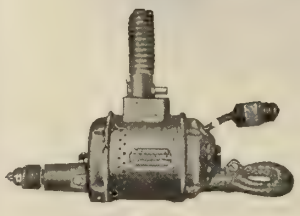
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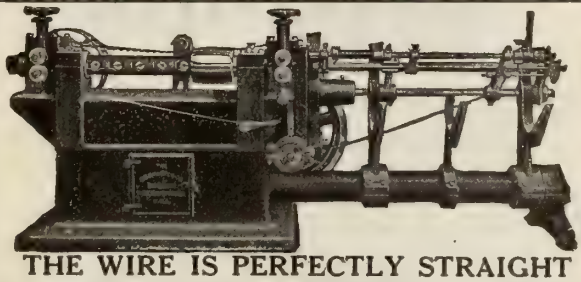
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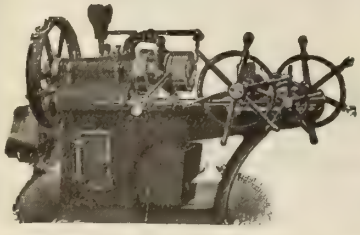

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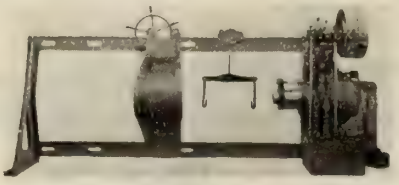
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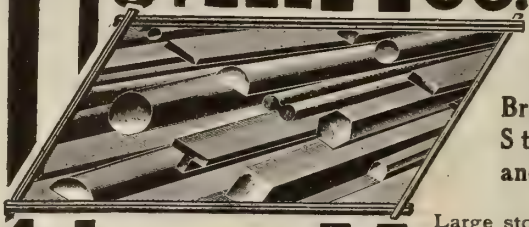
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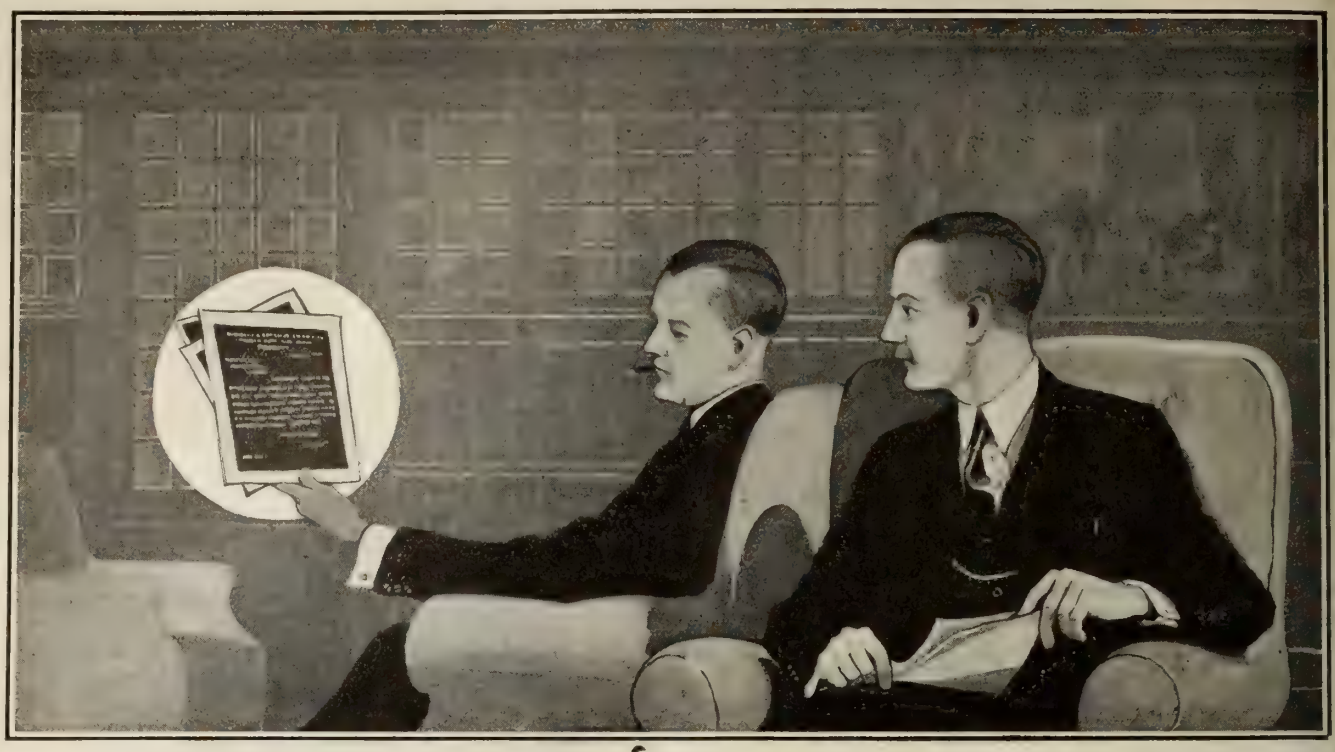
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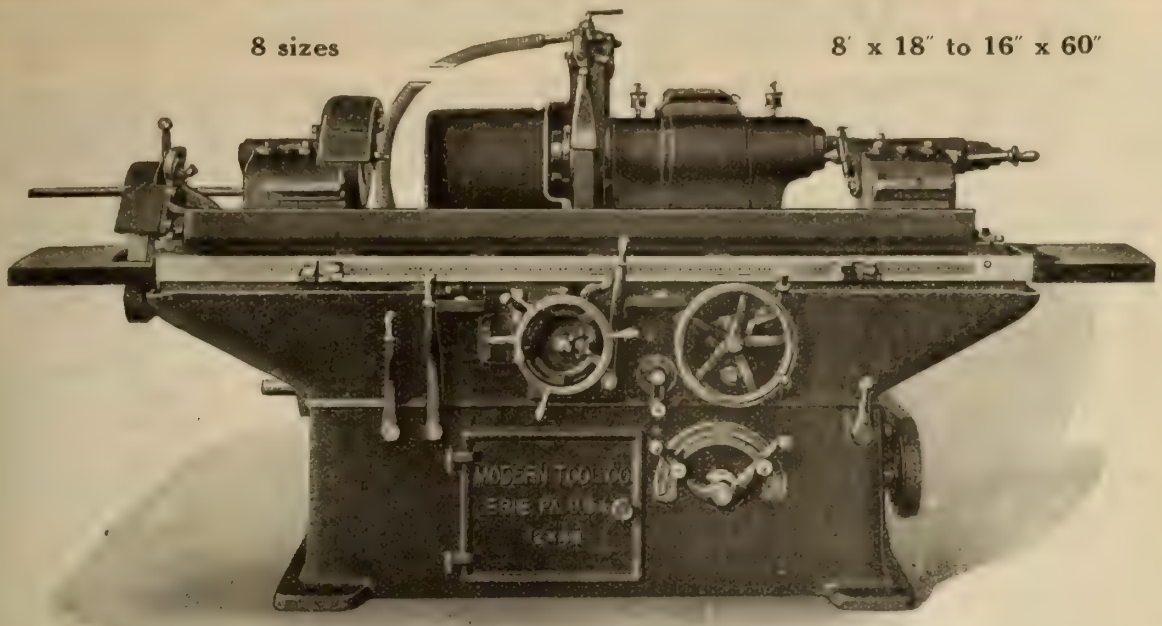
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More powerful than other types of same rating. A 4-in. endless belt carries the full power from main shaft direct to wheel spindle, giving constant smooth drive.

Gear Case

All speeds and feeds are secured from one gear box, a separate unit, which may be readily removed for inspection or renewal of bearings. Gears are in mesh at all times, and are engaged with shaft by our patented positive ball drive clutch, which permits instant change. Gears of steel with hardened bushings run in grease.

Send Us

—Blueprints and specifications, and we'll tell you what a Modern will do on your job.

Motor Drive

A constant speed motor may be attached to the main drive shaft of the machine by belt, silent chain or flexible coupling.

All Modern Plain Grinders are specially designed for most convenient connection to motor.

Wheel Side

Travel is on "V" and "Flat" ways, giving true, accurate movements and long life. A gib prevents raising of slide when heavy cuts are taken.

Bearings

Wheel spindle has bronze bearings with outside taper. Quick take-up for wear without dismounting is provided.

Main drive has anti-friction bearings.

Headstock has ball bearings.

Gear box has phosphor bronze bearings.

All provided with proper lubrication.

All shafts are ground.

MODERN TOOL CO., Erie, Pa.

Main Office and Works - Fourth and French Streets

BRANCH OFFICES:
New York City—54 Lafayette Street. **Detroit**—Kerr Bldg., 642 Beaubien Street. **Chicago**—541 Washington Boulevard.
SALES AGENTS IN UNITED STATES AND CANADA: Walter H. Foster Co., 50 Church St., New York City, N.Y.; E. L. Essley Machinery Co., 551-557 Washington Blvd., Chicago, Ill. **Branches:** Milwaukee, Wis.; Moline, Ill.; Manning, Maxwell & Moore, Inc., Railway Exchange Bldg., St. Louis; F. E. Satterlee Co., 120 Washington Ave., North, Minneapolis; Herberts Machinery & Supply Co., Los Angeles and San Francisco, California; Rudel-Belnap Machinery Co., Ltd., Toronto and Montreal, Canada; Sherritt & Stoer Co., 2006 Market St., Philadelphia, Pa.; Brown & Zortman Machinery Co., Pittsburgh, Penna.; Chas. A. Strelinger Co., 43 Larned St., East, Detroit, Mich.
Sales Agents in Foreign Countries: Leo C. Steinle, 1 Earl St., Westminster, London, Eng.; Glaenzer & Perreaud, 18 and 20 Faubourg du Temple, Paris, France; Aktiebolaget Rylander & Asplund, Stockholm, Sweden; Yamatake Company, Tokyo, Japan.

If interested tear out this page and place with letters to be answered.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E. Eng.

Acetylene, Dissolved
National Electro Products Co., Ltd., Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Attachments, Tapping
William I. Procunier, Chicago, Ill.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Fittings, Ltd., Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Ltd., Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Belting, Fabric
Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach. Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati,

Building Materials
Bertram & Son Co., Ltd., The John Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See also Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont

Castings, Marine
Can. Steel Foundries, Montreal, Que.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que

Castings, Grey Iron
Fittings Ltd., Oshawa, Ont.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.
International Malleable Iron Co. Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.
Fittings Ltd., Oshawa, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Kattie Foundry Co., Galt, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Boardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Can. Mathews Gravity Carrier Co., Port Hope, Ont.
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., B. B., Philadelphia, Pa

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchligh Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and nertz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drill Press Sleeves.
Preston & Schwartz, Galt, Ont.

BUYERS' DIRECTORY

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont. Montreal, Canada.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que

Filing Machines
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto Ont
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Atkins & Co., Inc., E. C., Indianapolis
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited. Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, On

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont
Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John. Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John. Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R I

Insulation
Diamond State Fibre Co. of Can., Ltd Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal,

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Stemie Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Prybil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Truing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto Ont.

Monel Metal
International Nickel Co. of Can., Ltd Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Northern Electric Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd. Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, C
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R I

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa.

BUYERS' DIRECTORY

Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. B., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited. Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R. Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal. Q

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can

Separators, Oil and Waste
Bowser, S. F. & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
National Acme Co., Cleveland, Ohio

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton, Ont.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton, Ont.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps, O'
Bowser, S. F., & Co., Ltd., Toronto, Can
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Wheel Truing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres,
Beardmore & Co., Ltd., Wm., Mon

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd. Montreal, Q
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton, Ont.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.

Welding Supplies
Carter Welding Co Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wiping Cloths
The Levi's, Toronto, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
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Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
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Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

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Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas. Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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H. W. Petrie Ltd., Toronto. Ont.

A. R. Williams Machinery Co., Montreal, Que.

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The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

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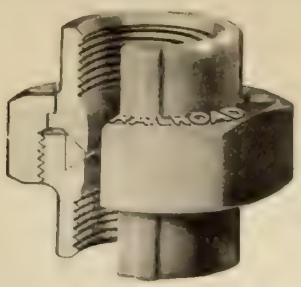
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CANONSBURG GAS COAL CO.
COUNTRY CLUB COAL CO.
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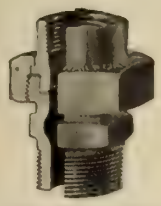
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No. 517 Reducing Pump Stud Union.



No. 519½ Male and Female Union.

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RAILROAD UNIONS AND FITTINGS



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No. 595 Tee Reducing or Outlet



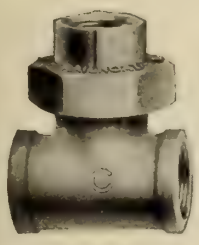
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THEY REQUIRE NO GASKETS AND MAY BE TAKEN APART EASILY.

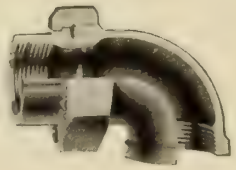


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Sales Offices:
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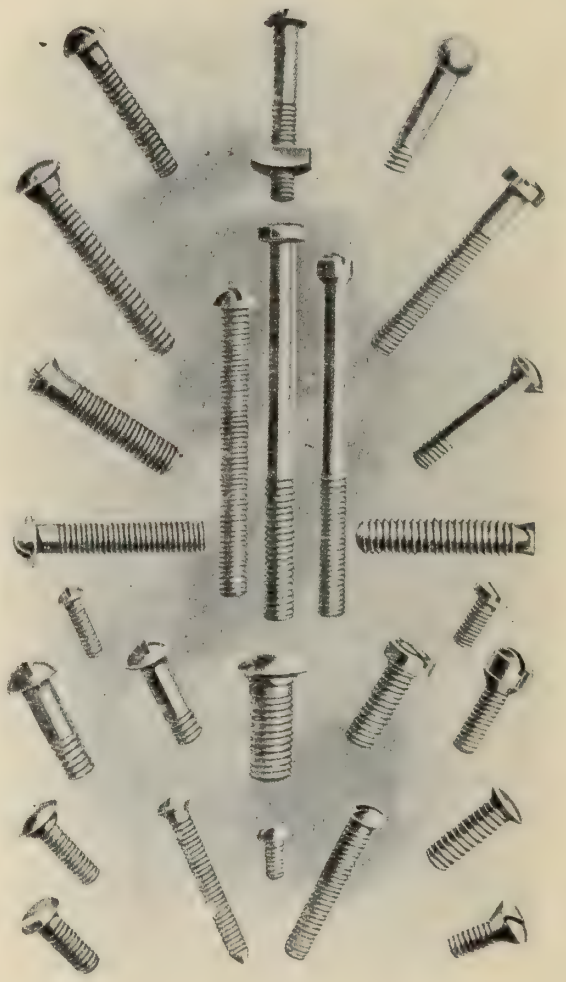
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UPPER BEDFORD, QUE.

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVII. No. 6 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Feb. 9, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Is your business efficiency four square?



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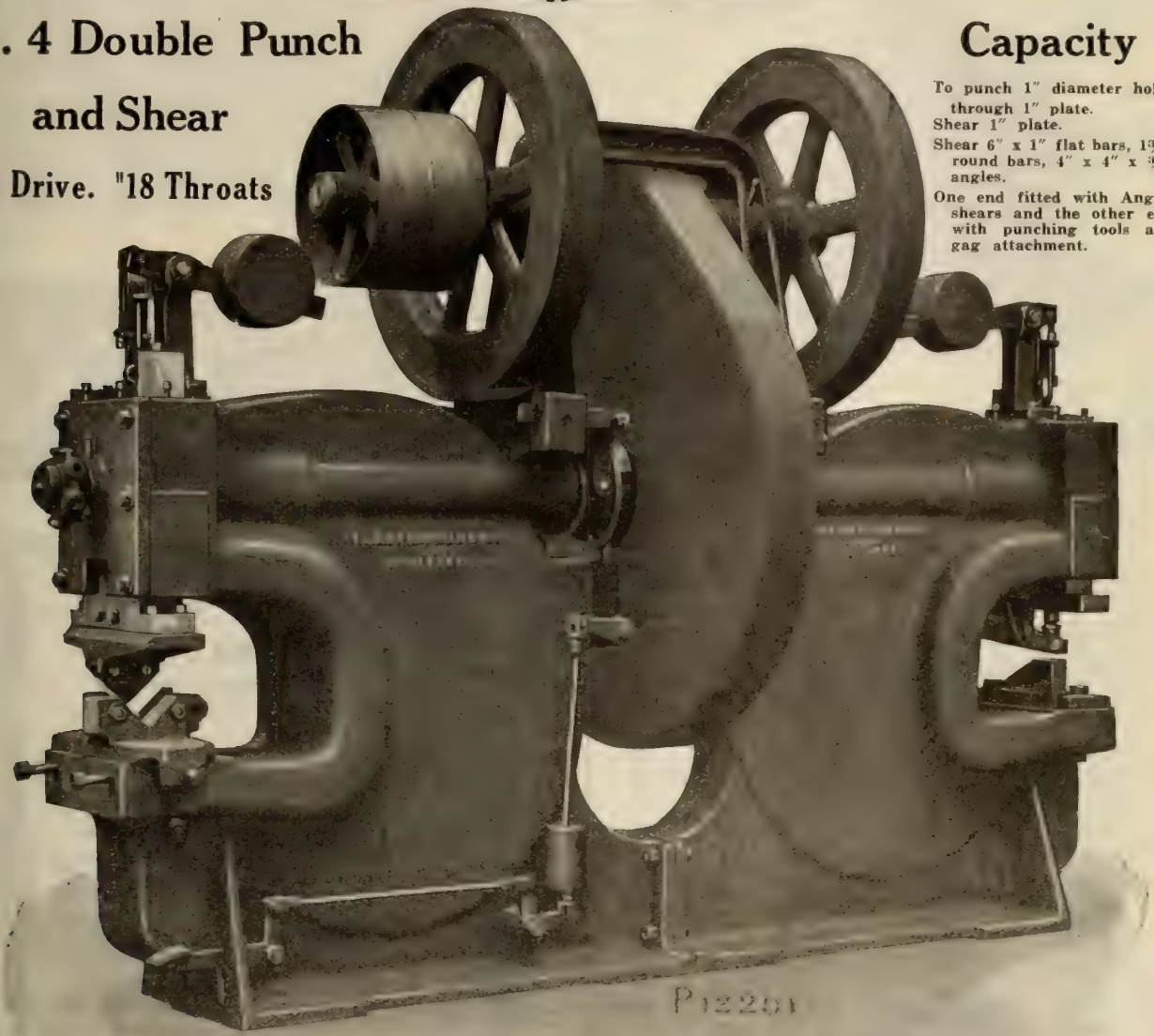
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MACHINE TOOLS

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No. 4 Double Punch and Shear

Belt Drive. "18 Throats



Capacity

To punch 1" diameter holes through 1" plate.
Shear 1" plate.
Shear 6" x 1" flat bars, 1¾" round bars, 4" x 4" x ⅜" angles.
One end fitted with Angle-shears and the other end with punching tools and gag attachment.

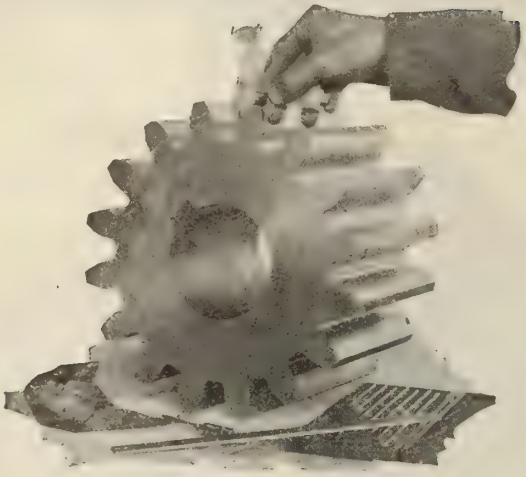
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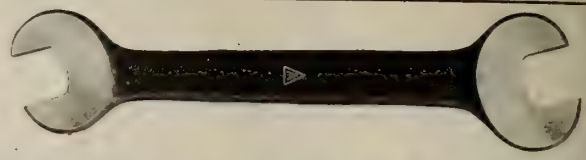
From the Hamilton Gear and Machine Co., Toronto

Diametral Pitch	Tooth Thickness at Pitch Line	Whole Depth	Dedendum	Addendum
1	1.5708	2.1571	1.1571	1.0000
1¼	1.2566	1.7257	0.9257	0.8000
1½	1.0472	1.4381	0.7714	0.6666
1¾	0.8976	1.2326	0.6612	0.5714
2	0.7854	1.0785	0.5785	0.5000
2½	0.6283	0.8628	0.4628	0.4000
3	0.5236	0.7190	0.3857	0.3333
3½	0.4488	0.6163	0.3306	0.2857
4	0.3927	0.5393	0.2893	0.2500
5	0.3142	0.4314	0.2314	0.2000
6	0.2618	0.3595	0.1928	0.1666
8	0.1963	0.2696	0.1446	0.1250
10	0.1571	0.2157	0.1157	0.1000
12	0.1309	0.1798	0.0964	0.0833
14	0.1122	0.1541	0.0826	0.0714

Write us for Quotations

Hamilton Gear & Machine Co.

76 Van Horne St., TORONTO



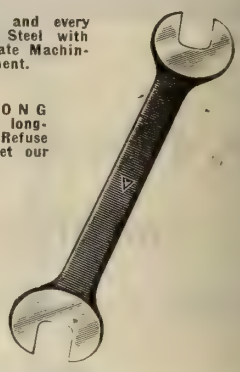
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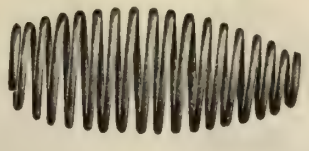
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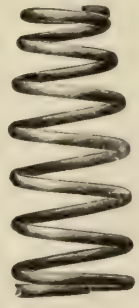




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Compression
Torsion
etc.

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Corry, Pa., U.S.A.



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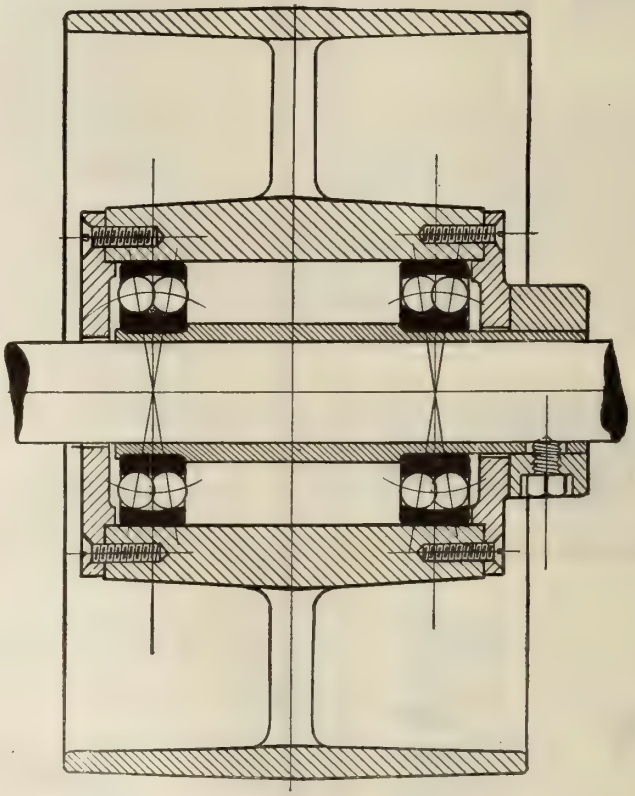


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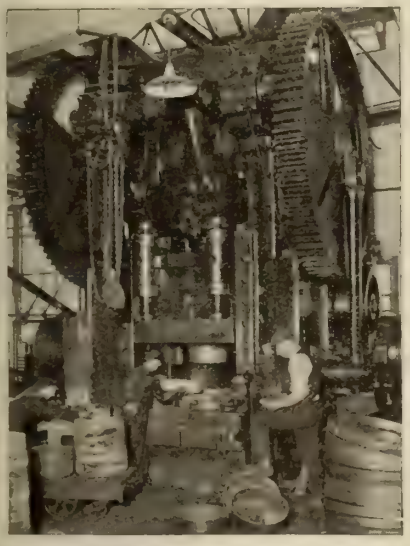
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Bliss Toggle Drawing Press in operation, drawing automobile brake drums.

Bliss Toggle Drawing Presses

The application to these presses of the "Bliss" patent toggle movement secures the greatest possible simplicity, durability and smoothness of action, and the most perfect "dwell" of the blank holder slide obtainable.

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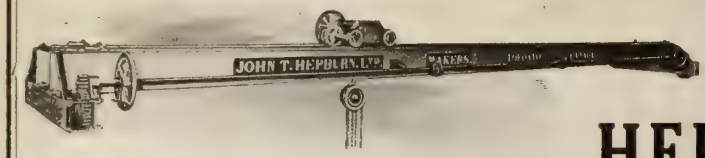
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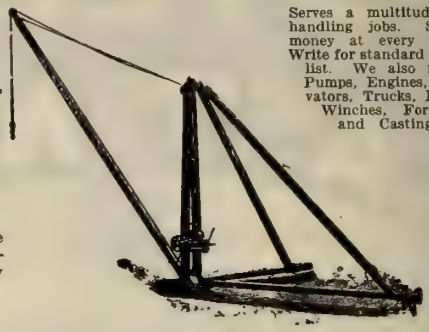
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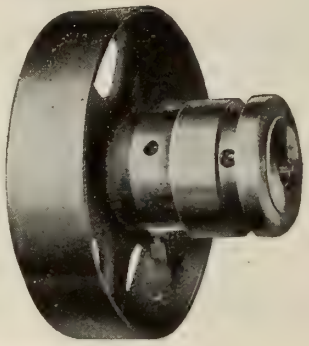
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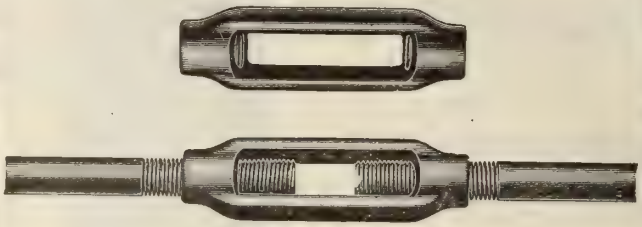
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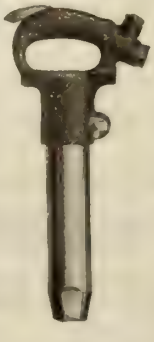
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For Foundry Work. Are furnished in any required size or weight for grey iron or steel castings; they have high speed, and are adapted for fast chipping now required by piece-workers.

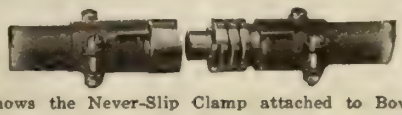


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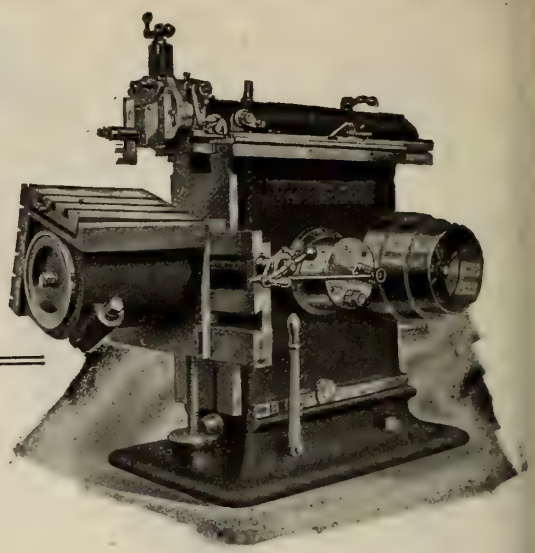


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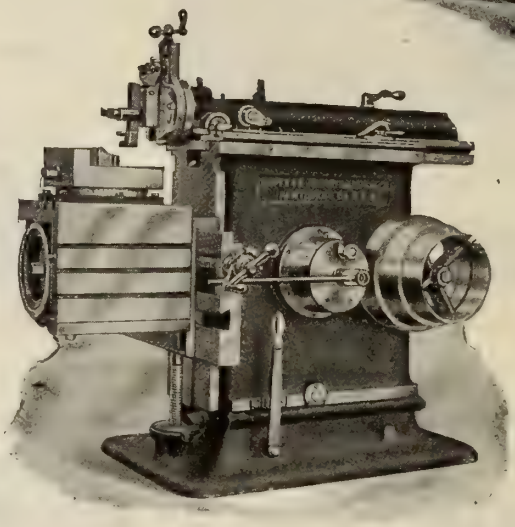
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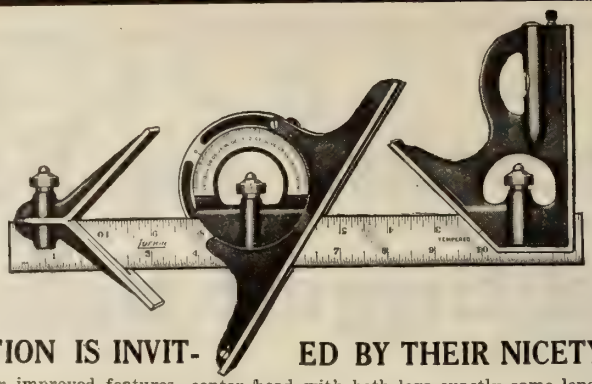
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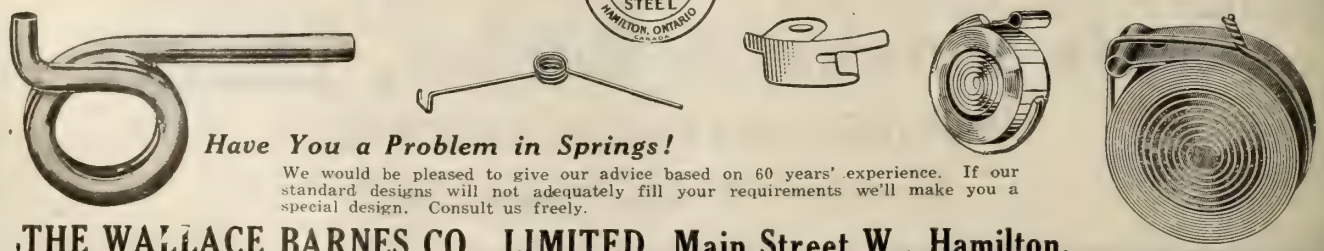
Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force can not replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every week will keep you posted on the latest developments for machinery equipment.

SPRINGS

THE WALLACE BARNES CO. LIMITED WIRE BARNES CANADIAN SPRINGS STEEL HAMILTON, ONTARIO



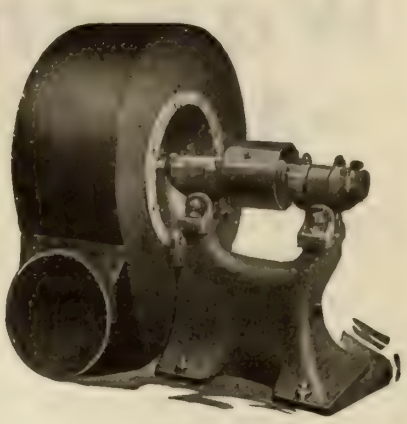
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They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

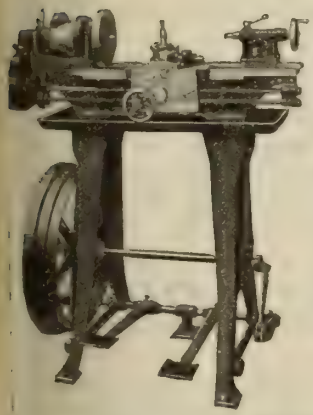
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Type B-6



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Actual Swing -	8¼
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Large and balanced flywheel fitted on shaft with roller bearings. Easy operation.



Send for Bulletin BC-661

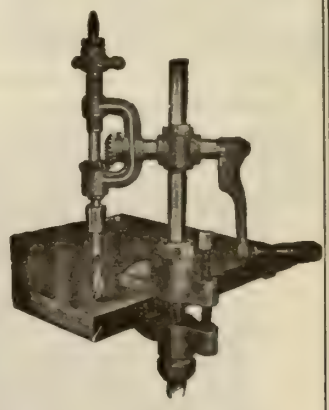
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Time is expensive when a machine is standing idle, waiting for repairs.





On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

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Was the New Cabinet Made in Montreal?

THE SECRET of the Cabinet is out. J. K. Munro, whose observations on what goes on behind the scenes in Ottawa have amused, entertained and instructed readers of MACLEAN'S in recent years, "explains" what happened when Premier Mackenzie King endeavored to pick his own Cabinet members.

Of course you will want to read this "inside" story of Canadian politics in

MacLean's Magazine
for
February 1st

which is on sale at all news-stands to-day.
This issue also includes several timely and authentic articles on subjects of national importance to Canadians, as well as a particularly attractive list of entertaining fiction, and a generous measure of Reviews.

Here's the "Inside Story"
According to Mr. Munro:

"Crerar had read the King proposals to his Western Progressives assembled at Saskatoon, and had so far received their approval that he was on his way East, presumably to close the deal.

"Then something happened. Sir Lomer Gouin and Senator Dandurand are represented as visiting Ottawa and turning the Liberal leader's plans topsy-turvy." Mr. Munro goes on to say: "The Cabinet slate had been smashed. . . . . A different reception had been prepared for the Hired Man's Hero. . . . . What did the little Quebec Boss do in those three hours? Well, report says that he went straight to the Rideau Club, where the young Premier-to-be was waiting for him in the 'Silence Room' (that said silence was so rudely shattered that a frightened waiter crept up and closed the door); and that behind that closed door an embryo statesman had it made plainly evident that the powers that made could unmake; and that a Quebec that had given him a sullen support would rise and rend him unless he listened to her voice—and Sir Lomer had Quebec's voice about his person."

READ THESE FOR INFORMATION:

THE WEST WON'T STAY DOWN—by Charles Christopher Jenkins: The second of two up-to-the-minute articles showing how the Canadian West is meeting its various agricultural, financial, economic, commercial and social problems in these days of stress and strain.

FAR NORTH REALLY LIVEABLE—by Vilhjalmur Stefansson: Canada's foremost Arctic explorer gives facts and figures to prove that life in the Land of Winking Night can really be pleasurable and profitable.

THAT MAN FROM CARSTAIRS—by Nicholas North: A breezy, informative sketch of Henry Wise Wood—formerly "That Man from Missouri"—who wields such a potent influence in Albertan politics.

SLEUTHS OF THE WILDERNESS—R. G. MacBeth: A series of fascinating—and true—tales of Canada's famous red-coated force, and how offenders are tracked for months and years, by the Dominion's relentless, tireless preservers of peace in the wilds.

AND THESE FOR ENTERTAINMENT:

A PRIMROSE AND A PROMISE—by Margaret Busbee Shipp: A light little love-story which commences on a continental train, progresses through the tulip hills of Holland, and culminates in an international hockey match.

THE SAIL-DRAGGER—by Frederick William Wallace: A melodrama of the sea; which includes a pretty typist, a brawny hero, half a dozen Bolsheviks and a mysterious will,—all the ingredients of a fascinating "thriller."

HOW "BOB'S MAGGIE" GREW INTO HER JOB—by Ethel M. Chapman: The fascinating and adventurous life-story of Dr. Margaret Patterson, Toronto's new Police Magistrate.

ON THE JOB—by Archie McKishnie: "The Swallow" decided to go straight, but found many influences endeavoring to force him once again into the influences of the underworld. Mr. McKishnie, as usual, has a strong "twist in the tail" in this yarn.

MOSTLY SALLY—by Pelham Grenville Wodehouse: Some more about Sally and her fortune, and Ginger and his foibles.

THE HOUSE OF APPLEDORE—by "Sapper"—H. C. McNeile: "The Writer's Story": how a journalist was imprisoned, how he faced death, and how he used a clever code to escape.

ODETTE ELOPES—by Margaret Hilda Wise: A simple little tale, entertainingly told, of a girl who announced her elopement.

Besides all of this, the **Review of Reviews Department** gives a review of world-wide matters of current interest that alone is worth more than the price of the magazine.

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British Empire Steel Corporation, Limited,
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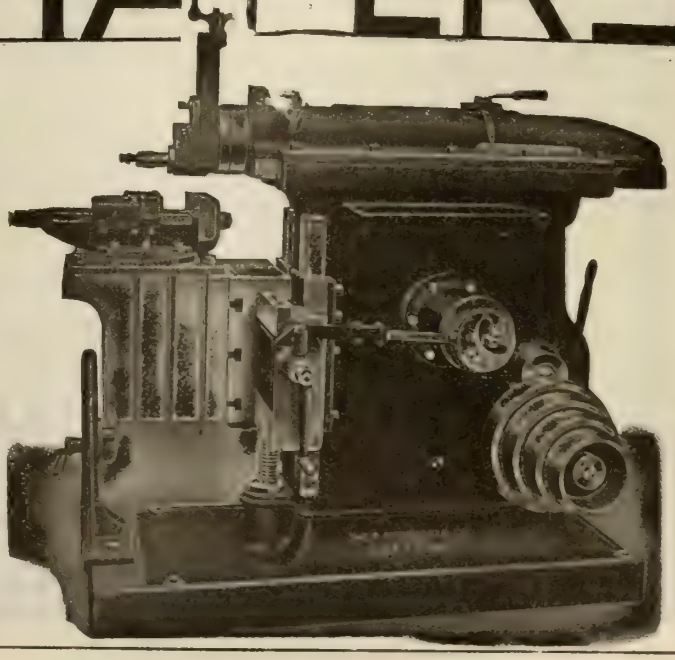
More Speed
Better Work
With

McDougall SHAPERS

16 and 20 inch Crank

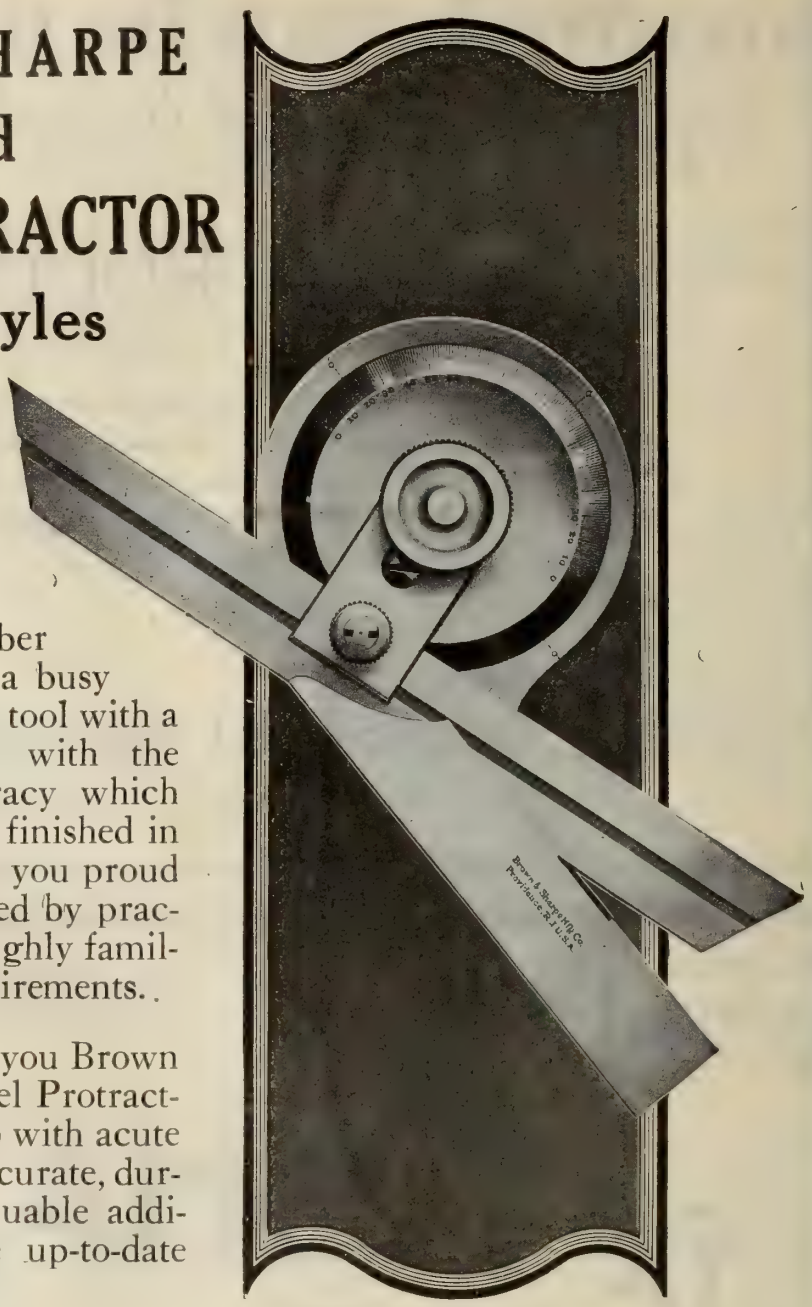
Modern methods of manufacture require modern tools. McDougall 16 and 20 inch shapers embody the best features of all machines which have been placed upon the market and can be depended upon to produce work **accurately** and **fast.**

An important feature is the column. It is massive in construction, well braced and reinforced internally. Has ample opening under ram for keyseating or other long work. Bearings for ram extend beyond vertical line of column both front and back. The ram is of exceptionally strong construction. McDougall shapers have other points of interest you should know about. **Write for full description.**



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BROWN & SHARPE
Improved
BEVEL PROTRACTOR
In Three Styles



An indispensable Tool for the all round mechanic

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Ask your dealer to show you Brown & Sharpe Improved Bevel Protractors, particularly No. 496 with acute angle attachment—an accurate, durable, useful tool—a valuable addition to the kit of the up-to-date mechanic.

Your dealer will be pleased to give you a copy of our No. 28 Catalog. Turn to page 86 and see some of the many ways you can use these Bevel Protractors.

If your dealer hasn't a supply of Brown and Sharpe Catalogs, write to us direct and ask for a copy of our Catalog No. 28

BROWN & SHARPE MFG. CO.

PROVIDENCE, R.I., U.S.A.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII. No. 6. FEBRUARY 9, 1922

The Designing of a Triple Riveted Butt Joint

Factor of Safety Must Be Allowed—Determining Proper Thickness of Boiler Shell Plate—Strength of Boiler Shell—Sketching Proposed Joint—Resistance Against Tearing and Crushing

*By L. T. RUTLEDGE

THE STEEL to be used in the joint spoken of in the previous article in the January 26 issue, should be tested in a testing machine in order to determine its ultimate tensile, shearing and bearing values, and the value of the elastic limit for each kind of stress. The following are average values for the ultimate strength of ordinary boiler plate: in tension 60,000 lbs. per sq. inch, in bearing 90,000 lbs. per sq. inch, and in shear 45,000 lbs. per sq. inch. In boiler design a factor of safety of not less than 5 should be used; this being the usual factor employed.

Example:—It is required to design a triple riveted double strap, butt joint for a boiler 66 inches inside diameter, the maximum boiler pressure being 160 pounds per square inch. It is required that the joint be at least 85 per cent efficient.

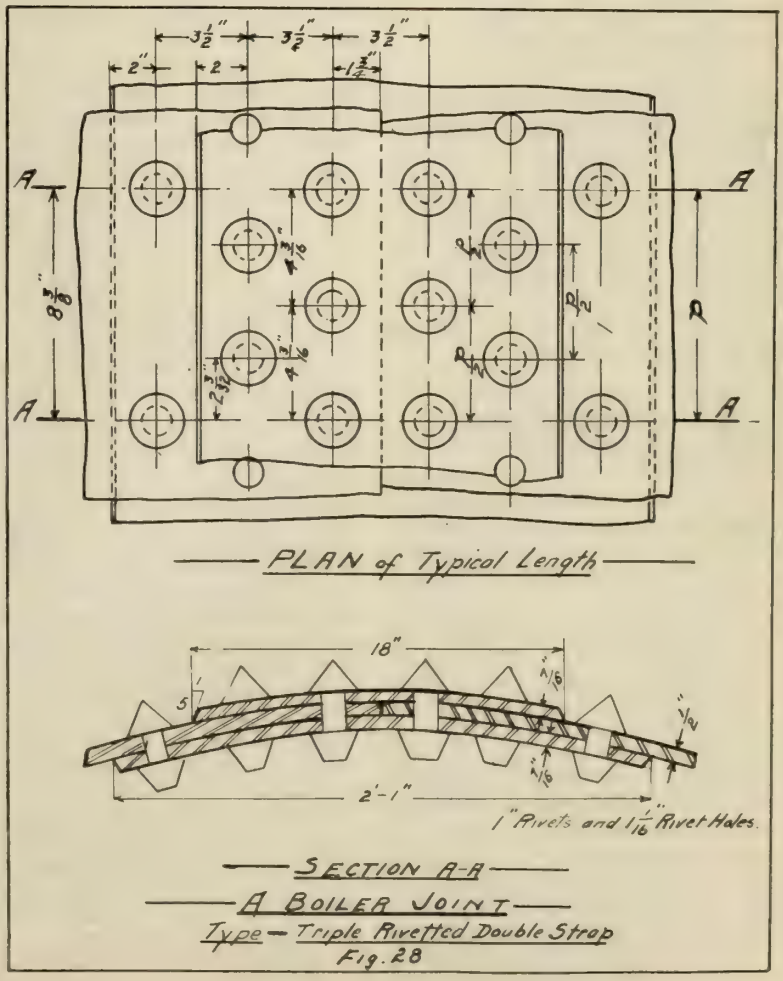
Solution:—The first step will be the determination of the proper thickness of boiler shell plate. The boiler is a hollow cylinder, in the walls or casing of which stresses are induced by the internal pressure. The internal pressure is transmitted undiminished in all directions, and acts with equal intensity on all equal surfaces and at right angles to those surfaces. We assume that the stresses resulting from the external forces are distributed uniformly over the cross-section of the boiler shell.

Strength of Boiler

We shall consider the strength of the boiler shell in two main directions, namely, longitudinally and circumferentially. The longitudinal stress is caused by the pressure acting on the end of the cylindrical boiler, tending to tear the shell transversely. For a state of equilibrium the bursting external force must equal the internal resisting stress. The bursting force is given by the area of the cylinder end multiplied by the unit pressure, that is

$$\frac{\pi}{4} D^2 P$$

Where D is the internal diameter of the boiler, and P the internal pressure in pounds per square inch. The area that resists the bursting force is the area between two concentric circles, one D inches diameter and the other D+2t inches in diameter. This area is practically the area given by multiplying the circumference D by t. The unit stress is St. Thus the total resistance



PLAN of Typical Length

SECTION A-A

A BOILER JOINT

Type — Triple Rivetted Double Strap

Fig. 28

*The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, Mr. Rutledge will be only too pleased to offer assistance. To save time, write direct to Kingston, explaining your trouble in detail.

is Dts. Now as stated above, for equilibrium

$$\frac{\pi}{4} D^2 P = \pi D t S$$

$$\text{Therefore } t = \frac{PD}{4St}$$

Next, let us consider the strength of the boiler in a direction at right angles to the above. The bursting force, in this case, is that which tends to lift one half of the boiler longitudinally from the other half. The bursting force is given by the expression PDL where L is the length of the boiler inside. Although the inside surface is a semi-circle in one direction, it is quite correct to consider the resulting pressures as those at right angles to a plane through the centre of the circle; the plane being the one passing through the sections of the shell where it resists the bursting force.

The area that resists the load consists of two rectangles, each t inches in thickness and L inches long, the two sections being 180 deg. apart. The resisting area is 2 Lt. The total resistance is

$$2Lt\,S_t$$

For equilibrium

$$PDL = 2Lt\,S_t$$

$$\text{Thus } t = \frac{PD}{2St}$$

It will be observed that this latter formula gives a thickness twice that given by the formula first obtained. This shows that if a boiler fails, it is altogether certain to fail along a longitudinal seam. So, for purposes of design and for safety, we shall use the latter formula, which gives the greater thickness.

Then, using the data given in the problem as stated, we have

$$t = \frac{PD}{2St} = \frac{160 \times 66}{2 \times 12000} = .44 \text{ ins.}$$

We use a factor of safety of 5; hence 12,000, being one-fifth of 60,000, (the ultimate strength of the boiler plate in tension) is the working tensile strength of the joint.

The boiler joint cannot be 100 per cent efficient. We are only required to make it 85 per cent efficient. This means that the joint is 85 per cent. as strong as the solid unpunched plate. So if we use the above value of "t" and have our joint 85 per cent. as strong as the clear boiler plate, it is apparent we shall not have a factor of safety of 5 in our boiler design as the joint will lower its value. The strength of the boiler is no stronger than the joint. Now, if we wish the joint to have a factor of safety of 5, let us make the plate thicker. If we consider 0.44 inches as 85 per cent. of the thickness to be used and find what thickness would be 100 per cent. then we have fulfilled the condition as regards the factor of safety.

Therefore the thickness to be used in the design is

$$t = \frac{0.44}{.85} = .50 \text{ ins.}$$

We shall, then, specify ½ inch boiler plate, which happens to be a commercial size.

The cover-plates or straps of a triple riveted butt joint for ½ inch boiler plate will be 7/16 inch, according to tables of standard practice as given in handbooks. The diameter of rivet that would be consistent with the thickness of plates to be used is 1 inch. Thus we shall assume $t' = 7/16$ in. and $d = 1$ in.

The diameter of the rivet hole; $d' =$ 1-1/16 in. The above assumed value shall be tested in the following solution, in order to ascertain if the assumptions are correct.

In the example, the following permissible working stresses obtained from the ultimate values by adopting a factor of shaft of 5 will be assumed:—

Tension 12000 lbs. per sq. in.
Bearing 18000 lbs. per sq. in.
Shear 9000 lbs. per sq. in.

The foregoing values are good average ones for boiler steel. In most cases the values are somewhat greater.

A sketch of the proposed joint should now be made, which sketch is quite similar to the illustration in Fig. 28. There will be three rows of rivets on each side of the butt joint and it is assumed at the beginning that the cover plate on the outside of the boiler does not have to be as wide as the inner plate since the pitch of the rivets in the outer row is made twice as great as in the middle and inner row.

The results given by the various calculations for strength will indicate if this is a correct design or not. Hence if the joints fulfill the specifications there is no reason to make the butt straps of equal width. Assume "P" to be the pitch between two rivets in the outer row. A typical length of joint on which to make the calculations will be that between the two similar sections marked A—A. The adjacent lengths are exact duplicates and similar for the entire length of the boiler.

In the analysis of the joint it is best to consider and determine the resistance against every possible failure in the typical length of boiler joint.

The various resistances against failure are:—

1. Resistance against tearing of the plate in the outer row:—

Using the previous notation, we have the resistance against this failure to be

$$P_1 = (p - d')\,t\,S_t \text{ ---- (a)}$$

Where $(p\text{-}d')$ is the length of solid metal between two adjacent rivets.

2. Resistance against tearing of the plate between the rivet holes in the second row combined with the failure of the rivet in the outer row, the rivet in the outer row falling either by shear or by crushing against the cover plate:—To express this correctly we need two algebraic equations, namely,

$$P_2 = (p - 2d')\,t\,S_t + \frac{\pi d^2}{4} S_s \text{ ---- (b)}$$

$$P_3 = (p - 2d')\,t\,S_t + d t' S_b \text{ ---- (c)}$$

In the equations just established, it is well to note the first term. In the second rivet row in our typical length of joint between sections A—A two rivet holes occur. These are shown deducted in the equations.

3. Resistance against shearing of all the rivets:—In our typical length of joint on the one side we have in the second and inner row four rivets in double shear and one in the outer row in single shear. The total of these is equivalent to nine rivets in single shear, therefore

$$P_4 = 9\,\frac{\pi d^2}{4} S_s \text{ ---- (d)}$$

4. Resistance against crushing of all the rivets:—The joint may fail by the crushing of the four rivets of the second and inner row against the boiler plate, and the crushing of the rivet in the outer row against the cover plate. Then the resistance against this probable failure is

$$P_5 = (4t + t')\,d\,S_b \text{ --- (e)}$$

5. Resistance against combined crushing and shearing. The joint may fail by the crushing of the four inner rivets and the shearing of the rivet in the outer row. For this we have

$$P_6 = 4dt\,S_b + \frac{\pi d^2}{4} S_s \text{ --- (f)}$$

A joint of this type should be designed so that it becomes stronger as the center line of the joint is approached. This condition is obtained by making equations (b) and (c) greater than (a) that is

$$(p - d) < \frac{t}{S_s p \pi} + \frac{\pi}{4} t (p\pi - d)$$

$$t S_t \text{ and } (p - 2d')\,t S_t + d t' S_b > (p - d')\,t S_t$$

For simplicity in this case, where absolute accuracy is not essential, assume d' equal to d, then by simplification of the above expressions we see that the condition is obtained if

$$d > \frac{4tS_t}{\pi . S_c} \quad --- (g)$$

which verifies our assumption for value of d in the first place and from the second expression we find that

$$t' > \frac{tS_t}{S_b} \quad ---(h)$$

The algebraic solution is completed. At this point we might insert arithmetical values in equations (g) and (h). Thus d must be greater than

$$4 \times \tfrac{1}{2} \times \frac{12000}{3014 \times 9000} \text{ or } .85 \text{ inch.}$$

Therefore a one inch rivet is satisfactory.

Also t' must be greater than

$$\tfrac{1}{2} \times \frac{12,000}{18,000} \text{ or } .33 \text{ inch.}$$

Therefore a 7/16 inch cover plate satisfies the condition.

The problem is to find the value of the pitch "P." To do this, determine the resistances of P_4 P_5 and P_6 as given by equations (d), (e) and (f)

$$P_4 = \frac{9 \times 3.14 \times 1^2}{4} \times 9000 = 63617 \text{ Lbs.}$$

$$P_5 = \left(4 \times \tfrac{1}{2} + \tfrac{7}{16}\right) 1 \times 18000 = 43875 \text{ Lbs}$$

$$P_6 = (4 \times 1 \times \tfrac{1}{2} \times 18000) + \frac{3.14 \times 1^2}{4} \times 9006$$

$$= 45088 \text{ Lbs.}$$

The minimum value is that given by P_5, namely, 43,875. Equate P_1 to this value in order to determine the quantity "P."

$$43875 = (p - d')t\,S_t \text{ or}$$

$$43875 = (p - 1/16)\tfrac{1}{2} \times 12000$$

$$\text{therefore } p = 8.36 \text{ or } 8\tfrac{3}{8} \text{ Approx.}$$

Therefore P=8.36=8⅜ approx.

We shall use the value 8⅜ but before adopting it finally, we must determine the values for P_2 and P_3 with P=8⅜. On substitution in equations (b) and (c) we get

P_2=44,568 lbs. and P_3=45,375 lbs.

It will be observed that the resistance as given by P_4 and applied to P_1 is the minimum value, the value being 43,875 lbs.

The efficiency of our joint as designed is equal to the minimum resistance or the strength of solid plate of length equal to pitch.

$$= \frac{43,875}{8\tfrac{3}{8} \times \tfrac{1}{2} \times 12,000} = \frac{43,875}{50,250} = .876$$

Thus the efficiency is 87.6 per cent. which is a little higher than the specifications called for.

The detail of the joint may be completed as shown in Fig. 28. The position of the gauge lines should be clearly dimensioned. The long pitch is 8⅜ins., the short pitch is 4-3/16 ins. The back pitch should be about 70 per cent. of the short pitch. This is given as 3½ ins. For boiler work, the marginal distance should be 2ins. where 1-inch rivets are used.

Suggested Problems

1. Determine the pressure that may be safely carried in an air receiver 60in. in diameter, the shell of which is ⅜in. thick. The longitudinal seam is of the triple-riveted butt joint type having two 5/16 in. cover plates. The rivets are ¾in. in diameter and the pitch in the outer row is 6½in. The back pitch is 2-7/16in. and the margin is 1-7/32 in. The permissible working stresses for tension, shearing and bearing are 12,000, 8,800 and 19,000 lbs. per sq. in. respectively.

2. A pressure tank 48in. in diameter is subjected to an internal pressure of 150 lbs. per sq. in. Design a double riveted lap joint for the longitudinal seam of the above tank assuming the same working stresses as given in problem 1.

PORTABLE CRANE

A new industrial portable crane has been placed on the British market recently. This crane is electrically operated and can run in and out through the doorways of warehouses and stockrooms and can be placed alongside a motor truck or railway car, that requires to be loaded or unloaded in the shortest space of time. It has a jib type of crane which is mounted on a "runabout" chassis, without the usual turntable arrangements. That is to say, that the crane is rigidly attached to the chassis and always remains in the same relative position to it. Motive power is supplied by storage batteries to electric motors. The two steering wheels can be turned so that the whole crane will revolve by power about its own axis without any motion of translation. The capacity of the crane is 1,500 pounds, at a radius of ten feet in any position in the circle, with a height of hook of twelve feet. The crane is guaranteed to sustain an overload of 25 per cent. The overall width of the apparatus is six feet. It rotates in a circle of 6 feet 3 inches in diameter. The weight, including the drive, is about three tons. The crane can travel at a speed of about 300 ft. per minute and will hoist at a speed of twenty feet per minute, and slews at the rate of 2½ revolutions a minute.

The overhead clearance when the jib is lowered into a horizontal position is such that it will pass under a 7 foot 6 inch doorway. The weight is so disposed that with the jib fully loaded, and in any position, the maximum weight on any one wheel never exceeds one ton. Provision is made to enable the apparatus to become a tractor and it will draw a load of 3 tons at the rate of three miles an hour. The crane is equipped with a storage battery of sufficient capacity for an average day's work. This battery is of 258 ampere hours capacity.

The runabout crane truck is manufactured by Messrs. Ransomes, Sims & Jeffries Limited, Orwell Works, Ipswich, England, and the crane mechanism is the production of Messrs. Ransomes & Rapier Limited, also of Ipswich, England.

AIR OPERATED JACK

An automobile jack operated by compressed air is useful in factories and garages where compressed air is available. Such a jack is now being made, and an 18 in. hollow handle connects a cylinder at the bottom, this extending up at an angle of about 30 deg. At the end of this handle are located an air cock and a hose connection. The piston is of the leather-cup type.

This jack, is made in two sizes, 6 in. and 8 in. The 6-in. jack has a piston head area of 28¼ sq. in., and, with an air pressure of 100 lb. per square inch, will lift 2,825 lb. The 8-inch jack has a piston head area of 50¼ sq. in., and, with 100 lb. air pressure, will lift 5,250 lb. By attaching a standard air gage with special dial graduations to the cylinder of the jack the latter may be used as a weighing device, indicating directly the weight on the tires. The particular advantage claimed for this type of jack is quickness of operation. It is said to take only five seconds to raise a car off the floor. The Avery Engineering Co. is the maker.

FLAME OF HIGH TEMPERATURE

A flame of extraordinarily high temperature has been employed in experiment by E. Hauser and E. Rie, this being mentioned in the Chemical Trades Journal. This flame is produced by liquid fuel, which is led by a tube from a storage container to a special burner, where it is atomised, and forced out into a horizontal cone by a stream of hydrogen or other suitable gas, and combustion is intensified by a mantle of oxygen enveloping the cone from the outer part of the burner. It is estimated that the temperature reached is at least 3,000 deg. Cent.

The Danger of Wear In Machine Tool Parts

Main Bearings Require Careful Attention—Watch Lubrication—Prevent Binding—Wear in Feed Screws—Emergency Devices to Overcome Effects of Wear—Indexing on Turret Lathes

By H. A. WILSON

THE DEVELOPMENT of modern machinery has progressed by leaps and bounds during the last century. During that period countless difficulties have been encountered and many have been overcome. Since the beginning of time, however, we have never really been able to overcome the disastrous effects of wear. Through the mediums of experimenting, research, and careful designing the effect has been reduced to a minimum, but always wear occurs in the most vital parts of a machine, such as in bearings, slides, feeds, nuts, gear trains, etc. The functioning of any machine is entirely dependent on the proper application of power and subsequent restriction of motion of the component parts. As soon as power is applied and motion of the parts occurs, the movement of these parts must be controlled if useful work is to be performed. In controlling this motion the moving surface of one part of the machine must rub against another, and of course, wear commences. The greater the pressure per unit of area, the greater the wear.

If two pieces of dry metal, with machine finished surfaces were rubbed together, the friction would be very great, and some form of lubricant has been used since primitive times to lessen the friction and reduce the power required to cause the pieces to move over one another. Thus we can feel tolerably certain that one of the first attempts to minimize the effect of wear was to make use of some form of lubrication.

Effects of Wear

To come to the present time and study the effects of wear and the attempts made to overcome it, we will consider a modern engine lathe. First, the main bearings. These are very rugged and of liberal dimensions as the strains of modern lathes have been increased for high speed tool steel has manifested its ability to stand up under heavier cuts at ever-increasing speeds. The large area of these bearings has a direct effect on their life. The lathe spindles are usually hardened and the journals ground. The bearings are lined with a good grade of brass, or bronze, and in some cases a first class babbitt, or even gun-metal liner is found. As the spindle is ground and has previously been hardened, it is not at all probable that any wear will occur here, but the linings of the bearings, being a softer metal, will wear.

The complications that follow worn bearings in an engine lathe, are many. There is no class of work that can be accurately machined if loose bearings exist. Another source of trouble caused by loose and worn bearings is chattering of the tool. Of course chattering has many sources of origin, and may occur with the main bearings in first-class condition, but work cannot be turned straight, it will not be round, and it cannot be faced square if worn bearings exist. If the designer has placed liberally dimensioned bearings on a lathe, there still must be given to these bearings, proper attention, if the wear is to be kept down to a minimum.

Lubrication Important

Proper lubrication is essential. A bearing will not be able to remain in good condition if it is overloaded and run at speeds beyond which it was designed to operate. Oil holes should be cleaned out at reasonably short intervals and any old and gummy oil removed. It is also a good plan to occasionally wash the journals and liners with gasoline or kerosene. The means used to take up the thrust on a lathe should have proper attention, because if this unit is neglected, wear will occur and it will be extremely difficult to handle certain classes of work, such as shoulders, etc. There will undoubtedly be a little end play in the spindle which will have a habit of permitting the tool to "dig in" on a finish facing cut or some other similar important operation.

Of course this is more liable to occur when work that is held in a chuck, or bolted to the face plate without tail stock support, is being machined. When a piece is handled on a mandrel and end-play exists in a lathe spindle, the thrust is bound to be taken up by parts not designed to function in that particular manner, and additional wear of these parts occur. At the same time extra power is required to operate the machine, which may, or may not, tend to stretch the belt driving it. A machine operated under these conditions will rapidly become worse, as wear, in the parts called upon to take care of strains and stresses for which they were not designed, will be excessive.

Passing from the spindle we will consider the effect of the saddle sliding on the ways. The surfaces here in contact with one another are usually large, and pressure between these surfaces, in pounds per square inch, is not great. But the ways usually catch a fair proportion of chips and cuttings, which, if not watched, will soon cause disastrous wear. A large number of modern lathes have felt wipers attached to the saddle which are fairly effective in brushing away chips and lubricating the ways. Most of the pressure is taken up by the "V" slides, which to a great extent shed the chips. To prevent the saddle from lifting, guides are found under the side of the ways or in the apron. Sometimes there is some slight adjustment to compensate for wear at this point, and as practically all lathe saddles are actuated through screws or splined rods passing under the apron, the pull is on one side of the saddle which causes a slight additional strain and wear on the saddle and ways. Thus, to prevent binding, a pretty snug fit must be maintained at all times.

Should a saddle be worn, or the ways on the bed be in a bad shape, it is impossible to produce accurate work on the lathe. The majority of work is done near the head stock end, and in the case of a lathe that has seen considerable service it will invariably be noticed that when the saddle is adjusted so as to slide evenly and snugly, near the head stock end, it will bind when it is moved to the tail stock end, making it impossible to accurately turn a job of any great length. The wear of the tail stock on the ways of a lathe is negligible. However, the practice of turning, away from the head stock, on all work machined on a mandrel, causes the tail centre to take up the thrust, and excessive wear occurs here, which tends to produce inaccurate work. Whenever possible it is good practice to do all turning toward the head stock end as provisions have been made to absorb all end thrust created under these conditions, which is not the case when turning toward the tailstock.

Prolonging the Life

In the high class lathe of to-day, many measures have been resorted to, to prolong the life of the ways. In some cases a form of chilling has been employed when they are cast. This measure, of course forms a closer grained iron of a harder nature that resists wear to a greater extent than the ordinary softer castings made of grey iron. Some manufacturers melt a certain percentage of steel with the iron and produce what is commercially known as semi-steel castings. These castings are also closer grained and more wear resisting than ordinary grey iron, and are made from ten to fifty per cent. steel. Semi-steel is more easily machined than chilled cast iron, which is a feature that must be taken into consideration when large surfaces of the castings are finished, as in the case of a lathe bed. The motion of the tool slide and the compound rest is a comparatively small one. However, to offset the wear in dove-tail slides, jibs have been provided. Inaccuracies in the work and chattering are results of wear in these parts. There is never any excuse for wear in these parts as it is only

small, and the jibs enable it to be taken care of effectually.

Probably wear in the various feed screws in the lathe cause more concern than in any other part. This wear is always there, and slack or lost motion is commonly termed "back-lash." There is no real way of compensating for this wear and it has to be guarded against with extreme caution. However, when wear is evidenced in such parts it is not impossible to obtain accurate work, as a good mechanic can always keep the back lash where he wants it, and this does not let it interfere with his work. However, this wear should be avoided. Wear in the friction feed mechanism in the apron can be kept within reasonable limits if intelligent care is given the parts. The quick-change gears, and back gears do not present serious problems from wear.

The step cone pulley revolving on the spindle will be a continual source of trouble if not kept properly lubricated. Wear will then result which, perhaps may not have any direct effect on the accuracy of the work produced, but will prove a source of trouble, as there is a tendency to run dry and seize. The troubles and dangers arising from wear in a lathe, are to a certain extent common with several other machines. The milling machine spindle operates on a similar principle to that of the lathe spindle, and many similar comparisons could be made.

In passing, perhaps a reference of interest can be made to one or two emergency devices used to overcome and circumvent the effects of wear. A few years ago when lathes were almost impossible to obtain, many old and decrepit machines were pressed into service, for machining shell projectiles. Some lathes that would not turn true within wide margins, were fitted with chucks which screwed on the live spindle and extended out from the main spindle bearing from twelve to sixteen inches. The outer ends of these chucks were turned, and steady rests of sturdy design were placed to carry the overhanging end. These rests were of varied design, some having a three point contact consisting of adjustable brass blocks, others had full circular contact and were babbitted. This expedient overcame the results of the wear in the spindle and bearings and enabled the work to be turned fairly true. Some of these machines had been previously discarded and were again placed in service. Creditable work was done by these lathes although no work requiring extremely close limits, was attempted.

During this same period it was extremely hard to obtain steel for large lathe spindles. Many manufacturers turned to cast iron lathe spindles, of hollow design for special purpose lathes, and these were made extremely large in diameter at the front bearing. Collets were placed in the machine bore of spindles, holding shells right inside the front main bearing. These bearings were babbitted, but were of such large dimensions that the wear was practically nothing.

Use the Best Materials

In all class of automatic machinery, the bearings, journals, and all wearing parts have to be of liberal area and constructed from the best materials. These machines usually operate at high speeds and with only the intermittent attention of a skilled mechanic, any undue wear would be magnified through many inter-connecting mechanisms, which would result in an error in the work which might cause same to be useless for the purpose for which is was intended. In the case of a turret lathe where tools are carried on extending bars, if wear occurs in the indexing mechanism it usually has very bad results. This is easily explained. The indexing apparatus may be located 10 inches from the centre line around which the turret revolves, and the tool may be 25 inches from this point, thus the error would in such a case be magnified two and one half times.

Example after example of standard, automatic, and special machine tools could be taken in which wear would always cause inaccurate work to be produced. Lubrication should always be attended to, machines should be kept clean and speeds, feeds, and loads, should always have intelligent consideration. A mechanic should also know of a few of the fundamental points about the load per square inch certain classes of bearings can carry, that certain types require heavy oil, other bearings light oil, and that grease is sometimes better than oil on an oscillating joint. That babbitt bearings won't take an oscillating or reversing motion, that a soft steel bearing will not permit a soft steel journal to revolve in it, that cast iron makes an excellent emergency bearing for steel, etc.

Many of the light classes of machine tools to-day are equipped with ball bearings. Ball bearings are much more efficient from a mechanical point of view, than are the ordinary type. During the last few years much scientific investigation has been made, and to-day these bearings are giving excellent satisfaction on reasonably heavy work. Roller bearings have been designed to take care of heavy loads, and one big feature of both these styles is the ease with which they are lubricated. Light to medium heavy greases are used and a bearing once packed with such a lubricant is able to give service over a long period without further attention. The design of both ball and roller bearings being of the enclosed type, dust and other foreign matters do not easily find their way into the bearings. For this reason grinding heads, tool and cutter grinders, in fact many types of lighter machinery are equipped with ball and roller bearings.

Question of Thrust

When thrust bearings are considered, perhaps there is no better type for light and medium duties than ball thrust bearings. In drilling machines, lathes, tapping machines, grinders, etc., etc., thrust bearings play an important part. Perhaps it would be impossible to consider cutting tools as component parts of a machine tool. Taps are always designed with a land, which permits of re-sharpening until the land has been ground away, without altering the size of the tool. This practice also applies to reamers, milling cutters, circular form milling cutters, hobs, gear cutters and a multitude of other tools. The sharp edges are bound to become dulled in service and to continue to get good work the tools must be sharpened. Great care must be exercised in withdrawing from service any tool on which the land has been ground away. Unsatisfactory results will surely occur, as sizes can not be maintained.

Wear is a very serious feature in tool and cutter grinders. These machines are usually employed to finish to size, tools, cutters, gauges, and standards that will be used to produce, and check the accuracy of work turned out in large quantities. A slight error due to wear in one of these machines, would often be reflected in the manufacture of pieces produced in the plant. Thus great care must be exercised when looking after the bearings on these grinders. In fact this remark is quite applicable to any machine tool employed in a tool room.

The larger types of grinding machines have many special features incorporated in their design to reduce wear. Take for example machines used to grind rolls for paper machines. These rolls are large pieces, of no small weight, yet accuracies measured in thousandths and ten thousandths of an inch are required. Inverted ways are used, and these are continually flushed with cutting lubricants to wash away all grit. If one of these large and expensive rolls is inaccurately ground, even to the extent of the close measurements referred to above, it is useless, and an expensive piece is ruined. This shows how dangerous and expensive it would be to permit even the slightest wear to occur on such machines.

The whole subject simmers down almost to one of bearings, because it is in bearings that about 99 per cent. of the dangerous wear occurs. Perhaps all machine shops have not made extensive researches into the bearing problem. Yet, good mechanics know how to care for bearings and other machined parts exposed to wear. Lubrication is a first essential. This should be attended to by administering the proper lubricant at proper intervals. Dust should not be allowed to collect on machines particularly if this dust is of a gritty nature, and likely to possess abrasive qualities.

Oil spilled on machines or bearing housings attracts dust and grit, and if allowed to remain, part of this accumulation will invariably find its way into the bearings.

Hammers, cold chisels, tools, jigs and fixtures should not be placed on the finished ways of a machine, or in fact on any machine finished surface. Tapping with a steel hammer on any machined surface mars it. Only too often drills and reamers being placed in or removed from collets, sleeves and chucks are abused by the free use of a forged steel hammer. Chucks, collets, and sleeves become burred and this really is a form of wear, which all tends to produce inaccuracies in completed work. In concluding we will reproduce an article prepared by Messrs. R. O. Sperry and C. H. Landon, two gentlemen who have for years been connected with the engineering department of the American Bronze Corporation, a firm which has specialized in the field of scientific research in connection with wear in bearings. The plant and organization, with which they are identified, has been built up, and is being sustained, because of the fact that there is "Danger in Wear of Machine Tool Parts." Let them speak for themselves.

Design and Material Should be Watched Clo

By R. O. SPERRY and C. H. LANDON

THERE is at the present time a growing consciousness of the importance of a thorough understanding of the principles involved in the selection of bearing materials and of appropriate bearing design. This condition is manifested among engineers in genearl and especially among those responsible for the design of machine tools and automotive units. It applies particularly to the so-called plain bearings as the manufacturers of anti-friction bearings have supplied every comprehensive information covering these types during the past few years.

Plain bearings, while the oldest type known, are perhaps the least known. By this it is meant that a plain bearing is customarily considered simply as a bearing and there is very little accurate knowledge extant regarding the possibilities, range of usefulness and limitations of particular combinations of bearing and journal materials, lubricants and lubrication methods. Engineers in general should not be criticized for this lack of information regarding plain bearings. A very extensive acquaintance with conditions in an equally extensive number of installations is necessary in order to make logical and accurate deductions as to the fundamental principles involved. For this reason the assembling and logical compilation of such information will be essentially dependent upon the manufacturers of bearings and of bearing materials.

All engineers have, however, observed the wide variance in results obtained from bearing metals of the same chemical properties. To illustrate, an engineer may have run half a dozen tests on a "gun metal" bearing, (a bronze analyzing approximately 88 per cent. copper, 10 per cent tin, 2 per cent. zinc) and have obtained as many different results as he ran tests, while the conditions of the test were apparently identical. This condition of fact without an understanding of foundry practice as well as of basic principles is difficult of understanding.

Matter of Lubrication

At the Standards Committee session of the Society of Automotive Engineers there were several speakers on the subject of lubrication. During the discussion much stress was laid on the fact that only when the shaft is revolving at high speed is there a perfect film of lubricant or a film even approximating perfection. At all other times there is metal to metal contact of varying degrees. It was unanimously conceded that were the film of lubricant constant and sufficient, wear would be a negligible factor. It might be mentioned in passing that the supply of lubricant is rarely sufficient to secure this ideal condition during operation. Moreover, this ideal is never approached when starting up or shutting down. Metal to metal contact—more or less complete—is an unfailing incident in the life of every bearing. It may be continuous or it may be intermittent but it is unavoidable and is always accompanied by wear.

It becomes quite essential that we consider first what constitutes wear, and second, what material will offer the greatest resistance to wear. By careful examination we find that all bearing surfaces, shafts and bearings alike, are actually rough, and that when metal to metal contact is permitted these rough surfaces interlock. The result is that as soon as the shaft or other member moves, the molecular structure of the softer metal is torn away. This fact being established we are induced to determine what bearing metal will best resist this pull of friction.

Engineers and laymen alike are accustomed to think of a bearing metal as a homogeneous alloy analogous to a chemical compound. However, a combination of practical foundry experience and of the essential theory of metallurgy leads to a realization that a bearing metal is not essentially a chemical compound but is a mechanical mixture of chemical compounds, solid solutions, and segregated metals and gases. These gases are introduced at the time of the alloying the metal. Theoretically the occluded gases are expelled incident to the slowing down of the molecular motion during the cooling of the metal. However, it is found upon microscopic examination that such is not always the case as frequently the gases remain in the mass causing porosity. This condition is obviously fatal to homogeneity.

From a consideration of the facts previously presented we are led to believe that a desirable bearing metal is one which is dense and homogeneous, incidentally density is reflected in the hardness of the metal Since copper and tin do not possess a perfect affinity for each other, and copper and lead absolutely no affinity, the difficulty of obtaining a homogeneous alloy is apparent. This, however, can be controlled to a great extent by experience and care in foundry practice. Lead, however, is always inimical to homogeneity and hence bearing metals containing lead will offer a lessened resistance to wear and a shortened life. They will, however, adjust themselves to conditions (i.e. "wear-in") to a considerable degree and are not prone to injure a journal in the event of failure of lubricant

The degree of comparative hardness necessary will depend on the conditions imposed by the installation, possible failure of lubricant, frequency of lubrication, length of service desired, accuracy demanded of the unit, (or conversely, the permissible looseness or play) both initially and during the life of the installation, and cost, the softer bearing metals being usually cheaper than the harder metals.

After determining the desired qualities, the problem arises as to the manner in which these qualities are to be attained. Is it sufficient to specify the chemical composition? It is, perhaps, generally realized that castings of a given size poured at different temperatures from the same alloy will possess different physical characteristics but it is not perhaps as generally realized that castings of different sizes poured at the same temperature from a given alloy will also possess different physical characteristics. Occluded gases can be expelled only by the proper method of gating molds and since this condition varies with different alloys, it is essential that the foundry producing a dense metal must be experienced and expert in the particular alloy they are creating.

The Rod Mills at the Sydney Steel plant, Sydney, N. S., will re-open the first part of next week, and the Wire Mill will start about the same time, according to the general manager of the Dominion Steel Corporation.

News From the Welding Field

Best Methods of Welding Locomotive Boilers

Welding Electrodes Should Have Even Flowing Qualities—Proper Preparation Means Good Welding—Repairing Front Portion of Crown Sheet—Mistakes Which Should Be Avoided

THE RESPONSIBILITIES of good welding depend largely upon the skill and experience of the operator. Welding electrodes that have the approved chemical constants or elements which will give the best tensile strength which conditions may require should be adopted for boiler repairs. Another important point is that welding electrodes which are to be used on firebox welding should have even-flowing qualities; that is, the globules of metal should flow from the point of the electrodes to the work in a steady stream, so they will not interfere with the skill of the operator or the functions of the electric arc.

The efficiency of the operator should be fully determined before he is allowed to perform any welding in locomotive fireboxes by having him weld specimens at least once each month. The welded specimens should be forwarded to the engineer of tests who will test them for tensile strength. The efficiency of the welded specimen should be at least 75 per cent. of the firebox steel used, before the operator is allowed to do any firebox welding. It is important that good judgment should be exercised in assigning operators to autogenous welding in fireboxes.

Importance of Preparation

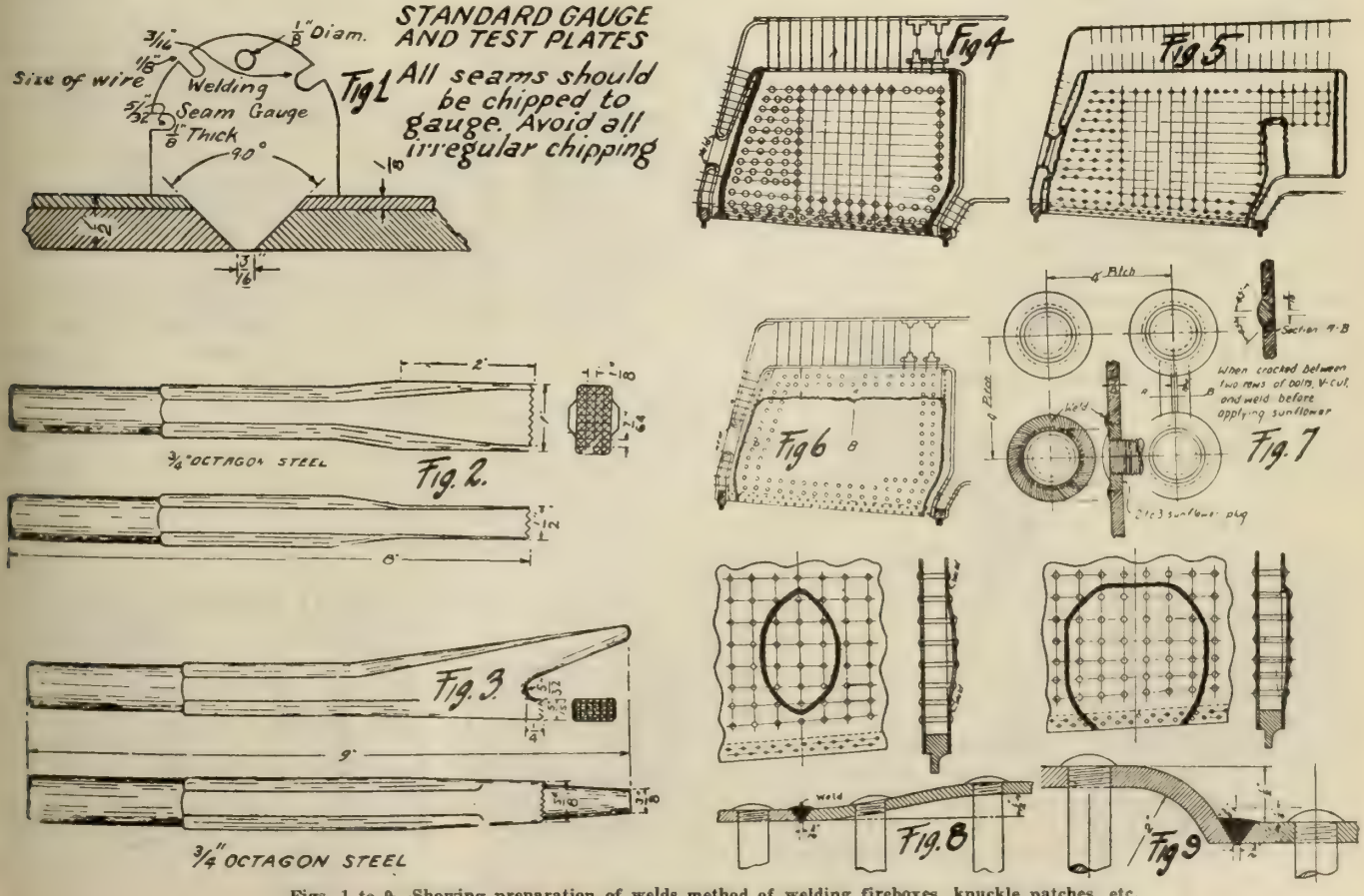
Another important feature is that no piece of work should be welded unless it is properly prepared. That is, all seams should be beveled as shown in Fig. 1, and should be thoroughly cleaned, free from grease, scale and other foreign substances. It is very essential that the weld be made on bright, clean metal and that this condition be preserved throughout the entire welding operation. The use of a roughing tool as shown in Figs. 2 and 3, or a sand-blast machine, may be used for cleaning purposes. All seams should be carefully fitted and beveled to 45 degrees, not allowing more than ¼ inch, or less than 3/16 inch space at the bottom of the "V" as shown in Fig. 1, as determined by the use of a gauge.

If the opening at the bottom of the "V" closes to less than 3/16 inch, the welder should stop and have it chipped to the standard opening. Under no condition should the plate be burned with the cutting torch to enlarge the opening, unless it is going to be chipped afterward.

Welding of Complete Fireboxes

All sheets should be beveled on the rivet line from the fire side, see Fig. 4 and plates should be fitted into the mud ring, held together with strong backs or clamps about every 12 inches in order to hold the plates in perfect line. The sheet should then be tack-welded between each of the clamps, the tacks being from two to three inches wide. After this operation has been

The suggestions contained in this article will be presented in the form of a report before the Master Boiler Makers' Association Convention at Chicago in May, 1922. The report committee responsible for these findings consisted of H. H. Service, supervisor of welding, Atchison, Topeka & Santa Fe Railway, Topeka, Kansas, chairman: I. J. Pool, and R. W. Clark.



Figs. 1 to 9—Showing preparation of welds method of welding fireboxes, knuckle patches, etc.

performed, the clamps should be re-welded. Do not remove the firebox from the ring until after the welding has been completed. All seams should be reinforced 20 per cent. of the thickness of the firebox sheet on the fire side, and when it is possible to do so, seams should be reinforced on the water side approximately 10 per cent, especially on the crown sheet.

All welding should be started on the bottom of each intermediate space and finished at the top of the seam. For all firebox work, current values from 100 to 125 amperes will give the best results when properly handled by the operator using a 5/32 inch diameter electrode. The cost of welding firebox seams per lineal foot is 90 cents for labor, material and current.

The sheet should be bolted to the mud ring after it has been properly beveled and fitted in place. Staybolts may be applied except the rows adjacent to the seam which is to be welded. All horizontal seams should be held in place with strut bolts and tack-welded every 12 or 14 inches. Then weld intermediate spaces alternating from the centre space to the spaces at either end. Vertical seams should be tack-welded similar to horizontal seams. After being tacked, start welding at the bottom space and finish at the top space. Current values for successful welding on this operation are the same as for firebox welding described in Fig. 4 and Fig. 5.

Firebox Sheet Knuckle Patch

Preparation for the firebox knuckle patch Fig 6 may be followed as outlined for the welding of half side sheets or door sheets. The use of strut bolts can be applied to hold the patch in line when necessary, while it is being tack-welded. All strut bolts should be removed after the patch is welded into position. Under no circumstances should the knuckle patch be less than 12 inches from the crown sheet.

Weld the horizontal seam first, then tack-weld the flanged sheet to the wrapper sheet. Remove all strut bolts and weld intermediate spaces, working from the bottom on either side of the patch upward, finishing at the top. The method indicated in Fig. 7 is to be used to repair cracks at staybolt holes in firebox sheets, where not more than 6 sunflowers are necessary to complete repairs, and not more than 4 sunflowers will be joined together. This system may be used in main shop general repairs, sunflowers not to exceed 3 inches in diameter.

Repairing Small Portions of Side Sheet

When the defective portion does not extend over six staybolts, repairs can be made as per instructions given for Fig. 7 which give very efficient results. When the defective portion is larger it is then advisable to use methods as shown in Fig. 8 by removing the defective portion and applying a patch of an elliptical or circular shape. In preparing the patch, sufficient metal should be allowed so that when the patch is dished ⅜ to ½ inch in the centre, the opening at the seam should not be more than ¼ inch wide at the bottom of the "V", and not less than 3/16 inch.

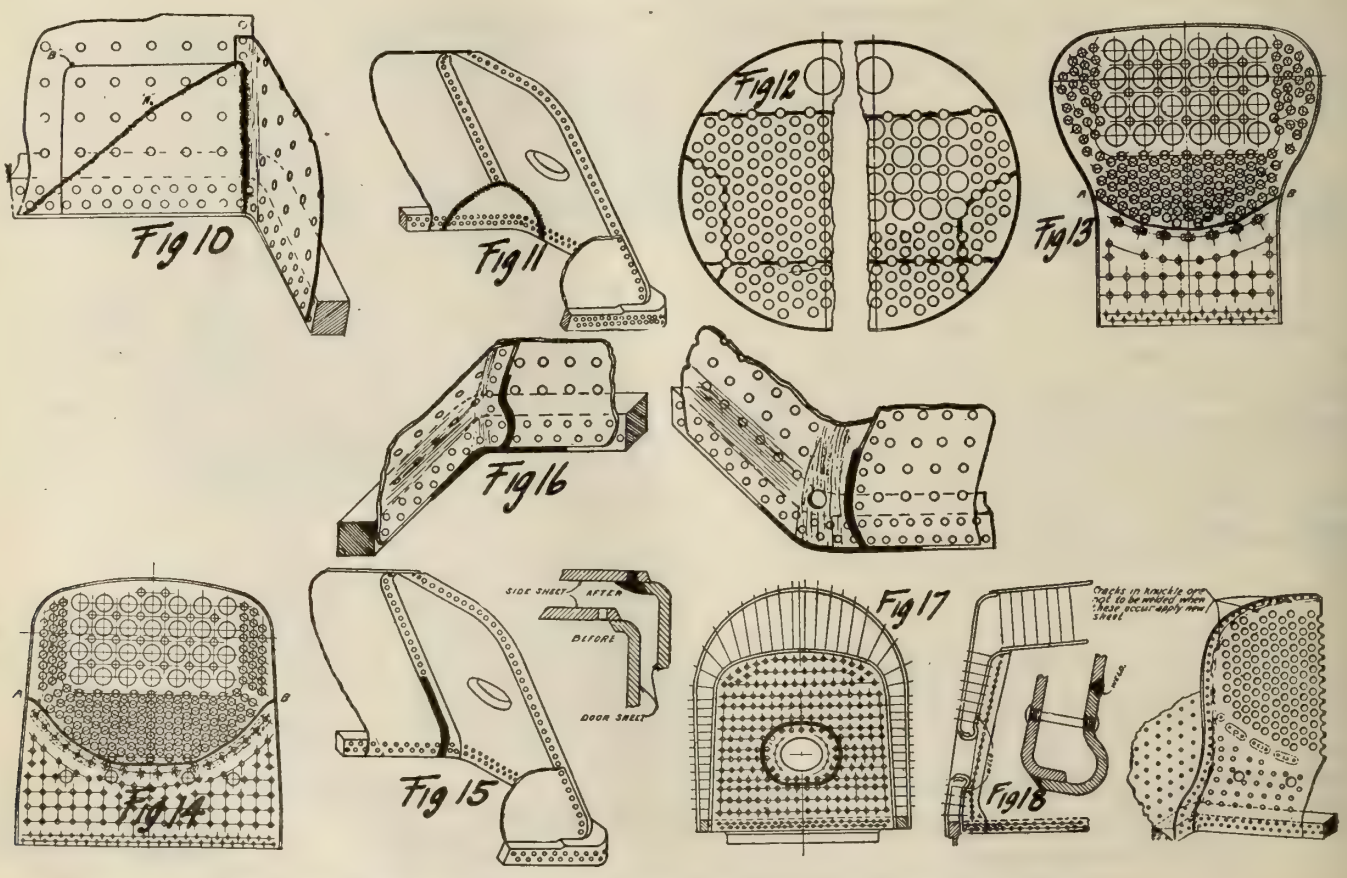
The patch should be held in place by strut bolts and tack-welded on the right or left side; then weld this seam of the patch before the opposite side is tack-welded, so as to allow the patch to draw in one direction. After this has been completed, allow it to cool before starting on the opposite side. By so doing there will be only one contraction of the patch. All welding should be performed from the bottom upward. Should the defective portion of the side sheet extend down to the mud ring rivets, apply the patch as in Fig. 9, the welding operation being the same as outlined for Fig. 8. Should the defective portion be at location as shown in Fig. 10, the seam may be applied as indicated by line "A".

Should the plate at the corner of a firebox become defective and it is necessary to remove a portion of the side sheet and the door sheet, it is advisable to apply a patch to both sheets as in Fig. 11 Should it be necessary to make repairs according to Figs. 12, 13 and 14, the work should be done by welding from the fire side of the sheets and reinforcing them on the water side.

Welding of Seams

Should the seams become defective and cause considerable trouble, repairs can be made with the electric arc process as shown in Figs. 15 and 16. Remove the defective portion of the flange, which is giving trouble, by cutting through the back of the rivet holes, bevel the sheet 45 degrees and tack-weld it every 12 inches; then weld the intermediate spaces. The weld should not be any thicker than the flange of the

(Continued on Page 37)



Figs. 10 to 18—Showing welding of seams. Improper welding of firebox plates. Applying patches, etc.

Methods of Securing and Manufacturing Rubber

Wild and Plantation Products—Bringing the Latex Into Marketable Form—Methods of Collecting Differ According to Locality—Manufacturing Process—Extending Hose Pipe—Reclaiming

By JAMES FEA

HAVE YOU ever paused to contemplate how much your daily round brings you in contact with the substance rubber? You get up in the early dreariness of a rainy morning, turn on by means of a rubber-handled switch a flood of electricity through rubber-insulated wires, proceed to a rubber-tiled bathroom, shave yourself with a rubber handled razor, wash yourself with a rubber sponge, return to your room and don, amongst other things, rubber garters, rubber belt, rubber soled and healed shoes and perchance a rubber collar.

After breakfast you protect yourself against the elements with rubber overshoes and rubberized coat, and just as you leave the house you make sure that the rubber tobacco pouch is in your pocket, that your hard-rubber fountain pen is safe in its place, and that you are in possesion of your rubber-stemmed pipe and cigarette holder. You then proceed to the corner and catch the bus with its huge rubber tires, not to mention the many pounds of rubber in that complicated machine in the form of gaskets, washers, insulation, etc. Have you ever wondered where it all came from or how, or have you just taken it for granted as you would the stone in the rasin-pie or the fly in the currant-bun?

The Discovery of Rubber

The earliest mention of rubber was in 1493 when Columbus, during one of his rambles abroad, saw the natives of the island of Haiti playing with balls which were made from the gum of a tree. However it was the Portuguese who late in the sixteenth century, found that the Hevea tree which grew in Brazil, produced a gum which could be used very successfully in waterproofing their garments. From that time the industry went ahead and was taken up by other countries. About 1910, the introduction of cultivated or plantation rubber was signalized by a boom which netted much for some and was extremely disastrous for many others, after the fashion of booms. Since then, the rubber factories have grown and multiplied, and to-day we include the substance among our daily necessities.

What the future may bring, is a subject for conjecture and also a source of worry to rubber producers, for at present more rubber is beig grown than can be utilized, so further uses will have to be found. Experiments in the use of rubber in paving streets and in making furniture have not been unsuccessful and who can tell but that the little demon who chortles over broken dishes may be disconcerted by the substitution of rubber cups and saucers.

Two Types of Rubber

There are two types of rubber on the market, the wild, and the plantation or domesticated. The former comes from Brazil, Peru, and Bolivia on the banks of the Amazon, as well as from Central America and Mexico. In the Old World it is found in Africa, Northern India, and the East Indies.

The Para rubber from the Amazonian forests is perhaps the best known to the uninitiated. It comes in three grades, fine, medium, and coarse or negro-heads, the quality depending on the skill with which it was first treated in the raw state. The rubber gatherers live in small settlements called estradas, on the rivers' banks. Through the dense tropical growth they clear paths starting and finishing at their camp, and during his daily trip along this path, the native passes some hundred Hevea trees which are about eighty feet in height and as much as four feet in diameter. At a convenient distance from the ground, he makes a cut around the trunk and at intervals hangs small tin cans to catch the thickish, milk-like fluid, which oozes from the cuts in the bark. As the tins are filled, they are emptied into a larger vessel for treatment at the estrada.

In order to bring the latex, as the fluid is called, into a form which can be marketed, the worker builds a fire of palm-nuts which gives forth a very thick and pungent smoke. Into the pan of newly collected latex a wooden paddle is dipped, and the paddle with the adhering rubber is held over the smoke until the rubber solidifies. The paddle is again dipped into the latex and the next coat similarily treated over the fire. In time the worker has made a large ball which is cut in two in order to remove it from the paddle. You have no doubt, seen these in rubber exhibits, and their smoky, hammy odor still permeates your nostrils. This is the first quality, the other two differing in that they are made from the scrap and refuse from the fine Para. It is not an unusual thing to find in the coarse Para, such unrubberlike articles as old boots, charred bones of some lately lamented animal, and numerous pieces of bark and palm-nut shells.

Another Method

In Bolivia and Peru, the rubber is derived from another species of tree, and is distinguished by the name of Caucho. Here they fell the trees and collect the milk from numerous cuts that are made in the bark, and coagulate it by means of soap, lime, or potash, the lumps being removed and later pressed into square blocks known as "Peruvian slabs."

In Central America, can be seen small, semi-clad figures shinning up to collect caucho-milk from trees which are often well over a hundred feet in height. The procedure here is to make "V" shaped cuts in the bark and collect the gum in calabashes. When he has taken the milk from several trees, he pours it into a shallow tin and adds the juice of a vine growing in those parts. This has the same effect as smoking or the adding of an alkali, and coagulates the rubber into curds which float on the top, and are skimmed off and kneaded into cakes to remove the surplus water.

In Mexico, the story is different, for in place of huge trees, scrawny bushes are the source. These Guayule bushes are cut down and crushed in pebble mills. The rubber contained in the cells of the plant is removed by flotation, the rubber rising to the surface of the water and the residual matter sinking. Guayule rubber is of sufficiently high quality to permit of its being used in the manufacture of surgical goods.

For many years the grade of rubber from Africa did not measure up to the standard set by the New World fields due to the careless manner in which the latex was coagulated and packed; however the introduction of better methods by European experts is gradually improving conditions. Congo-Kassai is one of the better known African rubbers and can be recognized by its dryness and woody smell. From Malay and the Far East comes a substance by the name of gutta-percha, a second cousin to rubber, but while the mode of treatment and collecting is the same, is has slightly different characteristics, being inelastic and inclined towards brittleness when cold. It is used considerably in the manufacture of golf balls and in insulating cables. Another kindred substance to rubber is balata, a gum taken from a tree which flourishes in the forests of British Guiana. Its principal use is in the manufacture of machinery belting.

Cultivated Rubber

The rubbers mentioned in the foregoing paragraphs have all been of the wild variety, but there is another kind which has put the industry upon an entirely different footing, namely the plantation or cultivated rubber. The domestication of the Hevea is almost entirely due to the efforts of a Mr. H. A. Wickham, who had experimented with the cultivation of this species in the Brazilian districts, and came to the conclusion that the same could be grown successfully in the East. The problem narrowed down to the transporting of the seeds, for the Brazilian authorities

were very jealous of their monopoly and hampered any movement that might jeopardize it.

Mr. Wickham took advantage of the misfortunes of a Scotch sea captain whose ship was stranded in a Brazilian port without any cargo for the homeward trip. He chartered the boat and after considerable trouble, loaded it with crates containing the seeds of the Hevea tree at an unfrequented spot up the coast. It was necessary that clearance papers be obtained at Para before the vessel could start on its journey, and it was here that he expected to meet all sorts of objection if not prohibition. Through the good services however, of the consul there, permission was granted for him to convey certain "rare and delicate botanical specimens for Her Brittanic Majesty's Kew Gardens in England," the nature of these specimens being unknown to the authorities for they did not take the trouble to investigate the unusual cargo.

Eventually the seeds reached Kew Gardens and in June of 1876, over seven thousand young Hevea plants were flourishing there, tier upon tier. As these became more hardy they were distributed among experimental stations in Ceylon, Burma, Java, and Singapore and for several years plantation rubber was taken up more as a hobby, but the boom in 1910 saw hundreds of companies formed for its cultivation, and plantation rubber was here to stay, and through its advancement the rubber industry as a whole has prospered.

The treatment of plantation rubber varies slightly from that of the wild. The milk is put in shallow pans and after reducing to a uniform rubber percentage, dilute acetic acid is added, curdling the solution. The curds of rubber are taken and the moisture removed before running through fluted rolls which work it up into long sheets, with markings corresponding to those on the rolls. These are usually diamond shaped and provide ventilation when the rubber is packed. As it comes from the rolls it is white in color but gradually it assumes a yellowish hue upon aging and a further smoking treatment over burning cocoa-nut shells gives it a brown color.

Process of Manufacture

So far only the planter's share of the treatment has been discussed. After unrecorded experiences with native uprisings, longshoremen and railway strikes, not to mention the rubber broker's kindly interest, it finds its way into the tender hands of the rubber goods manufacturer, who by the way is passing through an interesting period of transition from the regime of inherited rubber folk-lore to that of scientifically trained experts; or in other words, from the flannel-shirted boss to the white collared manager.

As he receives the crude rubber, it is packed in wooden boxes and barrels of various shapes and sizes. The first step is to remove the accumulated dirt and occasional scorpion, and to put it in such a form that it can be easily handled in the succeeding steps. The washing machine consists of two steel rolls about forty-eight inches long and twenty inches in diameter with surfaces marked by diagonal grooves. The rubber, which is cut into suitably sized pieces, is fed in between these rolls, water flowing all the while over the point where the rolls are closest together. The chunks of rubber are rolled into long strips while the splinters of wood and other foreign matter are washed away. Before the rubber can be handled again it is necessary to dry it. This is done by either of two methods; hanging the sheets of rubber in a kiln-like room, or placing in a steam heated oven under a slight vacuum.

The rubber is now ready to be mixed with the ingredients as demanded by its ultimate use. This is carried on in the heart of the factory—the mill room, an exceedingly dusty though interesting spot. Contrary to general opinion, the rubber as seen in most of the articles of everyday use, has only a very limited percentage of rubber, the balance being made up of such compounds as zinc oxide, white lead, magnesia, flour, graphite, oils, greases, sulphur, etc. In addition to these there are also used such powders as carbon black, ultramarine blue, chrome green, antimony red, barium white, etc., depending on what color is desired in the final product. The proportioning of these ingredients is not an exact science, or at any rate is not considered as such in many plants, for their methods are more or less of the trial and error variety; however the day is not far off when the compounder will simply work out his "receipts" on a slide rule or from a book of tables.

After the batch, as the collection of rubber, powders and oils, etc. is called, has been weighed out by the compounder, it is turned over to the mixer on the mill. There are usually quite a number of these machines run off one drive shaft. They consist of two smooth steel roll up to eighty inches in length and about twenty inches in diameter, and in order to produce a grinding effect on the rubber, the two rolls are run at slightly different speeds.

The rubber is soon worked up into a plastic mass like chewing gum, the process generating a large amount of heat and necessitating the cooling of the rolls by means of water circulating through them. As the rubber becomes "warmed up," the other ingredients are slowly added and assimilated by the gum, sulphur, the vulcanizing agent, being the last to enter the mass. When the proper degree of mastication has been reached, the mass is cut off from the mill in the form of slabs about two feet square and about half an inch in thickness. These are painted with a solution of chalk and water to prevent the pieces from sticking together when piled away for future use.

When the rubber is to be used in the manufacture of tires, belting, etc., the calender is the next machine employed. It consists of three large steel rolls superimposed, one on top of the other, of abut twenty inches in diameter and up to six feet in length. The rolls can be either heated by steam or cooled with water, and the successful operation of the calender largely depends upon the adjusting of the temperature of each roll. The machine is capable of rolling the rubber into sheets of varying thickness, and in forcing the rubber by friction, into the pores of the ducks or other fabrics required in the process. The distance between the rolls can be exceedingly finely adjusted, and the altering of the thickness of the rubber by some one or two thousandths of an inch can be done by the most clumsy workman.

Frictioning the Fabric

When the operator desires to friction the fabric—that is, to force the rubber into the pores—he causes the central roll to revolve at a different speed to the other two rolls, the rubbing action doing the trick. When he wishes to sheet the rubber to a certain thickness all three rolls turn at the same speed and their effect is the same as that of the rolling mill in a steel plant, or even the homely clothes wringer. By placing knives against the roll, the rubber can be cut to any desired width as it is being calendered.

A few words concerning the making of belts, hose, and press goods would not be amiss. There is nothing very mysterious about the making of a rubber transmission or conveyor belt, consisting as it does of layers of rubberized duck so folded and built up that the sems will not spring apart when the belt is put to any strain. Most of the smaller belts are made up automatically by machines which cause the fabric to be folded over to the required width and then pressed firmly by a small pair of rolls. If an endless belt is desired the two ends are joined together after separating the plies and making them interlap, the joint being strengthened by stitching. The curing or vulcanizing is sometimes done in a large iron cylinder, in which the roll of belting is in an atmosphere of steam at about thirty or forty pounds pressure—that is about 250 degrees Fahrenheit. Another method is to place the belt in a large press and subject it to a combination of heat and pressure. The conveyor or belt differs from the other in that it has an additional face of rubber to add to its wearing properties.

Making Hose

There are several methods of making hose but the most common and simplest is to build up on iron poles or tubes of the diameter of the bore of hose desired several layers of rubberized fabric on an inner tube of rubber. When the required thickness of wall is reached, the hose is spirally wrapped with wet cloth and the lengths cured in steam heated cylinders. To remove the vulcanized

hose from the metal mandrels, compressed air is introduced between the inner tube of the hose and the mandrel, making the stripping off of the hose a comparatively simple matter. As this method limits the length of each piece to about fifty feet or less, another process is resorted to for longer pieces.

A machine known as an extruder, which forces the rubber through a die forming it into a seamless tube, is used here, the tubes being later covered by a fabric wall in a modified knitting machine. Several alternating layers of rubber and fabric are built up before vulcanizing. The vulcanizing is done in a press which gives the corrugated or smooth finish, as desired, the hose all the while being inflated with air to keep the walls from caving in until the curing gives them the ultimate rigidity.

The ingenuity of the compounder is taxed to the limit by the innumerable uses to which hose is put. One which meets the needs of the gardener is absolutely useless to the man at the gasoline station as gasoline is an active solvent of rubber unless the rubber is especially fortified against it. Or again; a rubber hose that is used to convey compressed air would fall to pieces in a couple of weeks if it were compressed to carry steam as the latter will rapidly rot ordinary rubber. The pressure which is exerted on the walls has also to be taken into consideration, and such devices as placing iron or steel wire between the layers is called into service.

Recent Innovation

A fairly recent innovation in making of long lengths of hose, makes use of a lead-pipe making machine. The rubber and woven fabric hose is fed into this powerful press which coats it with a lead pipe formed in such a way as to give any desired surface to the hose. This is taken up on large drums, and after applying internal pressure to force the hose against the lead covering, the reels are put in vulcanizers and cured. When this has been accomplished, an ingenious combination of knives and rolls remove the lead covering. A length of hose up to in the neighborhood of fifteen hundred feet can be made by this process.

There is another place in the average rubber factory which is usually of great interest to the visitor—the press goods section. Here the never-ending variety of gaskets, bumpers, heels, etc., are made. Their story in a nut-shell is this; the uncured rubber is placed in sturdy steel or iron molds which shape the article with the aid of heat and pressure. Water supplies the pressure through hydraulic rams, and steam the heat. The combination of these two forces causes the rubber to at first flow, and then solidify in the form given by the cavity in the mold. If it is undercured, it will not be elastic and resilient, and if over-vulcanized, it will be hard and will break easily. A high percentage of sulphur and a long period of vulcanization will produce a hard rubber which is capable of receiving a very respectable polish.

Vulcanization

The question of vulcanization is an interesting one, and one in which there is still room for research. It was in 1893 that an American, Charles Goodyear by name, was successful in finding a method of making rubber more durable. He called this process vulcanization, and made use of sulphur to bring about the phenomena along with heat and pressure. The length of time required to cure a rubber tire is a considerable factor in governing the cost, so as sulphur alone is not a very fast agent, accelerators, as they are called, are brought into play.

The composition of these vary and as a rule are surrounded by a high wall of mystery in the factory, but their presence in the rubber cuts down the time in curing very much. To give some idea of their power, try and pronounce the name of one of them—Hexamethyllenetetramine. Vulcanization can also be effected by exposing the objects in some sulphurous atmosphere such as carbon bisulphide. This method is utilized in the manufacture of rubber gloves and their like. A porcelain form shaped like the hand is dipped into a solution of rubber and some solvent like benzol—in other words, a rubber cement. A certain amount adheres to the form which is then placed in the fumes of the vulcanizing agent for the required period, and then stripped off and dusted with soapstone, when it is ready for the market.

There is another department in the rubber factory which deserves mention, namely the reclaim. Here it is that all the scrap is sorted out and put into circulation again. The scrap can be roughly divided into three groups, unvulcanized, and rubberized fabric. The treatment of the first is simple as it is only warmed up on the mill and used over again. The cured scrap is reduced to a feathery-like powder and then mixed with fresh batches of rubber as a filler. The coated ducks and fabrics are ground between rolls with corrugated faces, and come out in the form of a fluffy appearing substance. This is mixed with fresh batches and used in the cheaper grade of goods, or in those which require a certain amount of strength which is imparted by the numerous fibers of duck. It is pretty good betting that the pair of rubber soles on your feet at the present moment were once a part of a flivver or Rolls-Royce in the shape of tires.

In closing, it is only fair to mention the artificial, or synthetic product. Many a budding chemist, as well as those in full bloom, have discovered how to make rubber in a test tube out of anything but the rubber plant, but although they deserve much honor for their work, and although some day we may be loudly claiming our home town as their birth-place, they are at present wasting their time, for there is about as much sense in producing a synthetic rubber, as there is in making an artificial dande ion for the front lawn—nature puts too many there already.

NOVEL BOX SPANNER

Many improvements continue to be made on engine ring accessories which have been familiar since engineering was born. The box spanner, for example, is one of those simple tools which one is inclined to take for granted, but even it can be made better for many purposes by the exercise of a little ingenuity. A British firm has brought in a new type which can be used conveniently in a great variety of awkward positions. The box head is connected with the shank by a universal joint which allows the shank to be tilted so as to clear the projections which might interfere with the use of the spanner.

CUTTING STEEL BY FRICTION

In the cutting of steel it is usual to employ either a tool of the saw type or a cutting flame supplied by oxy-acetylene or the electric arc. Some time ago, however, it was found that a plain disc driven at high speed would cut through steel simply by the heat of friction. This device has been considerably developed by a number of British machine tool makers in association with each other. The saw consists of a plain mild steel disc with a notched edge. In recent tests one user cut eight large joists right through in 40 minutes. In another case the saw was successfully used in cutting manganese steel rails, which, previously could not be cut except by the oxy-acetylene flame. A manganese tramway rail can be cut through in 72 seconds. An ordinary tramrail can be severed in 37 seconds.. Owing to its efficiency and simplicity it is felt by those interested that the friction saw, as it is called, will come into extensive use for cutting all kinds of steel sections.

ROLLER CAGE SWAGING MACHINE

The Langelier Mfg. Co., Arlington, Cranston, R. I., have recently brought out their No. 3½ A T 4 roller cage type swaging machine. The design is somewhat unique, and the new machine has a hardened steel ring driven into the head, which receives the revolving cage carrying the rolls. Other features of the mechanism follow the general lines of machines previously produced. It is claimed, that this new tool is especially adapted to solid work in both swaging and sizing operations. Various adjustments including that to the speed of the rolls enables a fairly large range of work to be handled.

Practical Ideas from Practical Men

CHUCK WRENCH HOLDER

By Harry Moore

Special lathe chucks which are tightened by means of a central screw, can be operated much quicker, if a holder as shown is used in conjunction with the regular type of wrench for ordinary chucks. The holder is made to fit the tailstock, and it is bored at front to take the body of the wrench, at the same time being slotted to clear the handle.

The screw used, must of course, have a head to fit the square of wrench. In operation the tailstock spindle is advanced to a convenient distance from the work and locked, leaving enough space between the end of wrench and the chuck face to allow the screw to be withdrawn. The wrench is used in the same manner as an ordinary one, the advantage being that it is always in place ready for use, whereas a loose wrench of any kind has a distinct tendency to slide through to the floor, or to be absent mindedly placed in different positions around the lathe, resulting in useless motions and lost time.

HEAVY DUTY TOOLPOST COLLAR

By Harry Moore

In turning some odd shaped forgings, trouble was experienced with the tools under repeated heavy knocks as the work rotated. The result of this was a gradual taper as the tool progressed which necessitated another cut to rectify before the finishing cut was taken.

The sketch shows a collar and shoe made to overcome this objection. The collar, A, has a slot cut across the centre into which the shoe, B, sits. A tapped hole in the end of B admits a headless screw, the end of which enters a recess or dimple in the bottom of slot. The piece B is raised or lowered by the screw to approximate height of centre of tool, and being raised to a taper, the tool is finally adjusted by moving it in or out a little. This idea is not advanced as an improvement on the regular collar and rocker for general work, but as a better method for the type of work stated above.

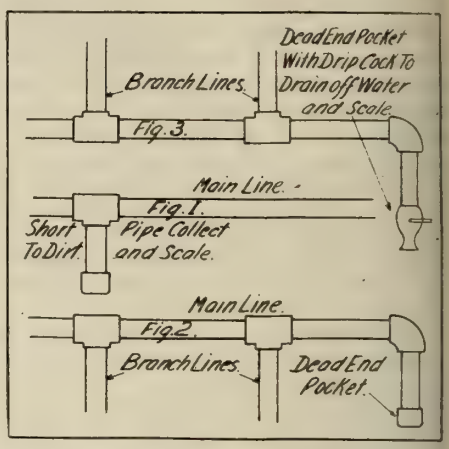
SAVING THE AIR TOOLS

By C. Rye

From personal experience as repair man on air-driven tools such as drills, clippers, riveters, etc., I have found, that according to the condition some tools come back for repairs, some advice regarding their care is badly needed. The working parts of such tools, especially the valves, are fitted to very close limits, and naturally all dirt should be kept away from these parts, otherwise trouble is sure to follow. As most of our repair work was caused by scale and dirt from the air pipe line, I devised the scheme shown in sketch to prevent the necessity of further repairs from this source at least.

In the old air line I placed short pieces of pipe as shown, these collecting any scale or dirt that might be rolling along the bottom of the pocket. I continued the dead end of the line a little beyond the last branch of the air line. In this pocket would collect all dirt and scale.

When piping new lines I took all branch lines off main at the top and



Showing how author caught dirt in the air pipes.

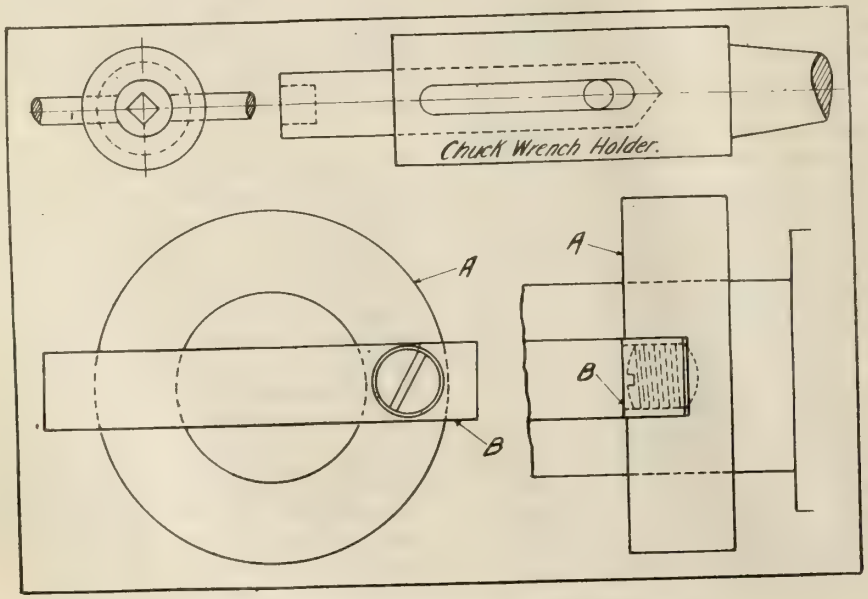
put in a dead end pocket, this allowing dirt that might have been knocked loose, or even rust from getting in the branch lines, later finding its way to the valves and cylinders.

Many air tools have strainers in them when new, but quite often these are lost when they are being overhauled. I also found that piping in this way gave us dryer air. This system also applies to rock drills, coal drills, etc., and to my mind ought to work well on steam-driven tools as well as air.

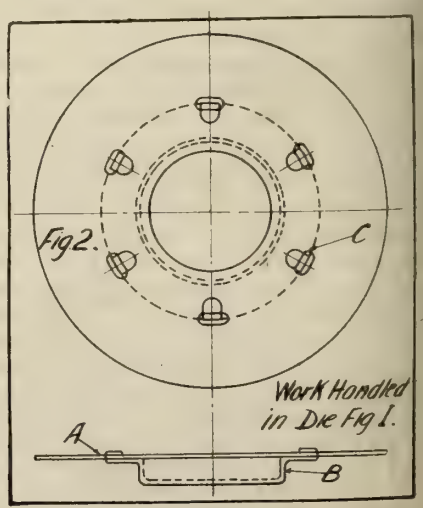
PUNCH AND DIE FOR FLATTENING PRONGS

By Scriber

A simple die designed for turning down six prongs used in attaching two metal parts together, is illustrated in Fig. 1. The principles employed in the operation of the die will be best understood by first noting the construction of the parts shown in Fig. 2. This shows a plain disc "A" having six slots cut in it; a saucer shaped piece "B" having



Showing the wrench holder and heavy duty tool post.

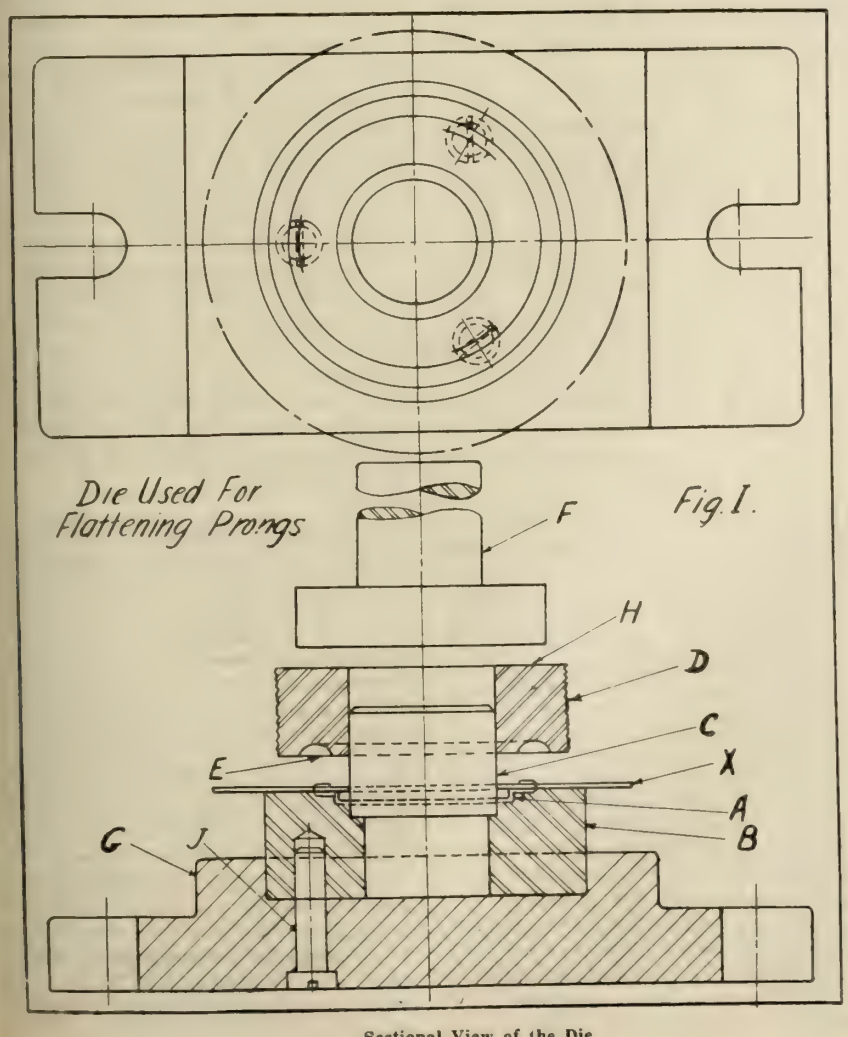


Detail of the work handled in die on Page 29.

six prongs "C" formed thereon which pass through these six slots, is also shown. The purpose of the die shown in Fig. 1 is to turn these six prongs down from an upright position after they are passed through the slots and to flatten them as shown.

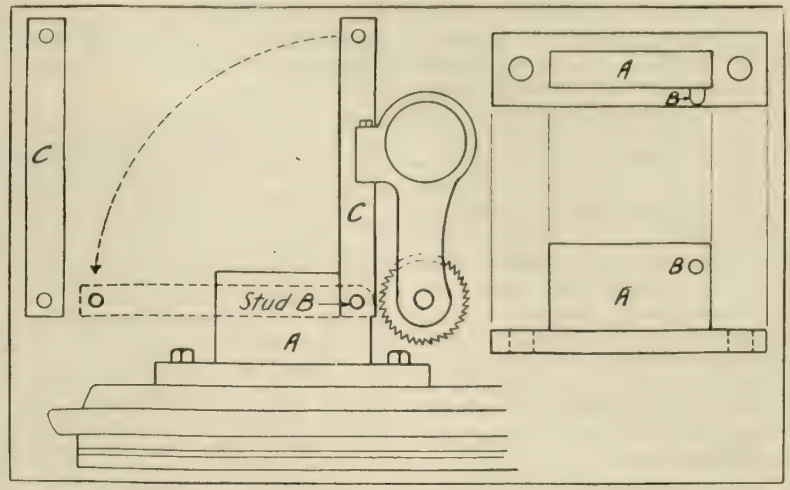
Referring to Fig. 1 the small diameter of the saucer shaped piece enters the recess "A" in the formed block "B," the large disc is here indicated as "X" and this is placed over the prongs, both parts being located central by means of a stud "C" passing through the hole therein. Over this stud "C" is placed a ring "D" which has a formed groove "E" cut in its lower surface. The flanged piece "F" is held in the ram of a foot press while the die shoe "C" is attached to the bolster plate of the press. When "F" is pushed down the recess "E" in "D" is caused to engage with the upright prongs and turn them down to approximately the shape of the recess "E."

The ring "D" is then removed from stud "C" and is reversed bringing the flat surface "H" on the ring nearest to the work. The foot press is then operated again and "F" forces down ring "D" until the flat surface causes the prongs to lay flat in the position shown. The ring "B" is held to "G" by screws "J" while the periphery of "D" is knurled to form a convenient finger grip for removing this by hand off the stud "C."



Sectional View of the Die.

This makes a cheap and efficient tool, that when set up requires practically no attention from the operator except to remove and put in the work, followed by reversing the ring "D" to perform the two functions for turning over the six prongs and flattening the same.



Illustrating how the author made the corner of radius shape.

MILLING RADIUS QUICKLY

(By V. W. J. Coffin)

The stretch shows an economical method of rounding the ends of flat bar stock. Previously this job had been accomplished by grinding, but proved a slow and tedious task. This work is 15in. long and it is drilled as shown, the radius starting from the centre of the 7/16in. hole at the end. We decided to speed up the operation by milling, so a tee shaped casting, A, which we had on hand was utilized. It was filled at one end and side with the stud, B, which was relieved in such a manner as to allow the stock to be placed and clamped. A hand milling machine was used, and the table raised so that the stud, B, was in a line with the centre of the arbor. A 2½in. stock cutter was used.

The piece was placed on stud B in a perpendicular position, and table was advanced up to cutter. The table clamp was then tightened, and all that was necessary was to pull down on the stock a quarter turn, the cutter forming the radius. We merely reversed the part to form radius on the other end.

VALVELESS GEARLESS ENGINE

The idea of an engine without valves or gear has been realized in Great Britain by the construction of an engine, which in the works at least, has been given remarkably promising results. This engine has three cylinders; and except for the ports it has no valves. There is not a single gear wheel and all the usual cams, shafts, tappets and springs and even the timing gear are cut out. The only moving parts are the crank shafts, pistons and connecting rods. The experimental engine was rated at ten horse power and on test developed twice as much. The cycle of operations is not easily described without a detailed diagram, but it can be said to depend upon ingenious inter-working between the three cylinders. This engine has been specially designed to meet the conditions in overseas countries where an extremely simple engine not requiring difficult repairs is for obvious reasons in great demand.

The Sarnia Collegiate Institute and Technical School is nearing completion and is now ready to purchase machinery and equipment for the several departments.

High Speed Belt Driving; How Far Can We Go

By RICHARD JOHNSON, M.E.

HOW much do we actually know about belting except from hearsay? Some of the more common facts we can gather all right from daily experience with them. This experience is not always absolutely reliable. Take, for instance, the good old rule that a quarter-turn belt should be so put that a plumb line dropped from the leaving side of the upper pulley should just touch the leaving side of the lower pulley. There are a good many practical men who would claim that a quarter-turn belt cannot be run unless this rule is very closely observed, and yet, occasionally, where belts are very high speed on short centres, the leaving side of the lower pulley may be some inches away from the plumb line.

Perhaps the most interesting of all is the generally accepted idea that a belt should not be run, at the utmost, at a greater speed than six thousand feet per minute. There are comparatively few who have ever tested to see whether this is true or not. It is a rule that has been handed down from the early days of belt driving, and generally it holds true. The idea is that the centrifugal force is so great at high speeds that the belt will not grip the pulley hard enough. As a matter of fact, however, I know of a fourteen-inch double belt which is running slightly over 7,000 feet per minute, and has done the work satisfactorily for some time.

One well-known type of edger on the market calls for speeds of seven to eight thousand feet right along. As a matter of fact, there are belts running as high as eight and nine thousand feet per minute in this country. It stands to reason that the pulleys have to be reliable and perfectly balanced, and the belt also has to be absolutely even and also well balanced in every way.

A speaker some time ago, before the American Society of Mechanical Engineers, talked about speeds of belts hitherto unheard of—ten, eleven and twelve thousand feet per minute, and one case of a belt which actually ran in use over 11,000 feet per minute. For this purpose the belt, of course, had to be practically perfect, and the pulleys had to be special.

Centrifugal Force

As a belt can make more power the faster it goes, it would follow that if we could run our belts at speeds of 15,000 to 16,000 feet per minute, or more, there would be a great saving in belt bills. But what of the centrifugal force which increases so rapidly with the speed? When you double your speed this force is multiplied by four, and when the speed is quadrupled the force is multiplied by sixteen. This means strain on pulley, strain on belt, and a very powerful tendency on the part of the belt to fly away from the face of the pulley and lose its grip.

But now comes a theory of high-speed belt driving which claims that there are certain efficiencies gained at these high speeds that overcome, and more than overcome, the loss by centrifugal force. Also the strain on the left due to this force is greatly relieved, and also the strain on the tight side of the belt, mainly because the belt is travelling so rapidly that when it leaves the driving pulley it not only travels, but is actually thrown violently against the top of the driven pulley, tending to push it around. Of course, if the belt can push on top, it helps out to a great extent the pull of the belt on the bottom, if the belt could only be thrown hard enough against the pulley and could push hard enough, therefore it would almost entirely relieve the strain on the tight side of the belt, and as a leather belt can stand a great deal of pushing without injury, we would have the spectacle of a belt comparatively small in size transmitting enormous power, not only on account of its speed, but also on account of the fact that it pushes as well as pulls.

Are These Possibilities?

Think of a nine-inch double belt running 20,000 feet per minute and transmitting seven or eight hundred horsepower! It would require only a forty-inch double to run the street car lines of a medium-sized city, and our big mills could easily be run by a twenty-four or thirty-inch double belt. On this basis a portable sawmill could be run, carrying a saw, a planer, a slab saw, a trimmer and an edger. As this place now requires about a sixteenth-inch heavy double, of the best grade, some idea of the saving can be formed.

The investigator of these high belt speeds, who claims to be more or less acquainted with belts which are working often at speeds of eight or ten thousand feet per minute, grows so enthusiastic that he predicts that the limit may range somewhere around twelve or fourteen thousand feet or more before we get full efficiency of our belts.

I am willing to admit from practical experience that on some silk machinery there are small belts, specially and carefully made, which run about eight or nine thousand feet per minute, but they do not last long and it is considered an extremely hard place for a belt. I am also willing to admit that, under peculiar conditions, fancy speeds may possibly be attained by such belts. Lathes are being speeded up, wood-working machinery is running at hitherto unheard of velocities, and no one can predict what will be the limiting speeds fifteen or twenty years from now. While we may reasonably doubt some of the visions of theorists, who only test out and theorize on experimental machinery, it might not be at all bad if experiments could be conducted to show how fast a belt could run under certain conditions, and what the conditions for safety would be.

POINTS ON LIQUID FUEL

Discussing a paper on "Liquid Fuel," which was presented before the Institute of Marine Engineers, in England, Mr. N. A. Anfilogoff mentioned that he would like to give the following practical hints: He said that unless the combustion space is sufficient, one cannot obtain complete combustion of liquid fuel. When the boiler furnace has been designed with an idea of burning coal, and grate area only was taken into consideration, it can be taken that the combustion space would be insufficient for burning liquid fuel weight for weight.

In order to get the oil in the furnace in a very finely divided state, one has to employ the best possible means. Unless the oil is properly heated, filtered, and atomised, a condition will arise in which little chunks of oil will be thrown into the furnace and deposited in the corrugations or even in the back combustion chamber, where they will slowly collect and get converted into porous masses of carbon which will burn away very slowly. Any oil imprisoned in the masses will probably contain a certain percentage of sulphur. This sulphur may get converted into injurious compounds, which, as gases, would travel through the pores of the mass and become deposited or condensed in the coolest part of that mass, which would obviously be the boiler plate.

Following is a tentitive list of machine tools and woodworking equipment which will be necessary for the new technical school at Sarnia, Ont. Tenders will be called for shortly, as this school will be opened sometime in September: 5-lathes, 6 ft. bed, 14 inch swing (one of these will be a tool room lathe with quick change gears; 1 16 inch shaper; 1 drill press; 1 universal milling machine; 1 power hack saw; forges, anvils, vises etc. These will be used in the machine tool section. In the wood working department the following machines will be required, 1 combination cut off and rip saw; 1 band saw; 1 tool grinder, 1 glue stand; 1 electric glue pot; 1 pony planer, and 3 wood turning lathes of different sizes. All machines to be motor driven. In addition to the above a blue print machine will be purchased.

Recent Developments in Mechanical World

Must Know His Own Needs

SPEAKING of "Production Control," what it gives and takes P. J. Darlington sums up the situation in this fashion in a recent issue of Industrial Management.

"To successfully install production control it would seem that the Works Manager must understand the principles involved. He must have a practical working knowledge of those means which have been developed and are available to him for applying those principles and he must have a firm grasp of the needs of his own factory and the objects to be attained.

"He will then apply the principles of production control to his own problems in the simplest and most direct manner, much as the engineer applies his knowledge of mechanical movements, structural stresses and properties of materials to the design of a machine for a specified purpose. The efficiency expert may aid by finding ingenious means and processes, but the proportioning and application of production control to given conditions is the business of the Works Manager. There are too many considerations and conditions to allow reasonable hope of finding a ready made plan.

"Production control is not a new invention or discovery. It is mostly common sense. All successful factories are exercising some measure of production control in some form, although they may not recognize it under the name. A clearer understanding of the principles may help them to extend and perfect their plans."

Making An Invention Pay

"IN EXPLOITING their inventions, inventors must not allow themselves to be tempted through any get-rich-quick schemes," says a writer in Practical Engineer, an English publication. He goes on to say that the percentage of patented inventions that are never exploited on a commercial scale is much greater than that of those that are developed. The undeveloped specifications may not, however, be useless, for they provide a permanent record of some of the enterprises and activities of the inventors at certain periods in their lives. Furthermore, in not a few cases the possession of a few patents has been the means of securing employment for an inventor, even although the inventions were not developed either before or subsequently.

"Inventions may be classified under two headings," this writer continues, "namely, those that are entirely novel in the sense that they provide means for carrying out a purpose hitherto unprovided for, and those which only provide an alternative means for carrying out a purpose already provided for. In the former case, the inventor must strive to determine as many means of carrying out the purpose as he can and have them all incorporated in one or more specifications. He will then be protected from competition from others who afterwards, perhaps inspired by his pioneer work, might think out the alternative arrangements and secure separate patents for themselves. At the same time, it must be understood that two inventions cannot be made the subject of a single patent, but an experienced patentee or patent agent can very often successfully incorporate two or three alternative means into one specification.

"With regard to an invention which is only to carry out the same purpose as something already in existence, the inventor must ask himself the following questions before he spends any money on applications for patents. Has his invention any advantages over the existing method? Will the cost of production on a commercial scale be cheaper or more expensive? If the inventor has any experience in engineering, he will probably be able to answer these questions himself. If not, he should consult his patent agent. It has been written, 'Any fool can invent, but it takes an engineer to knock the invention into practical shape.' "

Drawings For Drop Forgers

ACCORDING to A. Stubbs, who read a paper on drop forging lately, the drawings supplied to drop forgers should show the finished machined part, and the drop forger, when quoting, should be told what machining allowance has been made, and if necessary the quotation accompanied by a sketch showing, in addition to the machining allowance, the amount required for draft of dies and the position where the dies would be halved. The practice adopted by some engineering firms of sending two drawings, one showing the finished machined part and the other a stamped drawing, has much to recommend it. The drop forger with this information before him can not only decide which are the most important dimensions or points to be watched, concludes Mr. Stubbs, but can often make suggestions which make either for economical production or a better article.

Proper Heat Treatment of Dies

THE HEAT treatment of drop forging dies, is perhaps one of the most important steps in the economical operation of a drop forging plant, for nearly all other economies may be nullified by improper heat treatment. On the one hand, careless handling in the heat treatment may spoil the dies and cause a waste not only of the material from which they are made, but of all the labor that has been put into the sinking of the impressions. On the other hand, states the Drop Forger, even though the dies may pass from the hardening room in what may appear to be first-class condition, if they are not of the right hardness and toughness, they will not stand up under the hammers anywhere nearly as long as if correctly treated, and as a result the cost of dies will increase rapidly. Too much attention cannot be paid to the heat-treating department in any plant, and this is specially true in a drop-forging plant where dies are hardened and drawn.

Grinding Twist Drill

TWIST DRILLS, although correctly ground, are often observed to fracture at the edges. This may be taken as an indication of too heavy feed. The speed should be increased and the feed correspondingly reduced. If the extreme edges alone are affected, continues the Edgar Allen News, the speed is too high. If the edges of the cutting lips break down soon after the drill has begun its work of penetration, it is a sign that the angle of lip clearance is too great. The splitting of the drill from the point up to the centre may indicate too small a clearance angle. Unequal grinding of the lips and unequal angles on the cutting edges are productive of many drill failures. Sometimes the hole is larger than the drill, pointing to faulty lip grinding. Sometimes the drill will not centre properly, showing that the angle of the cutting edges is too great. In both cases the strain on the drill and the machine that drives it is intense. Slower drilling and excessive driving power required to do the work are symptoms which, if neglected, lead ultimately to breakage and consequent loss.

New Things in Shop Equipment

NUT-TAPPING MACHINE OPERATING DEVICE

The Key Equipment Co., East St. Louis, Ill., have recently developed an air-operated automatic device which controls the operation of bolt-cutting and nut-tapping machine. When this device is applied to a bolt-cutting machine it clamps the work, feeds it into the die, opens the dies after the thread has been cut, returns the carriage to its starting position, and sets the dies for the next cut. When the device is applied to a nut-tapping machine the spindles are held by an air-operated piston when the taps are full, the rising and falling of spindles are controlled, and the blanks automatically fed.

SECTIONAL FILING EQUIPMENT

The Economy Drawing Table and Mfg., Co., Adrian, Mich., have placed on the market a filing case, manufactured in five drawer sections. The filing case has been designed for the filing and preserving of tracings and blue prints. Provisions have been made so that it is impossible for the contents of the drawer to slide over the top, at the sides, or at the back. Each drawer enters a fully enclosed dust proof pocket separated from other pockets into which other drawers enter. When a drawer is closed, the front comes up against a groove in the frame, so that it is entirely dust proof. The cabinet is built in two sizes, one with drawers 26 inches x 38 inches x 2 inches and the other 32 inches x 44 inches x 2 inches, all in side measurements.

BENCH LATHE UNIT

A rather unique installation of several bench lathes mounted on a bench is being marketed by the Elgin Tool Works, Inc., Elgin, Ill. Several standard bench lathes are mounted on the bench, and in a superstructure, countershafts, jack shaft, shifters, etc., are mounted, while the motor driving unit is placed on the under side of the bench platform. It is usual to mount four lathes on a bench, two on each side of a wide bench, with the superstructure between. A larger (or smaller) number of machines can be supplied per unit. Any regular size of bench lathe can be provided. The motors can be furnished to operate on direct or on alternating current. All belt shifters are operated by a number of foot treadles, and the benches are constructed of kiln dried hardwood. A tool drawer and collet rack is furnished for each lathe mounted on the bench.

IMPROVED AIR OPERATED CHUCKS

The line of air operated chucks formerly manufactured by the American Air Chuck Co., have recently been designed and are now being manufactured by the S-P Manufacturing Co. of Cleveland, Ohio. The improved chucks have a capacity range from 6½ to 18 inches, and are designed to hold work by either external or internal surfaces. They are arranged to be of use in general manufacturing or in quantity production work. The jaws, when used as a universal chuck, are actuated by sector levers. A patented feature permits the air to be shut off from the cylinder without releasing the grip on the work. Should the air supply fail, the chuck can be quickly arranged for use as an ordinary lathe chuck.

PARABOLIC MILLING CUTTERS

After an extended research covering several years, the National Twist Drill and Tool Co., Detroit, Mich., have evolved a new type of milling cutter which they are marketing under the trade name of "Parabolic." The name was chosen as one that represents and characterizes the distinctive form of the teeth. Tests showed that in order that milling cutter teeth be of uniform strength throughout their length, the shape must be that of a parabola slightly modified at the small end, which shape is the one used in the new cutters. The number of teeth in the new cutters corresponds to the number usually found in the conventional fine tooth cutter. This feature was found necessary to obtain an efficient chip clearance per tooth, without an excessive peripheral speed. The cutter is made in plain, side, and end mill types, as well as for special purposes.

STRADDLE MILLING MACHINE

Recently the Newton Machine Tool Works, Philadelphia, Pa., developed a cycle feed straddle milling machine which is now being marketed under the trade name Model C-75. One application of the machine is for facing of crank shaft bearings of automobile motors. It is belt driven and can be connected to an electric motor or to a countershaft. The drive is applied through enclosed gears running in oil. The design provides two spindles, which are mounted in housings having individual end adjustment, which permits regrinding of the milling cutters. The method of operation includes a rapid downward advance of the table, a slow feed while the tools are actually cutting, and rapid upward return.

The machine is arranged to automatically stop at the loading position, which can be arranged to be on a level with conveyor rolls. Provision is also made so that the rate of feed can be altered to suit the material being machined, and other events in the cycle of operations are automatically taken care of. Hardened steel jig plates are provided as regular equipment on the table. The clamping arrangements are all taken care of from above through the medium of a double post beam clamp, that is hinged at one end and is supplied with a central clamping screw operated by a handwheel.

PNEUMATIC RIVETING MACHINE

The Blomquist-Eck Machine Co., Cleveland, Ohio, have recently placed on the market a pneumatic riveting machine that consists primarily of a standard pneumatic hammer mounted on a column and provided with an anvil, the control being through the medium of a foot treadle. The downward movement of the treadle causes the hammer to move downward and at the same time opens the air valve. When the pressure on the treadle is removed, the hammer returns to its top position, this movement being assisted through the medium of a counterweight. With the upward movement of the hammer the air is automatically cut off, and the air supply can be regulated by tilting a cam adjustment at the side of machine, this controlling the movement of the air throttle. The hammer slides within the carriage, and is backed up by a spring at the top which absorbs the shock. While operating, the hammer is rotated by means of a belt passing over a pulley which causes the hammer to revolve. Special anvils are provided if required although there are several standard types.

AUTOMATIC DOUBLE-SPINDLE GRINDING MACHINE

A double-spindle automatic grinding machine designed for the rapid and simultaneous grinding of two opposite parallel sides of a piece has been recently placed on the market by the Gardner Machine Co., Beloit, Wis. This machine has several features distinctly different from the ordinary double-spindle disc grinding machines. The machine is of the continuous feed type, and the spindles are horizontal and are offset in relation to one another. For wet grinding the grinding members con-

st of 24-inch diameter abrasive ring hee s carried in specially designed nucks. For dry work, 24-inch steel isc wheels faced with abrasive are used. he parts to be ground are conveyed by carrier that passes between the grind ig wheels. The feed arrangements of ne work carrier can be adjusted to ake care of various numbers of pieces er minute varying between six to forty. Vork is placed in openings in the car- 'er.

One of the grinding wheels is sta- ionary and the other approaches the :ork up to a positive stop, but main- ains an even and constant pressure gainst the work. The positive stop is djustable, and by it the thickness of 'ork is determined. The thickness of inished pieces can be controlled to with- n one ten thousandth part of an inch, nd in large work the automatic feed- ng device enables a large production o be handled. In grinding the largest vork the machine will handle it is ometimes necessary to operate the con- eyor by hand. Devices for trueing he grinding members are an integral art of the machine, and are constantly vailable for use. Among the many rticles that this machine can handle re, piston rings, ball and roller bear- ng races, adding machine parts, thrust vashers, gear blanks, etc.

AUTOMOBILE-BODY PRESS

A press for the production of an all teel automobile body has recently been uilt by the Southwark Foundry and Machine Co., Philadelphia, Pa. The apacity of the press is 450 tons, and he main ram is located in the lower ase to which is secured four columns. The press is provided with clamping nd stripper platens, and the stripper latten carries four hydraulic cylinders cting upon a forged steel plate, which, n turn has sixty stripper pins 1½ inch- s in diameter. These pins project hrough the clamping platen which is a solid steel casting provided with T- lots.

The top platen carries eight hydraulic acks having 5 in. diameter rams and strokes of 5 inches, these jacks being mployed to accomplish the clamping. This platen is adjustable to accommo- late the various sizes of dies, which it may be desired to employ with the press. The complete operation of the machine is controlled with a single lev- r and this lever operates a valve which subjects the four hydraulic cylinders and the main ram, to a low pressure. As soon as the dies come together, high pressure is applied through the steam operating valve to complete the opera- tion. The clamping cylinders are auto- matically controlled from a low pres- sure filling tank, and are capable of standing a pressure of 5,000 pounds per square inch. The die space of the press is 7 feet by 5 feet. The minimum vertical opening between the platen is 18 inches and the maximum is 4 feet.

WHEEL TRUEING HEAD

The Precision & Thread Grinder Mfg., Co., Philadelphia, Pa., is now marketing a grinding wheel trueing head which not only can be applied to their own Precision Thread Grinder but is quite easily used as an auxiliary trueing head on any thread grinding machine. It is claimed that the device will keep the wheel always in correct alignment with the thread being ground. It is quite possible to dress the V-form on the wheel to a sharp point so as to facilitate the grinding of fine threads. There is no limit to the length of threads that may be accurately ground, because the wheel may be trued while grinding.

The feeding mechanism for actuating the head, has a micrometer dial graduated in thousandths, which enables the attachment to be fed forward sufficiently to make up for the reduction in wheel diameter due to wear and dressing. The grinding wheel is trued by means of two diamonds, which cut progressively and alternately. When diamonds are dull they can be rotated a fraction of a turn in order to present a new point to the wheel. The new point will always be sharp so the diamond can be worn down to its setting. A stop is provided for regulating the traverse of the diamonds and can be utilized for predetermining the amount of flat produced at the bottom of the thread, thus insuring that the amount of this flat will be constant, regardless of redressings and without subsequent regauging.

AUTOMATIC HOB SHARPENING MACHINE

The Barber-Coleman Co., Rockford, Ill., have placed on the market an automatic hob sharpening machine. It has a capacity enabling it to take hobs up to four inches in diameter and four inches long. It can also be used to sharpen formed cutters of sizes within its capacity, and the design was developed with the idea in mind that hobs and formed cutters must be sharpened in such a manner that they will continue to reproduce their forms correctly.

The machine can handle hobs that have straight gashes, and also those that have right or left hand spiral gashes up to 30 degrees of angularity. The indexing mechanism will handle any number of gashes between ten and sixteen, there being seven separate index plates furnished. After each complete revolution of the work the machine automatically takes a pre-determined deeper cut as the work starts on its second revolution.

The machine is driven from a countershaft bolted to the back of frame. Electric motor drive can be used by placing a motor on a bracket bolted to the back of the machine frame. A two horsepower, 1,800 r.p.m. motor is furnished. Power to drive the grinding wheel is applied through the medium of an endless belt running over grooved idler pulleys and transmitted finally to the grinding wheel arbor through spiral bevel gears at the back of the wheel head. The grinding wheel is 7 inches in diameter. The machine is automatic throughout. The weight is about 2,250 pounds.

CRANKSHAFT-CHEEK TURNING LATHE

A rather novel type of special lathe has been designed by the Gordon Form Lathe Co., Cincinnati, for turning all the cheeks of automobile crank shafts simultaneously. The machine is manufactured by the Willard Machine Tool C., of the same city, and when developed for crankshafts of four cylinder motors, is equipped with eight rocker arms, each of which controls a tool held in a block that swivels in the rocker arm, the number of rocker arms corresponding to the number of cheeks on the crank shaft. These arms are located back of the work and swing from an over-arm shaft to and from the crankshaft to suit the contour of the cranks. The rocker arms are spaced to coincide with the location of the various crankshaft-cheeks, by means of collars on the overarm, and guide plates fixed to the main frame of the machine. The guide plates are inserted in the rocker arms below the tool blocks.

Feeding of the work is accomplished by movement of the plate, which is fed by a screw. A gear quadrant connected to the feed screw at the front end of the machine provides a wide range of feeds, from very coarse to very fine. An automatic trip serves to throw out the feeding movement through the medium of a lever, at the conclusion of the cuts across the crankshaft-cheeks. At the completion of an operation, the platen is returned to its starting position by turning a handwheel. The head stock, tail stock and steady rests are bolted to the platen to make one unit and travel as an integral piece with the work.

On account of the wide range of feeds the machine can be used on both roughing and finishing work. Ample chip clearance has been provided between the bottoms of the rocker arms and the platen. The chips fall directly into a chip pan within the machine and are removed through a large door in the front of the bed. Cutting lubricant is led to each tool from a belt driven lubricant pump. The main drive of a machine is through a friction clutch pulley.

According to information coming through to the British Trade Commissioner in Toronto, the general industrial condition in Britain is slowly but steadily improving. Speaking broadly there was a marked betterment during October and the early part of November. That there are many hills yet to climb is obvious, but reports indicate a decided spirit of optimism.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Bigger Things Are Ahead

IT IS HARD to visualize the viewpoint of an otherwise sane business man, who expressed the opinion that the world is about to come to an end, *because we have reached the point where little else can be discovered or perfected.*

This outwardly rational individual went on to tell us that the aeroplane was now an accomplished fact, that the submarine was a commercial success and that trains had reached the limit of speed and economical design.

He also went on to point out other wonderful engineering achievements, such as the completion of the Quebec Bridge. At this point we spoiled his discourse by remarking that bigger and greater problems were ahead of us than had ever yet been solved. Although this man did not hail from Missouri, he requested to be shown, and here are a few of the things we told him:

Orville Wright, one of the authorities on aviation, says the need of to-day is a machine capable of landing at such low speed as to make landing in small, fenced-in areas, perfectly safe.

Elmer A. Sperry, of the Sperry Gyroscope Co., says conservation of our liquid fuel resources is the need of the hour. The present methods, in Mr. Sperry's opinion, are criminally wasteful, and he strongly advocates intensive research toward a permanent cure for such inexcusable waste.

The Hudson Bridge, on which a start will be made in 1922, will be the largest ever undertaken, and its completion will take at least five years. New foundation problems are bound to crop up, and when even such a well-known bridge designer as Gustav Lindenthal, who designed the Hell Gate Bridge, remarks that many new problems will be encountered, we must realize the importance of this latest engineering feat.

Chas. P. Steinmetz, the electrical wizard, says that the breakdown of solid and liquid insulations under electrical stress is the most pressing scientific achievement required in the electrical field. D. W. Griffith yearns for a camera and film which will produce stereoscopic and natural color effects in photography with economic accuracy, while Alexander Graham Bell, the inventor of the telephone, says that alcohol fuel is the hope of the future.

J. G. Vincent, vice-president of the Packard Motor Co., and designer of the Liberty engine, says that the motor industry needs a more efficient utilization of fuel in internal combustion engines, while F. G. Cottrell, famous research chemist, is just as positive that what the world needs is a standard code of language.

Needless to say we convinced our business friend that great times are ahead. If men in these key positions in their respective industries feel the need of such inventions, surely there is a good chance for the brains of the country. If these suggested problems were easy to solve, the men making the suggestions would be only too pleased to present to the world their solution. The very fact that men with such wide experience admit their inability to offer a solution shows clearly the depth of the problem.

So many improvements can be made in all branches of industry and science, that the field of possibility can well be said to be illimitable.

Will Coal Prices Come Down?

THERE APPEARS to be a movement on foot to reduce transportation rates on coal, but railway companies seem to be holding off until coal merchants get rid of their high priced stocks. Another reason for the delay is that some of the railways are owners of coal mines, thus they hesitate to hurt their customers by reducing prices and rates.

In the meantime thousands of cars filled with coal stand on sidings waiting for further moving instructions. People refuse to buy at present prices, except for immediate requirements, so that dealers have still considerable high-priced stock on hand. The mines have in turn reduced their output, this having its effect on the railways' receipts. It is expected that the carrying companies will soon be forced to lower their rates in order to get traffic back to something like normal.

Such close connection between the mines and railways is not always wise, but there is more to the lowering of coal prices than the mere reduction of freight charges. Take the case of the coal miners in Wales, England. The story of their determined strike for nationalization is now history, but since their return to work, and we emphasize the fact that they are now *working*, production has practically doubled. This proves it is not altogether a reduction in wages that counts so much as an increase in production. England is now producing coal on a competitive basis, and sending her fuel to all parts of the world once more.

What can be done in England can likewise be accomplished in Canada and America. Let miners get the spirit of 100 per cent. efficiency, mine owners the proper co-operative feeling, then watch the cost of mining coal come down. Add to this lower freight rates, and fuel will reach a reasonable figure, something it hasn't done for some time past.

There is a crying need for a reduction in transportation prices on more than coal. Railway executives should make a decided effort to offer manufacturers a better rate on the moving of their products. Nothing will speed up business quicker than lower railway charges, and the railways themselves will eventually benefit by the increased tonnage passing over their lines.

Latest News From Various Markets

Steel Mill Output Slowly but Gradually Improving

Tin Plate and Pipe Mills Retain Lead—Small Tools and Supplies Are Active—Ingot Metals and Scraps Continue Quiet —Machine Tools Not Much In Demand

THE GRADUAL improvement in steel mill demand continues. This comes from all sections of the country and from every class of trade. Buying continues to be of the hand-to-mouth variety. The present production rate is approximately the same as it was at the beginning of December, before the lull, but so far, the mills have not reached the 23,000,000 tons rate, which existed during October and November. If the present improvement continues, the rate should get back to the above figure by the middle of February.

The tin plate industry is running at from 70 to 75 per cent. capacity, this really being above the average for this season of the year. Pipe mills are turning out work at about 60 per cent. capacity, and sheet mills at approximately 45 to 50 per cent. Production at bar, shape, plate and rail mills continues to be very light. Taken as a whole, the steel industry is running at about 42 per cent. capacity.

The pig iron market continues dull. Prices have not changed and existing figures do not show much strength. Furnace coke is stagnant, demand being practically non-existent.

The metal market continues very dull. There is some talk of lower iron in the near future, but so far nothing definite has occurred.

Small tools are selling at a better rate. A decided improvement has occurred in this section of the trade, and a further upward movement is expected. In some cases, more business has been closed with firms this year, than all the orders secured during the entire twelve months of 1921. The automotive trade is largely responsible for this improvement.

MILL OUTPUT SHOWS INCREASE; COMPETITION CAUSES SHADING

PITTSBURGH, Feb. 8.—There has been a gradual improvement in demand upon the steel mills since the first of the year, but at a decidedly slower pace than was expected.

There are no particularly outstanding features in the steel demand, which is quite variegated in character and comes from all sections of the country, also from all classes of trade. The demand shows just what is going on industrially. Business is being carried on to the extent that is necessary in a period of readjustment and recuperation, and everything is being done on the most conservative basis. Buyers are not making forward purchases in any case and are not attempting to carry anything like normal stocks. The orders are small individually and the specifications are decidedly mixed. It is strictly what is commonly called hand-to-mouth buying.

Operations of Mills Increasing

As the buying is all for prompt shipment, mill operations show plainly the rate of buying. Almost week by week since the first of the year there have been heavier operations by both the Steel Corporation and the independents, but the Corporation has gained more than the independents and is now operating almost one-half greater percentage of its mill facilities than are the independents. With the increase that has occurred since the first of the year the Steel Corporation has been producing steel ingots in the past two weeks at the rate of about 11,500,000 gross tons a year, while the independents, with their gain, are doing about 10,500,000 tons a year, making about 22,000,000 tons a year as the rate of the steel industry as a whole. This is approximately the rate at the beginning of December, before the lull, when production dropped to below 18,000,000 tons. The rate during October and November was 23,000,000 tons, so that the industry has not thus far, altogether gotten back to that rate. With the recent improvement continued, however, it will do so by the middle of February. As the Steel Corporation has 44 per cent. of the capacity and is producing about 10 per cent larger tonnage of ingots than the independents, it is doing much better than the independents in proportion to the respective capacities.

The best percentage rate of operation is shown by the tin plate branch of the steel industry, which has been running at 70 to 75 per cent. of capacity since the first of the year. Production is really above the average for this time of the year. Prospects are that demand for tin plate for strictly domestic consumption this year will run well above the average, and a record output might easily be made were it not for two handicaps; the light demand for tin plate for export and the relatively light exports of oil in tin plate containers.

Next in point of activity come the pipe mills, which are probably averaging an operation of 60 per cent. of capacity. Pipe mills operations are likely to have a slight seasonal decline in the next few weeks, with an improvement by early spring. Just now the demand for oil country goods is light, but there is still heavy production of line pipe against contracts booked a couple months ago. Demand for standard steel pipe is fairly good.

The sheet mills are operating at an average of between 45 and 50 per cent. of capacity and the present state of the market does not augur much improvement in the near future. Wire mills are running at approximately the same rate. Operations at bar, shape, plate and rail mills are very light. With ingots being produced at 22,000,000 tons a year the steel industry as a whole may be said to be operating at about 42 per cent of capacity.

Steel Prices Generally Firm

While there is very keen price competition in nearly all branches of the finished steel trade the regular or nominal asking prices are not declining, having indeed shown no important decline for over six weeks. The old prices are retained as regular asking prices because small orders can still be booked at those figures, the competition being on orders of particular size. The mills are making concessions for smaller orders, but it is a question whether the extreme concessions are any greater than a few weeks ago. This is a matter that is not tested to any extent because scarcely any really large orders are coming out. Regular prices remain at 1.50c for bars, shapes and plates, 71 per cent. basing discount for standard steel pipe, 2.25c for wire, $2.50 for nails, 2.25c for blue annealed sheets, 3.00c for

black sheets, 4.00c for galvanized sheets and $4.75 for tin plate.

Steel Corporation Earnings

The quarterly report of the United States Steel Corporation shows earnings, after payment of interest on subsidiary company bonds, of $19,612,033 for the December quarter against $18,918,058 for the September quarter. At a glance this looks favorable, as there is an increase of 3.7 per cent., but the shipments in the September quarter were about 30 per cent. of capacity while shipments in the December quarter were about 48 per cent., so that the earnings per ton were greatly reduced. Furthermore, the earnings in December were only $4,967,237, or at the rate of less than $15,000,000 per quarter. Production cost decreased during the six months by reason of the increasing operating rate, also on account of the general wage reduction August 29, prices realized dropped in greater ratio. This year there is further shaving of prices, and still smaller earnings are to be expected for a time. The majority of the independent steel companies have been reporting losses. As a rule they have had two disadvantages by comparison with the Steel Corporation, having had to make various inventory and other adjustments during the past year, which the Steel Corporation attended to before reporting its earnings for 1920, while they do not have as good an operating rate as the corporation, which gets the preference in many cases in the placing of orders on account of the good will it acquired in 1920, by holding down its prices while all the independents made large advantages. Not infrequently the corporation secures slightly higher prices than the independents on this account, apart from getting the preference at identical prices.

Pig Iron and Coke Quiet

The pig iron market continues very dull. Prices are quotable at the same level as a week ago, but do not seem very strong: Bessemer, $19.50; basic, $18; foundry, $19, f.o.b. valley furnaces, freight to Pittsburgh being $1.96.

Connellsville furnace coke is stagnant, there being scarcely any demand, and prices appear still easier, in that two sales for shipment over February, aggregating about 17,000 tons, have been made at under $3.00. Hitherto, prices under $3.00 were applicable only to small prompt lots. As for several weeks past, it is possible to pick up spot furnace coke at $2.75. Foundry coke is in somewhat better demand, though the demand is very spotty. Several large foundry interests are operating at better rates, while there is a little disposition to stock up. Spot foundry coke remains quotable at $3.75 to $4.25 according to brand.

POINTS IN WEEK'S MARKETING NOTES

Montreal merchants, in speaking of the trend in iron and steel, emphasize the belief that the "corner has been turned."

Producers are applying themselves to the securing of business, as they consider that small turnover, even at a slight loss, is better than closed mills.

Requirements are exceptionally light and pig iron production, consequently, is affected, and sales are relatively reduced.

Slow return to normal is exhibited in the gradual increase of production indicated in reports of mill output in the Pittsburgh district.

The tin plate situation is the one bright spot in the metal working industry. Present operations show the mills to be operating at from 70 to 75 per cent. of capacity, and as this is above the normal average for this period of the year, the fact is encouraging.

Total earnings of the U. S. Steel Corporation, for the past quarter were about a million dollars higher than the previous three months, but compared on a production basis, the earnings per ton were considerably lower than for the September quarter.

The local market is spotty. All lines, with the exception of small tools, are dull. The latter mentioned is showing good activity, and further improvement is expected as the year progresses.

IMPROVED CONDITIONS EXPECTED; TREND TOWARDS SPECIAL MACHINES

MONTREAL, Feb. 8.—Reports covering the local trading conditions in the iron and steel business for the last few weeks apply pretty well to the situation that has prevailed during the past week. From no quarter does there come any encouraging news. Before Christmas practically all lines were moving nicely with a very comfortable little increase from week to week. The belief in all circles was that the corner had been turned. It was quite natural to have conditions flatten out during the holiday season, but it was almost the universal opinion that business would pick up again very soon after the new year. This has not been the case, as the month of January has registered the leanest month in this period of depression. Steel plates have been in but little demand. Although no definite reduction in the base price of steel has been announced the present figures are not strong. Merchant bars are also in little demand.

Structural sections have been rather quiet for the last few weeks, but inquiries for this class of material are growing a little more numerous, and in some cases these inquiries have developed into a few small orders. In the city and surrounding district the activity in the building line is rather marked. Every week reports show that building will be very active on the Island of Montreal throughout the 1922 season. There has been a very fair amount of construction this winter, which fact has been the result of a very fair amount of business in the structural steel line. Sheets still continue to be about as active as any department of the steel business. Galvanized sheets have been surprisingly active for the last week or ten days.

Production Cost

In times such as we are at present passing through, prices do not bear the same relation to cost of production as they do in more prosperous periods. Today the idea of the steel producer is to market as much of his product as possible. It is considered that a small turnover, at a slight loss even, is better than no turnover at all and mills closed. For that reason every order is very aggressively sought. This condition of affairs has worked out to the disadvantage of the jobbing house somewhat, as the mills do not hesitate to solicit orders direct, and some mills have a very representative sales force covering the field usually taken care of by the jobber.

To close an order prices are frequently shaded. Thus, the condition of business generally is not in a very attractive position. Matters are not, however, in such shape that they cannot be readily improved, and it is found that there is not much talk in most circles but a sane acceptance of the conditions as they are, which perhaps is the best possible method to be pursued in the present combination of circumstances.

Slow Movement in Pig Iron

Conditions in the pig iron trade remain the same as was reported last week. The drop of two dollars a ton two weeks ago was a very serious blow to the prospects of the producers. There was barely production cost in the higher price, and at the lower quotation, money is lost on every ton sold. The foundries still have no prospects of work ahead of them which would permit them to come into the market to any extent, and even the low levels now prevailing, do not tempt them to purchase. On the other hand the producer is anxious to keep losses at as low a point as possible; it is therefore obvious that orders for any large quantities of pig iron are not attractive. There is no doubt but that the price will advance as soon as normal activities are resumed in the foundries but as that time is still far in the future it is not likely that any immediate advance in the quotations on pig will be made.

Tendency to Special Purpose Tools

The machine tool business is still very quiet. The machine shops are not any nearer the point of coming into the mar-

ket than they appeared to be some weeks ago. For that reason there has been little moving in this line locally.

The shops engaged in strictly manufacturing activities are still operating at away below normal capacity and thus they are not in the market. One point that has been referred to in these columns before is the steady improvement in design that is taking place in all lines of machine tools. There is a growing tendency toward manufacturing special purpose, automatic, and semi-automatic machines and marketing same. Not long ago there was a standard line of general purpose machines that was offered to the buying public. Now there is a wider choice offered the machine man. This increase in the number and variety of machines available adds a few new features to the business of the machine tool dealer, which in times of general activity gives him a better proposition to offer a customer. Here and there an inquiry is received, but orders are only of the smaller kind. At present there is no prospect of conditions improving at an early date. There are many peculiar angles to the present situation and it is not a safe matter to attempt any definite prophecy as to what turn the situation may take in the future.

The small tool business is continuing to be the bright spot in the market. The fairly good demand continues and the volume of business moving in this department compares very favorably with the volume that was passing in the fall months. Prices remain rather steady, but from time to time discounts from the list are announced as manufacturing conditions improve.

Dullness in Metals and Scraps

The non-ferrous metals have also experienced another inactive week, there have been no events that have had any direct action on this market. Prices in some cases are a bit easier but there is no announcement of any drastic price reductions.

The scrap metal markets are still very languid. The inactivities of the foundries influence this market to a great extent. For that reason there is little or nothing to report in this connection.

SMALL TOOLS SHOW ACTIVITY

TORONTO, February 8.—With the exception of the small tool market, conditions are much about the same this week. Steel dealers are finding the going none too good. Some report a fair amount of orders, but generally speaking, things are pretty quiet. The automotive industry seems to be picking up a little, causing a slight stir of activity in steel, but nothing to boast about.

The only comfort, if such we may call it, is that dealers never expect much business at this time of the year. The first two weeks in February are noted for their dullness. What demand does exist on the steel market is general in nature, and scattered so far as territory is concerned.

Machine Tools

There is very little improvement showing in the machine tool field. The market is spotty, with the result you find one dealer fully convinced the corner has been reached, while another may tell you the same day that the bottom has dropped out of his business. The funny part of it is, that both may be telling the truth, but still one cannot describe the market from either of these tales.

If enquiries counted as orders, all would be well, but unfortunately such is not the case. One dealer summarized the situation to a nicety this week when he said, "You know, we have got so used to judging conditions by the ease with which we land orders that we have got the wrong perspective. I thoroughly believe that business can be secured if we go after it hard enough. In fact, I tried out my theory during the past two weeks with favorable and surprising results. The day to take things easy has gone. We must get out and follow every enquiry closely, otherwise conditions will not improve.

"Do not look for any sensational improvement, but I firmly believe that if we make up our mind to dig deep for business, we will find it," concluded our informant.

Metal Market

There is absolutely no change in this section of the market. Conditions are just as dull as ever. When things will pick up is doubtful, in fact one dealer said he was looking for lower priced iron in the near future. This market has had some rude bumps during the past year, but unfortunately we cannot see much hope for improvement for some little time to come. It's a case of waiting for business to pick up. Once let that happen, and the metal market will soon gain strength.

Small Tools

We have at least one cheering story to tell, viz, the small tool market shows steady signs of improvement. One dealer says he has got more business this year already from one concern, than he gathered in from them all last year. Canadian Machinery knows this to be a fact, having seen the orders. All lines in small tools are picking up. Evidently manufacturers allowed their tools to get in such poor shape that before commencing the New Year they felt it good policy to purchase new material in order to speed up production, thus lowering the cost of their product. The demand is general, and orders are coming in from a scattered territory. The orders received are not very large, but in the aggregate they are worth while. The best part of all is that dealers look for still further improvement.

Growing confidence in the ability of the market to pick up, is the only other feature worthy of mention. Dealers in all lines are not discouraged, even if business is weak in some quarters. They feel it will be only a short time before things brighten up, and from present outlook there is no reason to think otherwise.

WELDING LOCOMOTIVE BOILER

(Continued from page 24)

sheet and tapered to a point. Weld the old rivet hole solid as shown in the illustration.

In case mud rings become broken it is advisable to remove a portion of the firebox sheet. Bevel the mud ring from the top, giving at least ¼ inch opening at the bottom of the "V," and reinforce it at the bottom of the mud ring after the weld has been completed on the top portion, afterward applying a patch on the portion of the firebox which was removed. The welding current values for welding mud rings are from 125 to 150 amperes, using an electrode 5/32 inch in diameter. Should the door collar become defective, the defective portion can be removed and a patch applied as in Fig. 17, following the instructions as described for Fig. 8.

Under no circumstances should welding be allowed directly in the knuckles of firebox sheets as shown on Fig. 18. This ruling should be enforced vigorously. It is very important when applying copper flue ferrules to the flue sheet, that, when set and rolled, they do not project out on the fire side of the sheet, so that when the flue is applied the copper will not project under the flue beads. After the flues have been set in the regular manner very good results may be obtained by welding them after having received the second working. That is, if the locomotive is allowed to work its regular turn until the flues are to be reworked the second time, this allows the flues and flue sheets to get a good setting. By so doing it also allows the grease to be burned off the sheet. After the flues are worked the second time, the sheets should be thoroughly sand blasted.

When welding, the top row of flues should be welded first; the second row next and so on until the entire flue sheet has all flues welded to it. It is very essential that the welding be started at the bottom of the flue and worked upward, the weld being finished at the top to secure satisfactory results. It is in this operation that the flowing quality of the electrode is most important and should be given a great deal of consideration. The heat values on this operation vary widely and the operators should use their best judgment according to conditions.

Care should also be exercised on the part of the operator not to apply an excessive amount of metal. If he should do so, the metal will overheat and crack and cause a great deal of trouble. If it should become necessary to reweld a leaky flue which has been welded previously, all the old metal or weld should be removed and the flue worked tight into the sheet, after which it should be sand blasted and welded as formerly described.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago.	30 00
Standard low phos., Philadelphia.	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 25
Toronto price:—	
Silicon, 2.25% to 2.75%	27 15

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 2 90
Steel bars, base, Toronto	2 90
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 75
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	78
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Gross. Montreal	Toronto
Lake copper	$17 50	$17 50
Electric copper	17 25	17 25
Castings, copper	17 00	17 00
Tin	35 50	34 50
Spelter	7 10	7 50
Lead	6 50	6 75
Antimony	6 50	8 00
Aluminum	24 50	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT
Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.08	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C
Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.59	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$12 00
Heavy melting steel	9 00	14 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	7 00
Malleable scrap	12 00	14 00
No. 1 machine cast iron	22 00	21 00
Pipe, wrought	8 50	8 00
Car wheel	22 00	25 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	20 00
Cast boring	3 00	7 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and less	55
Coch and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, fl. and rd. hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	$1.25
Nuts, hex., tapped off net list	75c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾" and larger	$8 50
Structural rivets, as above	8 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 40%
Square and hexagon head cap screws	Less 30%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 20%
Semi-finished nuts up to and including 1-in.	Less 35%
Semi-finished nuts 1⅛ to 1½"	Less 30%
Semi-finished nuts 1⅝ to 2 in.	Net list
Coupling bolts	Plus 10%
Taper pins	Less 40%
Planer bolts without fillet	Plus 40%
Planer bolts with fillet	Pus 50%
Patch bolts	Plus 80%
Hollow set screws	Plus 20%
Thumb screws	Less 35%
Thumb nuts	Less 65%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 90
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 10¼
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 26
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Linseed oil, boiled, single bbls.	9 92
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters, plus	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
Pure turp., single bbls., gal.	1 20
Linseed oil, raw, single bbls.	1 00
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Gasoline, per gal., bulk	
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to plus	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	57
Class B	22	32
Class C	14	22

Cast iron fittings, 5%; malleable bushings, 22½%; cast bushings, 22½%; unions, 37½%; plugs, 20% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 50
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 50	....
Galvanized sheets, No. 28		5 85
Queen's Head, 28 B.W.G.	7 25	.....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown No. 28.	....	...
Premier, No. 28, U. S.	6 45	6 10
Premier, 10¾ oz	6 50	6 50
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.50; ⅜ in., $13.20; 7-16 in., $11.30; ½ in., $10.20; 9-16 in., $10.70; ⅝ in., $10.30; ¾ in., $9.95; ⅞ in., $9.60; 1 in., $9.25. Extra for B.B.B., $1.20.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13; 5-16 in., $11; ⅜ in., $10; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	58
Black oil, per gal.	24.1
Cylinder oil, Capital	75.6
Petroleum fuel oil. bbls., net	11.2

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Popular	9
Standard	10½	Keen	7½
No. 1	13	Fancy	13½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored. 13
Mixed colored. 14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

INDUSTRIAL NEWS

Mr. T. J. Moore, Wiarton, Ont., is in the market for a double-end matcher for hardwood flooring.

The Industrial Supply and Service Co., Vancouver, B.C., is in the market for a double end punch and shear, also a nut-making machine.

The Dresden Machine Shop and Garage, Dresden, Ont., are in the market for equipment for their machine and auto repair shop.

Fire caused half a million dollars damage to the Brunette Saw Mill, Sapperton, B.C., on January 29. The saw and planing mills are totally destroyed.

The Red Star Oil Refineries, Montreal, Que., which has a capitalization of $3,000,000, is reported to be planning the erection of an oil refinery on an 18-acre site.

The London Concrete Machinery Co., of London, Ont., has been awarded the contract to supply a 12-inch deep well turbine pump, with motor, to Kitchener, Ont.

Loss to the extent of about $65,000 has resulted from two fires at Port Colborne, Ont. The Maple Leaf Milling Co.'s building and machinery were damaged to the extent of $15,000 and in the other fire the Maple Leaf Hotel, auto garage and various shops, suffered to the extent of $50,000.

The Holden Company, 354 St. James street, Montreal, are in the market for a punch and shear which is to be placed in the factory of the Canadian Brake Shoe Company at Sherbrooke, Que. New tools are to be preferred, but if a second-hand or re-manufactured machine in good condition can be offered for prompt delivery, such a machine or machines will have their consideration.

The city of London, Ont., plans to spend about $4,000,000 on schools this year, according to the extensive programme of building outlined by the Board of Education. The addition to the London Technical and Art School is estimated at $1,000,000, while the programme provides for the erection of new buildings to cost $400,000, including a new 14-roomed school in London, East.

An Incorrect Statement. In the Jan. 26th issue, page 41, we made a statement to the effect that the Ford Motor Car Co., of Canada had acquired the plant of the Bain Wagon Works, Woodstock, Ont. We published this story in all good faith, but we find our source of information was not reliable. John A. Bain, the vice-president and manager of the Bain Wagon Co., says there is absolutely no truth in the former statement, so we take this opportunity of correcting the matter.

The Malcolm Furniture Co., Listowel, Ont., are in the market for equipment for machine shop, small metal working tools, drills and lathes.

Plans for the new Jarvis Street Collegiate, Toronto, Ont., of 32 rooms have been adopted by the school property committee. The building will cost approximately $400,000.

The Canadian Tobacco Growers' Co., Kingsville, Ont., are in the market for equipment, tanks, shredders, and special machinery for the manufacture of fertilizers for tobacco growers.

The public school at Copper Cliff, Ont., valued at $100,000 was recently destroyed by fire. The school will be rebuilt at once, according to Mr. Gallagher, the Secretary of the School Board.

Canadian Pulp and Paper Exports in December, 1921, were valued at $10,325,533, as compared with $14,612,083 in December, 1920. News print and all other classes of pulp show heavier increases in volume over last year, despite slight decreases in values.

J. G. Sullivan, for many years well known as chief engineer for the Canadian Pacific Railway, has been elected president of the Engineering Institute of Canada. Mr. Sullivan succeeds the retiring president, J. M. R. Fairbairn, present chief engineer of the C.P.R.

The Trussed Concrete Steel Co., has appointed Mr. A. C. Riley as manager of the Montreal territory with offices at 323 Drummond Building, St. Catherine St. W., Montreal. Mr. Riley, who was formerly general sales manager of the company, succeeds Mr. G. B. Reynolds, who has resigned.

Algeria is thought to be an excellent market for paints and varnishes in proportion to its population of about 6,000,000. Paints and varnishes are imported principally from France, Belgium, England and the United States, in about the order named, says a United States consular report. In 1919 and 1920 these imports were as follows: In 1919, 69 metric tons of varnishes and 782 tons of paints; in 1920, 253 tons of varnishes and 1,860 tons of paint.

The Swedish Ironworks Association's statistics for the first ten months of 1921 show that the total exports of iron and steel of all kinds amounted to 117,200 tons, which was 50 per cent less than during the same period of 1920, and less than one-third of the normal export. As a result only 21 smelting furnaces were working out of 134, and activity at the rolling mills and other plants was reduced correspondingly. The production of pig-iron during the ten months amounted to 274,000 tons, compared with 376,700 tons during the same period of 1920.

The Georgetown Foundry Co. office Georgetown, Ont., were damaged by fir recently to the extent of $10,000.

A Montreal firm of general contract ors have the contract in hand for th erection of additions to the Chatea Frontenac Hotel. The addition consists o a 20-storey tower containing 200 room at a cost of $500,000.

The Canadian Asbestos Co., which ha its head office, and many branches i Eastern Canadian cities, has announce the opening of distribution plants i Winnipeg to take care of the Weste business.

St. Andrew's-by-the-Sea, New Bruns wick, has been selected by the execu tive committee of the Canadian Manu facturers' Association as the meetin place of the Dominion convention for thi year. The convention will be held on Jun 20, 21 and 22, and after the variou meetings the delegates will travel b special trains on a trip of inspection o the industries of the Maritime Provinces

The Silk Voile Co., a new Bridgebur industry, are looking for additional fe male help, as they are planning to im mediately double their capacity. Thi concern manufactures silk waists, etc and has been established in Bridgebur only a short time. The local manage states that he is having difficulty i getting local help, and has been com pelled to send to Buffalo to secure suf ficient girls to increase his staff.

Shipyards throughout the worl launched 4,341,679 gross tons of ship ping in 1921, or more than 1,500,00 tons less than in 1920, according t Lloyd's Register of Shipping, and 2,803, 000 less than 1919, the record year, bu 1,000,000 more than in 1913. Unite States yards showed a decrease of 1,470, 000 tons of launchings; British yards decline of 500,000 tons, and the tota for yards of other countries a gain o 467,000 tons.

Mr. T. Dick, Junior, president of the National Sand and Material Co., Wel land, Ont., has signed a contract with the Collingwood Shipbuilding Co., for the construction of a sand and gravel carrier, that will surpass anything in capacity that has yet been built on the Great Lakes. Its carrying capacity will be 2,200 cubic yards, which is about four and a half times the size of any boat now in their service. Mr. Dick states that he could have let the contract in Glasgow, Scotland, at a saving of $30,000, but owing to the fact that the boat is to be used on Canadian public works, and municipal works, also in view of the unemployment in Ontario, he thought it best to have the shipbuilding done locally. The Collingwood Shipbuilding Co. are said to be putting on a staff of 150 men this week.

Major-General Sir Alexander Bertram as been appointed treasurer of the Engineering Institute of Canada for the enuing year. Mr. Fraser S. Keith has been e-appointed secretary.

The Collector of Customs for Galt, Ont., reports that the collections there or January amounted to $65,669, an ncrease of $26,082, showing that things ndustrially are improving.

Alexander MacKenzie, who has been ssociated with the Prest-O-Lite Co. for he past four years, has been appointed General Sales Manager of the Canadian National Carbon Co., and Prest-O-Lite Co. of Canada.

L. M. Manley, representative of the Wilmarth & Norman Co., Grand Rapids, Mich., visited the A. R. Williams Machinery Co., a few days ago, the latter mentioned company being agents for W. & M. machines.

J. H. Markel, representative of the Landis Tool Co., Waynesboro, Pa., has been in Canadian territory for about he past five weeks, looking around for possible buyers of grinders of the cylindrical or automobile cylinder type. He s making the office of the F. F. Barber Machinery Co., his headquarters, as this firm are agents for the Landis line.

The value of permits for new buildngs issued by the Architects' Department, City of Toronto, during January, 922, aggregated well over $1,100,000, ractically double the value for the coresponding month last year; but that ells only part of the story, as plans ave been filed for examination, for tructures to the value of another milion dollars.

The General Motors of Canada are eported to be doing a good export usiness, an average of 100 cars per lay being shipped from the Oshawa lant. The Gary Motor Truck Corporaion has secured new orders, and it is nticipated that the Toronto plant will e in full operation before the end of ebruary. The Ford Motor Co. of Canda is operating on a five-day-a-week asis, and it is anticipated that business n 1922 will exceed both 1920 and 1921.

A comparative survey of the industrial tatistics of the Province of Ontario for he three years 1917, 1918 and 1919 has een published by the Dominion Bureau f Statistics. The records show a large ncrease in the number of establishnents, the capital invested, employees, alaries, wages, etc., for the year 1919 s compared with earlier years, although here is a slight decline in the cost of naterials, and in the value of the proluct. Establishments in 1919 numbered 6,438 which shows an increase of 2,100 ver 1917. Capital invested shows $1,-83,161,271, as against $1,335,968,699 n 1917. Employees in 1919 numbered 4.545 compared with 37,132, in 1917. Salaries showed a similar increase, being 20,000,000 over 1917. Cost of materials in 1919 totalled $943,622,018, an inrease of $122,000,000 over 1917. Value f product shows an increase of over 305,000,000 over 1917.

The construction of an ice arena in Montreal, Quebec, will commence early in April.

The American Society for Steel Treating have changed their plans for their sectional meeting, and will now meet at the Hotel McAlpin, 34th and Broadway, New York, on March 3rd.

The ratepayers of Silverthorne, Ont., will be asked to ratify a proposition to raise $161,000 for a new school, together with the site. The cost of the school when completed would be $200,000.

Henry Ford has just purchased the Lincoln Automobile Co. for the sum of $8,000,000. Henry M. Leland, president of the old company will be retained to manage the new concern under the Ford ownership. Immediately following the sale, Mr. Leland announced that all models of cars now on hand would be reduced in price, the cuts ranging from $800 to $1,200.

"The improper use of explosives, caused 31 deaths and 73 injuries during 1920," remarked Lieut.-Col. G. Ogilvie, chief inspector of explosives, Ottawa, during an account of the operation of the Explosives Act of Canada, at a joint meeting of the Montreal Branch of the Engineering Institute of Canada, the Montreal section of the Society of Chemical Industry and the Canadian Institute of Mining and Metallurgy. Sheer negligence, he said, was the cause of many accidents and recklessness contributed its share. "It is very fortunate for us," continued Col. Ogilvie, "that the supply of explosives, other than fireworks, is practically all from Canadian factories. Not only does this facilitate the authorization of the explosives put on the market, but, enjoying as we do the co-operation of manufacturers, we have benefited by their influence over their customers in matters relating to the keeping of explosives."

Tractor exhibitions recently held at Le Bourget, produced rather negative results, writes Assistant F. G. Singer, Paris, in the United States commerce reports. The tests were not held under favorable conditions, as the fields given to the various tractor companies for demonstrations were several kilometres apart, and the companies were not authorized to plough deeper than 10 or 15 centimetres in rather dry, sandy ground, in which potatoes have since been planted. The demonstrations held under such conditions do not seem to have had any practical value. Few tractors are being sold at present, as the French farmer is manifesting considerable conservatism in his purchases. The high cost of fuel is a deterrent to the purchase of tractors, and in fact a number of tractors are now lying idle on the farms, as they cannot be operated profitably. The American tractors have a strong hold on the French market, being superior in quality to French machines, and can easily compete with them as regards prices A 9 to 20 horsepower tractor with a 2-bottom, 14-inch plough, apears to be the most suitable.

A one story addition is to be erected in the rear of the main factory of the Wettlaufer Foundry at Mitchell, Ont.

Exports of Paper from Canada during the first eleven months of 1921 and valued at $69,394,795 compared with $52,-315,475 during the corresponding period of 1920.

While the customs receipts for Oshawa, Ont., for the month of January show a slight decrease compared with those of the previous month, customs officials state that business in Oshawa has been considerably heavier.

The Holden Co. of Montreal, announce that they have assumed control of the Canadian Brake Shoe Co., of Sherbrooke, Quebec, manufacturers of electric steel castings. Mr. N. J. Holden, president of the Holden Co., has been elected president of the reorganized Canadian Brake Shoe Co. The Board of directors of the Holden Co., compose largely the directors of the Canadian Brake Shoe Co. and as the Holden Co. have interests in other plants, machinery is being moved from some of these factories to the plant of the Canadian Brake Shoe Co., in an endeavor to consolidate all the Holden manufacturing activities in one plant. It is claimed that the new, improved, and enlarged facilities of the Canadian Brake Shoe plant for manufacturing, together with the adequate systematic inspection, will enable the Holden Co. to guarantee the quality of their product and also assure prompt delivery. The home office of the Canadian Brake Shoe Company will be that of the Holden Co., in Montreal.

NEW TYPE CONCRETE MIXER

A new type concrete mixer, made in Britain, embodies an interesting departure from the older method of design. In this machine the sand and stone are mixed in the correct proportions, and after being sprayed with water are passed into a cylindrical screen fixed inside the mixing drum and revolving on the same axis. The wet sand and stone fall through the holes in the screen in separate particles and meet a cloud of cement which is blown in from the end of the mixing drum. Every particle thus receives its coating of cement. The mixture is then tossed up several times, and at each revolution of the drum meets the cloud of cement, so that finally the machine delivers a uniform concrete in which the cement is thoroughly transfused through the sand and stone. The flow of cement can be regulated to any desired amount, so that any mixture may be accurately determined. Two sizes of machines are made, the larger being capable of mixing from four to five cubic yards per hour, the energy required being only one horse power.

The manufacture of wood pulp within the Dominion is increasing. The amount exported in the year ending 1913 was 5,862,176 tons. This was increased to 15,389,582 tons in 1920.

Marketing Canadian Goods in the Argentine

By H. POLLARD

HOW can Canadian goods be marketed in the Argentine? Being on the ground floor, so to speak, I think it wise to divide the subject into two sections, and the first viewpoint I will take up is the prospects of business, as I have found them, while acting as a representative for Canadian firms.

I spent some eighteen months down here previously as an employee of an English firm engaged in demonstrating and selling aeroplanes. This is, or was, I had better say, a comparatively new line of goods so far as the Argentine is concerned. Now, as one knows, aeroplanes are not an everyday necessity, and they cannot be sold to anyone, nor with the ease with which one can dispose of hundreds of other things in normal times. The field is limited, but the experience I gained while engaged on this work led me to find out many things regarding the native and the country that one does not discover in a general manner. There is today in the Argentine a field for anyone who has the initiative and energy to go and get business. I saw that it was necessary to know the native, and my journeys into the country gave me many valuable pieces of knowledge.

Being employed with an English company, and having Englishmen around me, I did not at first take any great pains to pick up the language, but used an interpreter whenever required. I very quickly found that this was a nuisance, expensive, and altogether to my disadvantage. After a period I decided to start and look around to see if it would not be possible to act as representative for someone and accordingly took stock of the market, to see where to turn my steps. My decision was that I would go to Canada and look around there first. Now I have been asked why did I choose Canada when I am an Englishman and know so very few people in Canada. The reason is that I think Canada can, if she so desires, market a reasonable share of her goods in this market. Canada has, comparatively speaking, few representatives here, her exchange is better than America, and there is today a decided feeling amongst people here to know more of Canada, and her products. As England and America are already well represented, England having been so for a great number of years in a thorough manner, combined with the decided leaning away from American products, then I chose Canada.

If one studies export figures, they will see that the exports of America to Argentina have gone down tremendously this last year. One of the chief reasons why the Americans gained their increase of exports to this country in the last few years, is because they were the only country able to ship to foreign countries, everyone else being busy fighting in Europe. Deliveries and bad packing have been largely responsible for the falling off in their export trade. The sending of goods that have not been up to specification and just as they were ordered, have also helped tremendously.

Points to be Watched

Now, having opened with these general remarks, I will endeavor to give, in as short a manner as possible, the necessary points to be studied by Canadian manufacturers who wish to enter this market.

To enter into any foreign market without some inside knowledge of that market is folly. The best, and only proper way, is to get this from someone who has had action in the particular country concerned. Paper knowledge is all right as far as it goes, but I myself have got particulars of various things from trade statistics that one can get by the mile, but in actual practice it is much different. Take first of all the article you wish to sell. If it is an article that is already in the country you wish to enter, then you must be prepared to advertise well, sell at a close figure to your competitors, less if possible for the time being and demonstrate it thoroughly. If it is an article with a big demand or one that is a necessity, then for the best results you must be prepared to place stocks in the country.

People in the Argentine will not wait eight to ten weeks for an article that is new, and then go to the trouble of pushing it, unless it is a novelty. Having found if the article is saleable or not, then you must proceed to make the selling of it secure. For instance, if it has a registered trade mark, then you must register that mark first before putting it on the market. Take, for an example, an article called "Canada." This name must be registered, and one registration is good for ten years. Now the object of this is, if you do not register the name then, anyone who cares can do so and he has the power to stop you from selling that article for ten years, unless of course, you care to pay him whatever he likes to ask you for allowing you to sell in the Argentine.

Many cases are on record where huge sums of money have been demanded by men who have taken out a registration for an article in their name, then when the article has been put on the market have asked for payment or closed up the sales. I know of more than one instance where this has been done, and the amount paid for the "patente," as is is called, has in some cases been enormous.

Question of Distribution

Next to be arranged is the order in which you are going to distribute your goods and who shall do it. Some articles can only be sold by demonstration. For instance, you could not expect people to buy an everyday article from a catalogue without a sample being shown to them. You do not expect to have samples, nor are you expected to send samples of large pieces of machinery which may be for special purposes. A good technical man and illustrations are quite sufficient. The question of what you should send, and how much, must be determined after carefully weighing the following points. What is likely to be the demand, amount of money invested, necessity of sample for clarity of explanation, competition in the Argentine, that is, the stocks existing in the Argentine.

Then comes the all-important question of how to pack and ship. Good packing is the essence of success to a successful export trade. The obtaining of an order is in many cases dependent on the firm's previous packing. Many buyers today will not change firms because they get their goods packed so well, and they arrive here in good order. I know of firms who would not change, no matter what inducements you offered to them, because all their goods arrive in first class order. Others have had to spend considerably more money than they had allowed for, in fixing the goods up so as to be able to sell them. You cannot pay too much attention to this question. It will in many cases bring repeat orders and always creates for you a friend. In preparing shipping documents it would appear from my experience that there is not much known regarding this point in Canada. In the first place you need the following documents.

(1) Ocean bill of lading giving marks on case, weights net and gross, volume of case, and the name of person it is destined for. Two of these are needed, but one must be stamped and signed by the Argentine consul.

(2) Insurance certificate. While this is not necessary for clearing the goods at this end, it is useless to expect to get a claim settled if you have not got one. It is also necessary to clearly have stated on this what you have insured the goods against.

(3) Certified invoice. This must show the price and weight of each individual item, but does not require to be stamped by the consul. As I have had considerable difficulty myself in this direction I am going to, in a later article, show a specimen set of documents to the Canadian Machinery for publication.

Another Important Detail

Another important detail is to study the man you are going to sell to. The personal point is a very great one in the Argentine, and there are any amount of splendid salesmen at home in Canada that would never get on at all in the

(Continued on Page 43)



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MARKETING CANADIAN GOODS

(Continued from Page 42)

Argentine. There are today any amount of people who have the impression that the South American is more or less the kind of man you can push anything on to at any price. Let me dispel any such notion at the outset. The Argentinian today is a very well educated man, (speaking of the business classes) who is as keen and alive to the other parts of the world as you are. His geography may not be as extensive, but he is far from being the fool that so many people have tried to make him out to be. Just because a man has different habits and customs to you does not make him one bit different when it comes to business. The business man of the Argentine today is a gentleman to his finger tips, and expects to be treated as such, because he treats you always as one.

You must keep your word to him at any cost and by so doing you have fought your biggest fight in the battle for his confidence and his business. Make a friend of a real Argentinian and you have made one who will stand by you through thick and thin. In expressing himself he does not employ the same direct language that you are accustomed to using, but has a way of his own, and he does not like to be disturbed from it. It is very annoying and trying at times, but you must accustom yourself to it if you wish to keep in business down here. You have your little peculiarities, and so has he. You are right in your way, and so is he, although each may think differently.

If that is the case, then it is better to think alone and not give public voice to your opinion. To do business in this country one must adapt himself to the country, study their laws, ways, etc., and do business as far as possible as the Argentine wants to do it, and not always as you think it should be done.

The Argentinian, when asking for an article, wants that article, and not one just as good or better. He has learned by experience what the value of an article is from a selling point of view, and to take him an article and say that it is just as good or even better, though the price may be much cheaper, you will have a poor opportunity of selling. In fixing your selling price do not try and get as high a price as you think you might be able to get. Remember, you are not the only firm in the world, so be satisfied with a reasonable profit.

In closing I would say, in short, that for success here you must look after price, shipping and packing. If you can arrange all these satisfactorily then you are well in the Argentine market if you are manufacturing an article that is worth buying.

Over 500 engineers from all sections of Canada will assemble in Montreal from Jan. 24-25 at the annual general meeting of the Engineering Institute of Canada.

Scotland's Industry and Trade During 1921

By G. B. JOHNSON
Trade Commissioner at Glasgow

SPEAKING of Scotland's industry and trade in 1921, Trade Commissioner G. B. Johnson says that last year was a disastrous one for the steel trade in Scotland as it was in America. "It is perhaps not generally realized," he continues, "that Scotland is the largest producer of steel of any district in the British Isles. The ingot output of Scotland last year was 2,077,000 long tons. The next in order was the North-East coast of England with 1,958,000 tons, with South Wales and Sheffield following. Scotland has, however, specially cultivated the trade for high-class Siemens steel such as is required for boiler-making, shipbuilding, bridge-building, and general engineering purposes. The Continent, on the other hand, has continued to produce Bessemer quality of steel.

"The steel industry is of such national importance as was perhaps only fully realized during the war when no industry played a more important part. The great demand for war material and the necessity for extensions have enabled the industry to greatly increase its power of production. There are many plants in Scotland to-day which embody all the latest developments, and can compare favorably with any steel plants in the world, although they are not on the gigantic scale of some to be found in the United States and the Continent. The prosperity of the country largely depends upon the steel trade being maintained at the highest standard in all respects, for upon this industry in Scotland and England rests the country's position as the greatest ship owning and shipbuilding nation, as engineers in the building of railways and bridges in this and many other countries, and in the production of machinery.

Foreign Competition

"The year commenced with falling prices and increased foreign competition through falling exchanges. In March the coal strike upset all the calculations of the makers, and plant after plant was closed down as stocks of coal became exhausted, and orders which might have been secured for the West of Scotland were picked up by Continental makers. In August when the strike was well over and coal supplies again available, prices were reduced, boiler plates to £19, ship plates to £14, and sections to £13 10s. per long ton. This action so reduced the difference between Continental and British prices, and Continental makers were so booked up with orders, that a more hopeful feeling prevailed until at a meeting of the Scottish and English Steel Association, it was found impossible to agree to a uniform basis of prices for the two districts. Since that time Scottish producers have been competing with English in the other's territories, and with each other, and some very low quotations have been made. In the export trade, competition from the Continent has been much less severe during the last three months.

Machinery and Engineering

In this branch of industry the past year has followed the course of trade in general. The marine engine section, the most important and in regard to which the Clyde is so pre-emient, is so closely allied with Clyde shipbuilding, that the fortunes of one tell the tale of the other. There are many other important sections such as the building of locomotives, mining machinery, and machinery for the manufacture of rubber goods, sugar and paper. An important firm who specializes in making rubber and paper machinery recently informed the writer that the year just past was the worst in their long history.

'As far as the shipbuilding industry on the Clyde is concerned, it has suffered a period of stagnation during 1921 from which there seems to be no immediate escape. As one expert says, it has been a year of cleaning off old contracts, and new work has been very slow in coming forward. The general depression has of course, been mainly responsible, with the result that ships have been laid up by the hundred in all parts of the world through lack of demand for cargo space and new ships have not been wanted. Continental competition has also been severely felt, mainly in the departments of repair and overhaul, as their quotations were usually lower.

"It was realized early in the year," continues Mr. Johnson, "that the demand for new ships apart from other reasons, would not revive until costs of production more nearly approached the market value of ships. Then the attempt to reduce costs, including wages, resulted in numerous strikes, one of which, that of the shipyard joiners, lasted nine months. Whether these strikes opened the eyes of both sides in the dispute to the urgent necessity of introducing good will instead of strife into their mutual relations in order to save their industry, or whether the loss of contracts to the continent and great unemployment demonstrated the necessity of lower costs, it is a fact that there is a new spirit of give-and-take in this industry as well as in others. Wages have been substantially reduced, profits have vanished, the cost of steel is lower, but it is said there is even yet too wide a margin between quotations and the prices which shipping companies can pay and earn dividends.

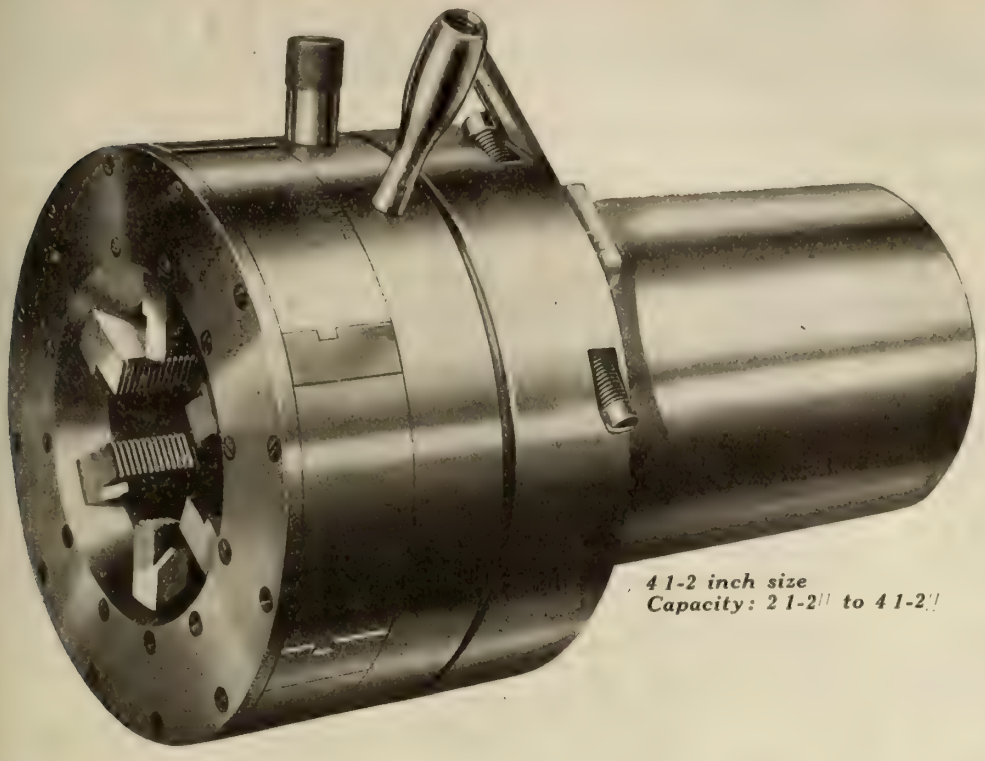
"The awarding of three of the four super-Hood battle-cruisers to Clyde firms, together with most of the machinery, was a bright spot in the year's gloom; but the position of affairs brought about at the Washington Conference quickly put an end to hopes in that respect. It is perhaps not remarkable especially, but at any rate is worthy of note, that the cancelling of these contracts by the Admiralty was received in such good spirit as was the case. The general relief at the savings to the tapayers of such large sums as these ships involved easily outweighed any disappointment at the cutting sho. of local benefits.

"The complete absence of anything in the nature of parochial spirit in the newspapers in this regard was conspicuous. The circulation locally of £30,000,000 of money, which these ships were expected to cost, would have relieved unemployment to a useful extent. But as a gentleman closely concerned with this industry remarked to the writer, the building of the warships was, after all, only an item, although an important item, in Clyde shipbuilding.

Motor Ships

"An interesting feature of the year was launching of nine motor ships. The internal combustion engine has made great headway at sea, as is indicated by the fact that at present there are several hundred ships so equipped. Hitherto this type of engine has not been applied to passenger-carrying ships, but one of the nine above mentioned, and the first of its kind, is the motor passenger liner, the Domala, built for the British India Steam Navigation Company for trade between London and India. This liner can accommodate 140 passengers in addition to 11,000 tons of freight. Her two oil engines develop 4,660 h.p., and her fuel consumption at 13½ knots is estimated to be 20 tons of oil daily. This ship sailed in December from London on her maiden voyage. She is equipped to carry enough oil for the round trip—a decided advantage compared with a coal-burning ship whose bunkers have to be replenished several times on the same journey.

"No immediate improvement in shipbuilding can be discerned, but it should be remembered that building ships is not a basic industry, and any improvement must follow a demand for cargo space, which will come from a trade revival requiring the movement of commodities. The launches on the Clyde in 1921 numbered 408, comprising a tonnage of 512,137 with an indicated horsepower of 493,530."



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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

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Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

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1 glue stand,
1 electric glue pot,
1 pony planer,
3 wood turning lathes of different sizes, all machines to be motor driven,
1 blue print machine.

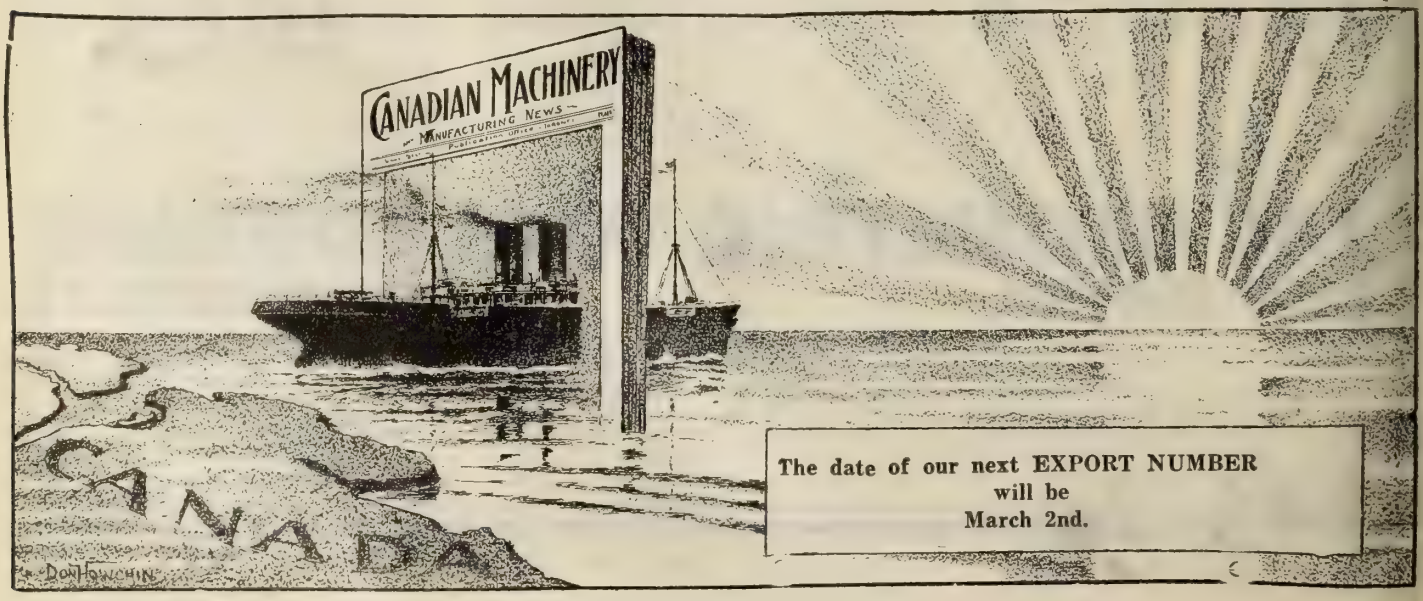
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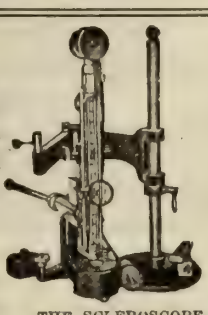


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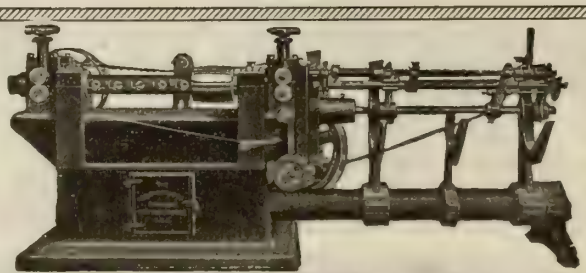
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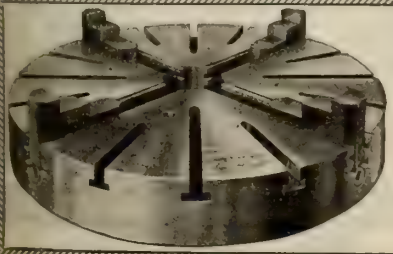
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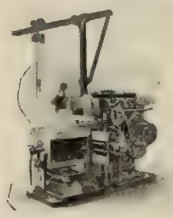
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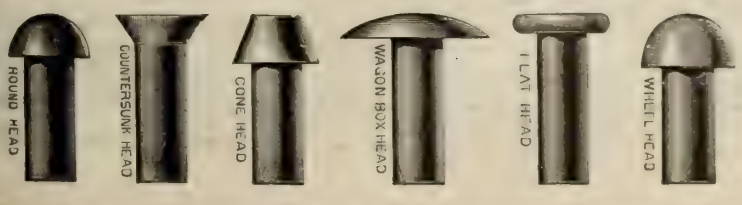
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Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Attachments, Tapping
William I. Procunier, Chicago, Ill.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.

Babbitt Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Canada Metal Co., Ltd., Toronto, Ont.
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Brantford Oven & Rack Co. Brantford, Ont.

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Canada Foundries & Forgings Co., Welland, Ont.
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Pilot Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Fittings, Ltd., Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd, Montreal, Que.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Ltd., Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, On

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto
Fisher Motor Co., Ltd., Orillia, Ont.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Grey Iron
Fittings Ltd., Oshawa, Ont.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton,
Hanna & Co., M. A., Cleveland,
Hepburn Ltd., John T., Toronto,
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound,
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa,
Dominion Engineering Works, Limi Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.
International Malleable Iron Guelph, Ont.
Kennedy & Sons, Ltd., Wm., O Sound, Ont.
Fittings Ltd., Oshawa, Ont.

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Belting, Fabric
Atkins & Co., Inc. E. C., Indianapolis, I.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

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Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Can. Mathews Gravity Carrier Co., Port Hope, Ont.
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
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Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drill Press Sleeves.
Preston & Schwartz, Galt, Ont.

BUYERS' DIRECTORY

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont. Montreal, Canada.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Atkins & Co., Inc., E. C., Indianapolis
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John. Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiten Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited. Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Gardine & Co., A. R., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal, Q

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)

Bandfield & Sons, Ltd. W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Co'y'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Co'y'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelofson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Terrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q.
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W.H., Toronto

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.

BUYERS' DIRECTORY

Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Teol Co., Toronto, Ont.

Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atha Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited. Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Robuster Co., F. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal. Q.

Screens
Can. Wire & Iron Goods Co., Hamilton.
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto.
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd, Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Wheel Truing Tool Co., Windsor, Ont.
Williams Machinery Co., A. B., Toronto, Ont.
Williams Machinery & Supply Co., A. B., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Tracks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Mon

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Supplies
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wiping Cloths
The Levi's, Toronto, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. B., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

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Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeats Machinery Co., London, Ont.

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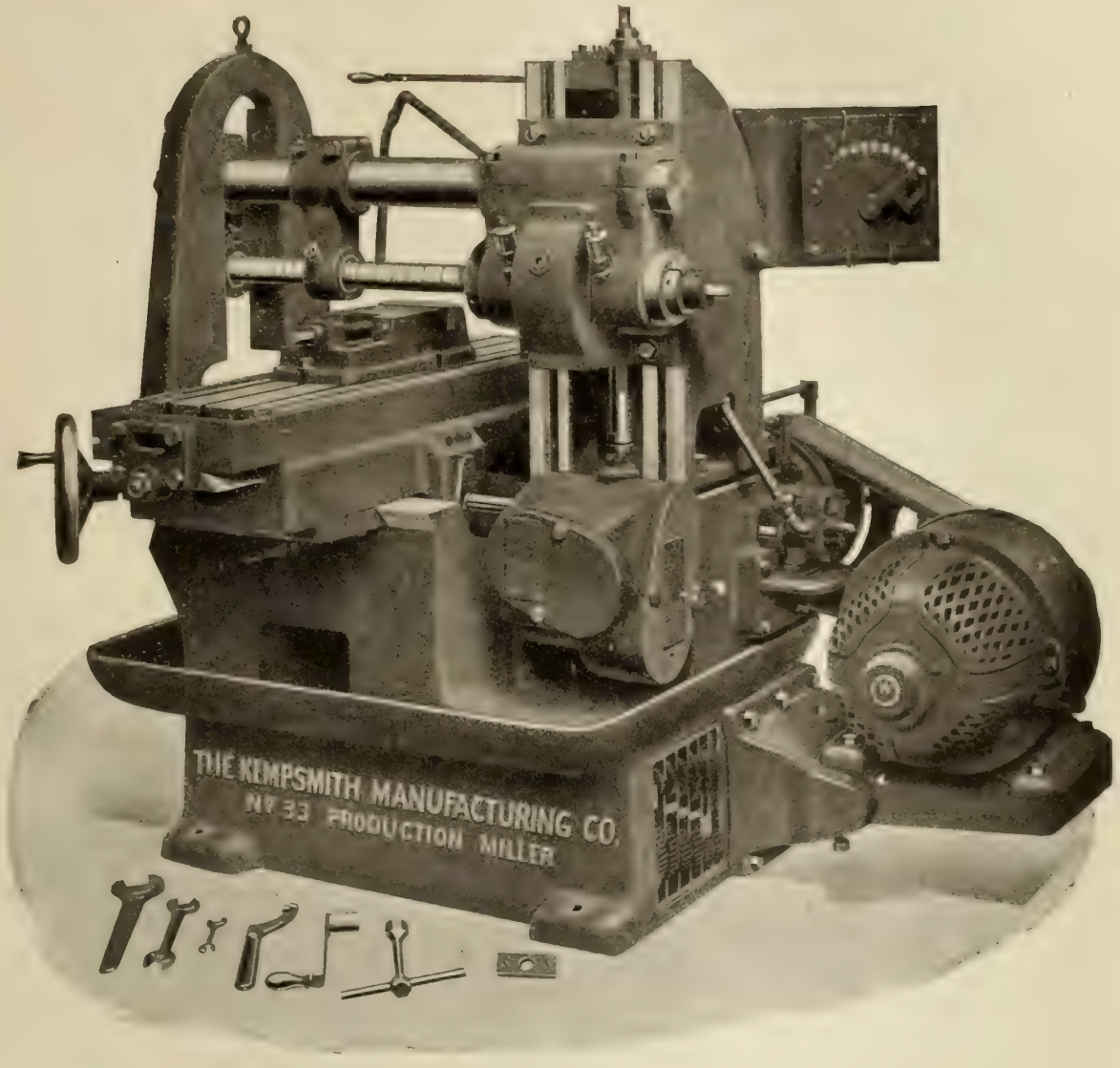
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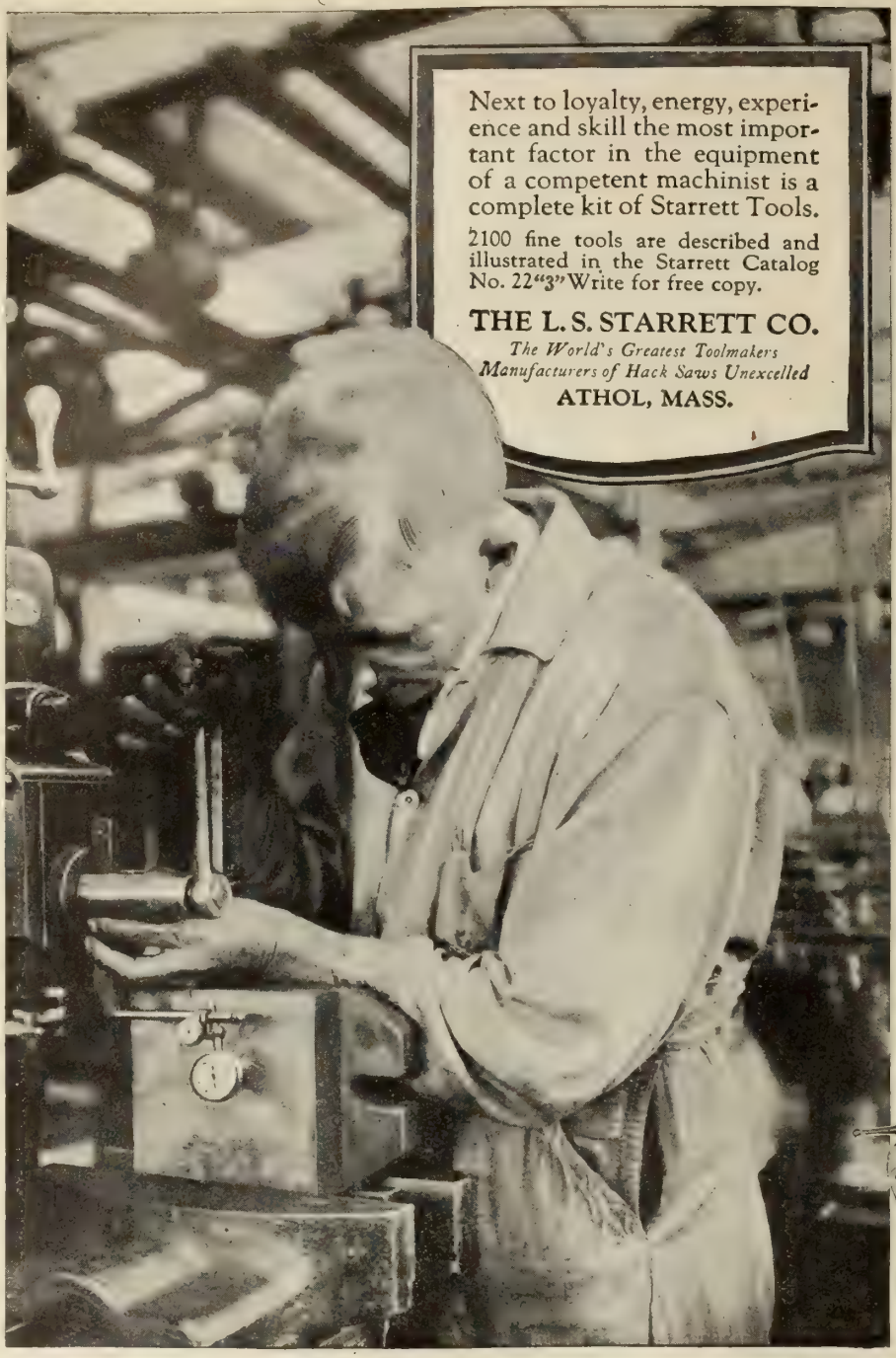
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CANADIAN DEALERS:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St .James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.



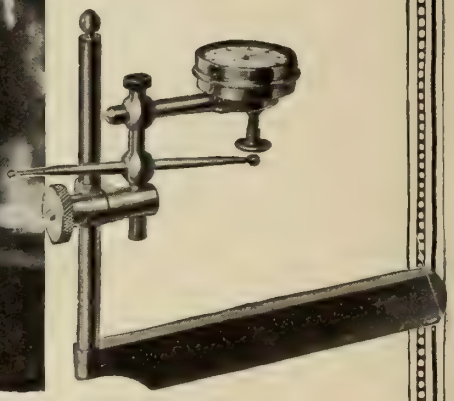
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Starrett Tools

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVII. No. 7 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Feb. 16, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

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AND

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For Information of Unusual Importance

(Advertisement)

You can't help noticing the good qualities of

Pratt & Whitney Taps

Their free cutting qualities, their extreme accuracy and their extraordinary ability to outlive others distinguish them.
The con-eccentric relief—a distinctive P & W feature—is the secret of their goodness. One-third of the cutting edge is concentric. The remaining two-thirds has eccentric relief. Taps can be sharpened at the only correct point—on the face of the cutting edge. Sharpening in no way affects their size.

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The BERTRAM Page

MACHINE TOOLS

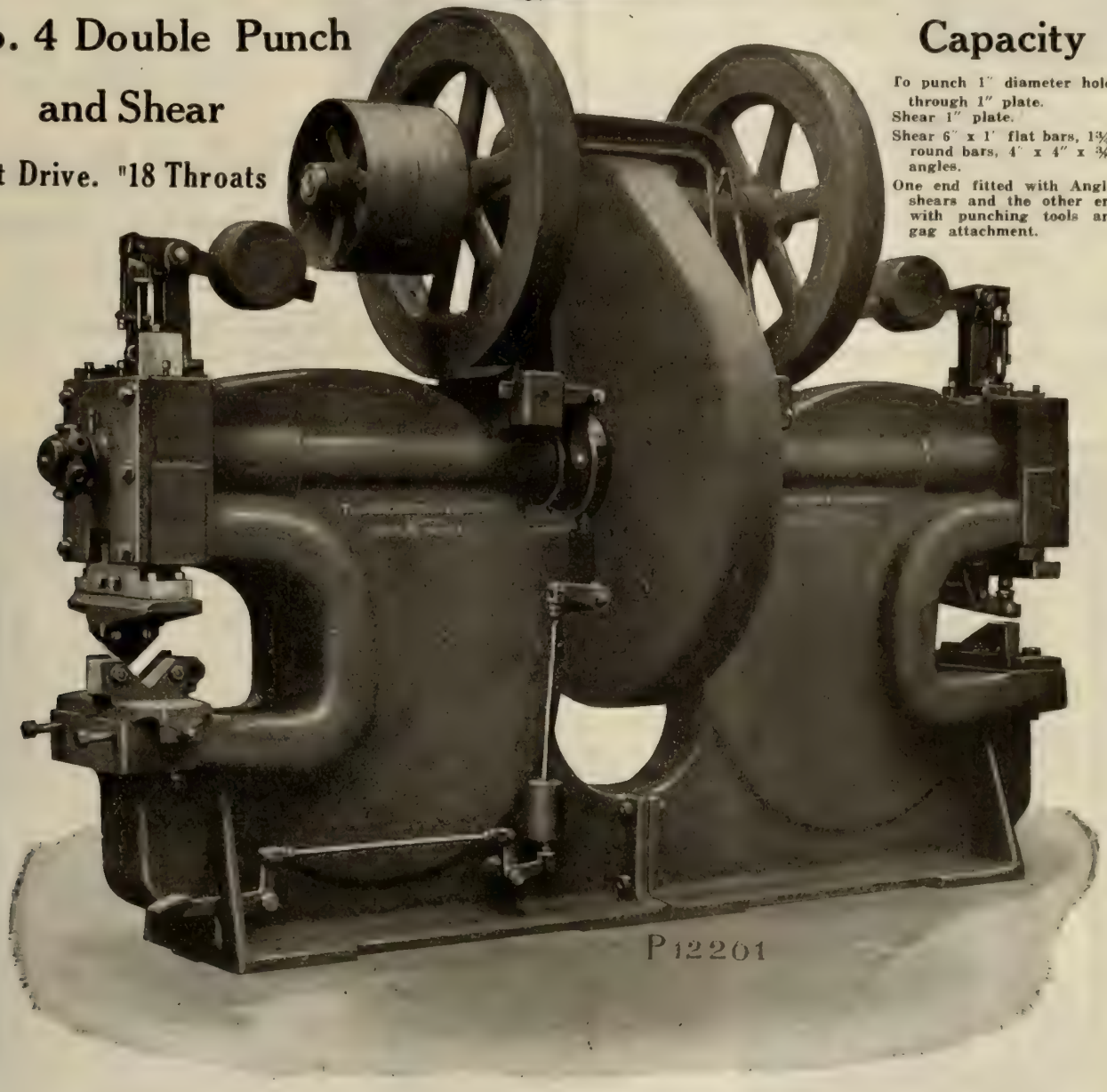
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Capacity

To punch 1" diameter holes through 1" plate.
Shear 1" plate.
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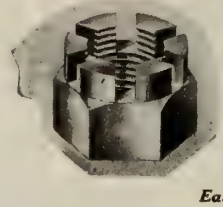
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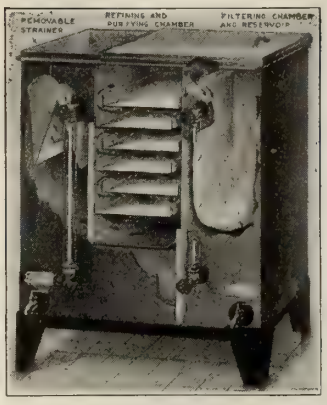


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The Bowser Systems save the cost of fuel consumed in generating that wasted power, lessen machinery depreciation by reducing friction and cut your oil bill in half.

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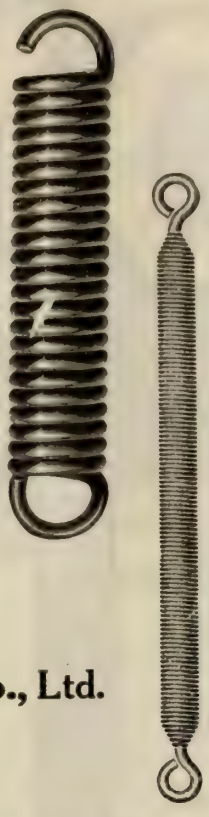
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HEALD

Are You Getting All the Possible Work in Your Vicinity?

Machine and auto repair shops can no longer rely on a miscellaneous set of small tools to maintain a successful business. To-day their equipment must be such that no matter what the job is, it can be handled properly and at the least expense if they are to get all the potential work in that locality.

This is clearly demonstrated by an article in "Motor Age" the issue of October 27, 1921, which says:

"In a small town of Nebraska of less than 2,000 people, there is a dealer who has one of the most completely equipped shops ever noted in automotive repair work. This shop is prepared to do anything except cutting gears.

"There are two lathes in it, several drill presses, a CYLINDER REGRINDING MACHINE, welding outfits, forge arbor presses and other equipment too numerous to mention.

"Naturally the question comes up, 'Why all this equipment in so small a community?' It is for this reason: In this part of Nebraska there are many tractors. The county is supposed to have a car for every four persons. There are farm trucks, too. This dealer knew that all this equipment must be maintained properly. He knew that there were HUNDREDS OF CYLINDERS THAT WOULD NEED REGRINDING EVENTUALLY, so he installed the grinder.

"Work is sent to him from a radius of hundreds of miles. The shop does a lot of miscellaneous work for farmers such as pointing and sharpening plough shares, making brackets for wagons, welding broken parts, etc., with the result that the farmers are sold on the place and naturally bring their cars and trucks there for repairs. THE SHOP IS BUSY SUMMER AND WINTER. It is true that new car sales in this territory are not what they might be, but the shop is making money. The dealer knew the potential service work of the community and then tooled up for it. He got it."

Needless to say, a concern with such foresight and business management would use equally as good judgment in the choice of its machines and therefore they selected a HEALD.

There are many repair shops all over the country that are not getting the potential business in their vicinity because they are not equipped for it. Especially is this true in regard to cylinder regrinding which is fast becoming recognized as a necessity if the motor is to give maximum results. The shops that pride themselves on being able to turn out a complete perfect job must equip with a HEALD unless they can secure HEALD finish from some nearby grinding shop.

Why This Shop Installed a Cylinder Grinder

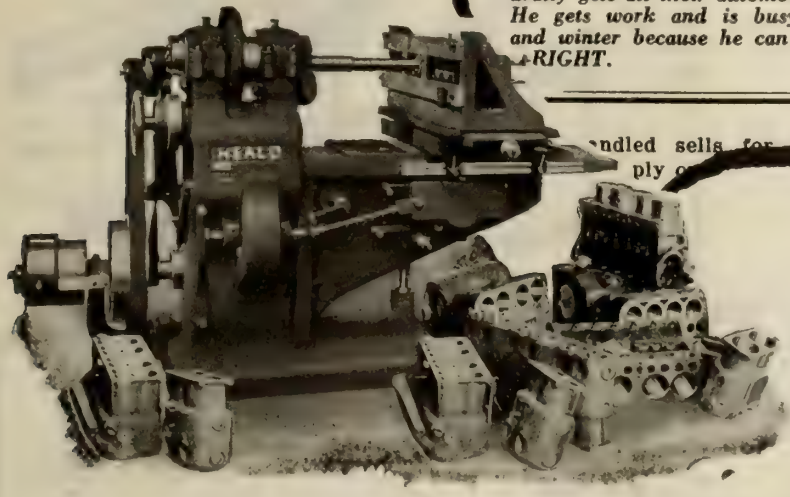
WHEN one thinks of a cylinder regrinding machine he hardly can imagine one of these expensive machines in any but a large town machine shop or in a good-sized service station.

Yet there is a dealer in a small town—less than 2,000—of Nebraska who, among other machines like engine lathes, drill presses, grinders, etc., has a cylinder regrinder. On this machine he can handle any engine block, from a Ford to the large blocks of the gigantic tractors operating in that territory.

Why a cylinder regrinder in such a small town? Just this:

This dealer knew the potential repair work in that territory. He knew by equipping his shop as completely as the large machine shops of the country he could handle any class of work, except gear cutting. He does work for the farmers on their agricultural implements and as a result naturally gets all their automobile work. He gets work and is busy summer and winter because he can handle it RIGHT.

Motor Age Oct 27



The above facts will be inevitable this spring when cars are overhauled and now is the logical time to write, wire or 'phone.

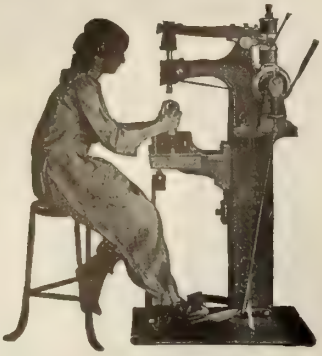
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Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
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Canadian Distributors: The A. R. Williams Machinery Co., St. John, Halifax, Toronto, Winnipeg, Vancouver, Montreal.



For Hard Work

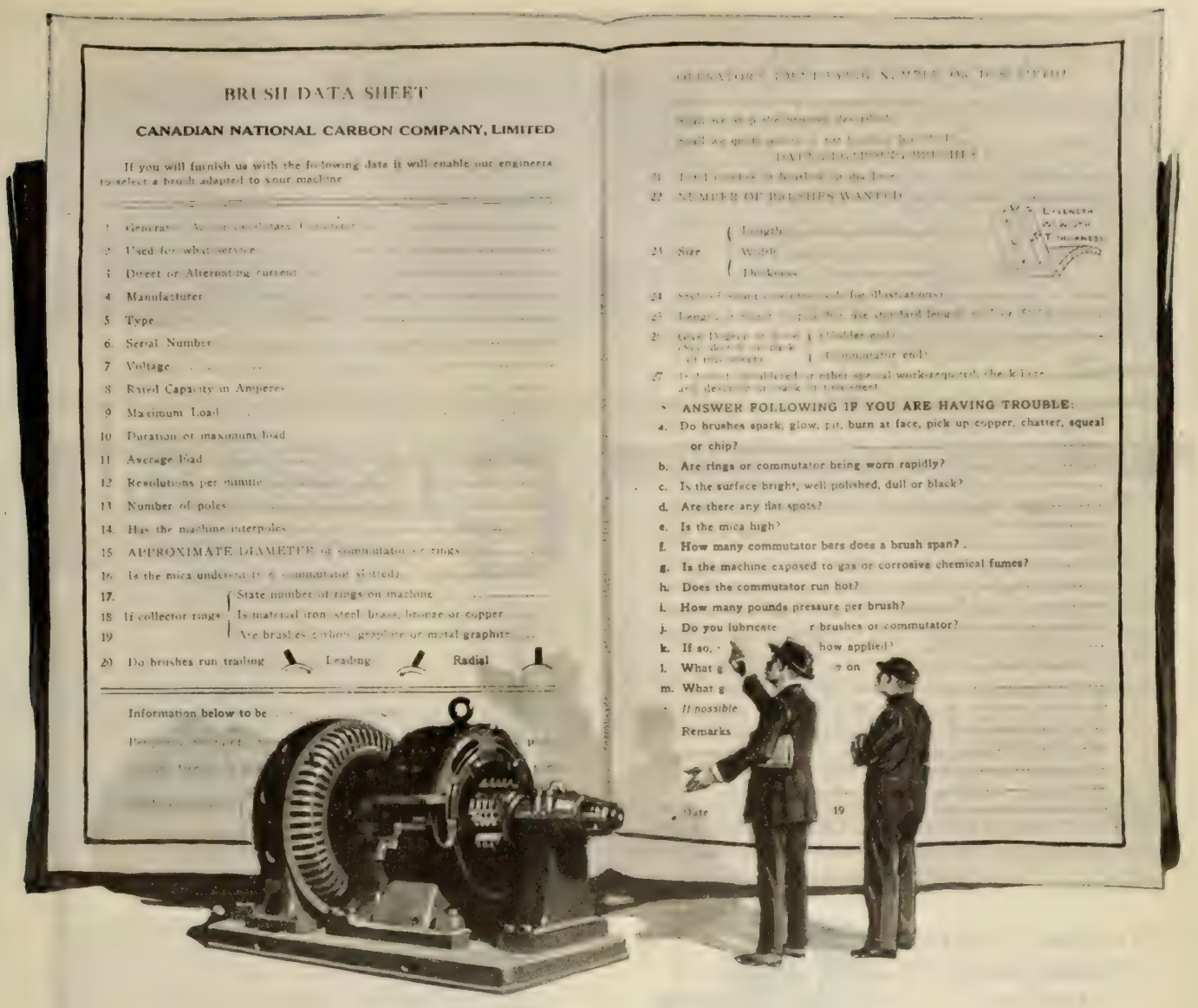
—no tools give longer service than genuine Armstrong Ratchet Drills. Drop forged bodies. Spindle, Nut and Screw of Bar Steel. A type for every job.

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Armstrong Bros. Tool Co.

"The Tool Holder People"

306 N. Francisco Ave., Chicago, U. S. A.



Same Motor: *different work, different brushes*

Columbia Data Sheet Service Solves Your Brush Problems.

Write the address below.

C N C

Brush requirements vary with the application of the motor or generator.

What is correct for a motor or generator in one case may be entirely wrong for the same motor or generator in another.

Only careful analysis of the service conditions will assure the best results from each unit. The investigation and analysis of these conditions is the function of Columbia Data Sheet Service.

At your request Columbia Brush Specialists will examine your machines—each machine individually—and ascertain exact conditions of operating.

They pass these facts to our Board of Engineers, which analyzes the facts and specifies correct brushes for each machine. The Columbia Pyramid Brushes recommended are guaranteed to give satisfaction in service.

You are invited to avail yourself of this service. It is at your command, whether you have one unit or a thousand.

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CANADIAN NATIONAL CARBON COMPANY

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THE MORSE CHAIN CO.

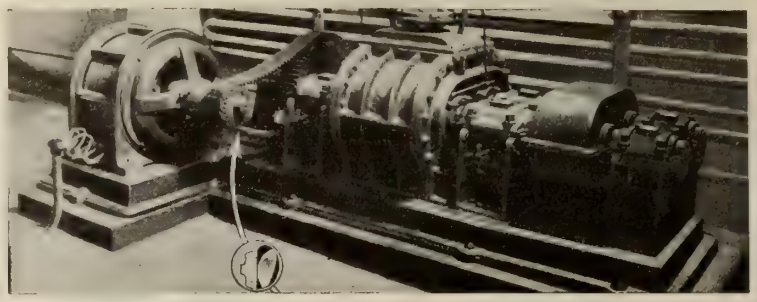
are the
Largest Manufacturers in the world
of
High Speed Silent Chains

The superiority of Morse Rocker Joint Silent Chain has never been seriously questioned.

They speed up production, cut belt expense and overtime wages.

Catalogue Free.

Jones & Glassco (Reg'd)
Canadian Agents
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25 H.P. Morse Silent Chain to Positive Blower.

THE JOHNSON FRICTION CLUTCH

Friction Clutches From Stock

Johnson Clutches, both single and double, can now be obtained from stock in our standard slow speed type to fit all common shaft diameters and all standard pulley bores, within the range of light and medium horse powers that we cover.

State definitely —

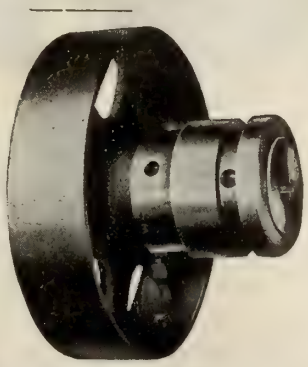
Just what the clutch must drive.
Actual maximum horse power.
Speed of clutch shaft.
Diameter of shaft.
Diameter, width and bore of pulley.

We Will Select the Proper Clutch and Make Immediate Shipment on All Ordinary Requirements.

Friction Control Means Better Machinery

And the Johnson Clutch is supreme among friction clutches. Adopt it as your standard — always dependable and always promptly obtained.

Complete engineering service to consult on your problems and to handle special installations of any kind.



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LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
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VERTICAL BORING and TURNING MILLS
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REAMERS, "SOLID ADJUSTABLE"
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Operators Prefer New Air-Tight Blast Gate

Detroit, Mich.

Air-Tight Blast Gates are giving very good satisfaction, and our operators prefer them to either valves or cocks for the air line.

LINCOLN MOTOR CO.

There are many reasons why—Low first cost and upkeep—Easily and quickly operated—Afford full area of the pipe.

An ideal substitute for heavy, cumbersome, expensive and slow-acting gate valves and stop cocks.

This New Air-Tight Blast Gate is made in sizes from 2 to 16 inches, threaded and flanged. Descriptive circular 210—T gives detail dimensions of all sizes. Write for copy.



NEW AIR-TIGHT BLAST GATE
Light, Strong, Compact, Inexpensive, Quick-Acting

"Air is Free, but not Compressed Air."

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GATE VALVE
Heavy, Cumbersome, Expensive, Slow-Acting



"Hisco" Machine—Molded Gears

The fact that "Hisco" Machine Molded Gears require no pattern is a factor of considerable importance when the price of lumber and labor is so high. "Hisco" quality insures accurate, dependable gears. Remember — **the price of "Hisco" gears does not include the cost of patterns.**

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Let us know your requirements —we do the rest.

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HULL, Quebec



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal

A Wiping Cloth Cut to Useable Sizes

and not a thing on it to scratch—

Button, Button, who's got the Button?

ALL buttons, hooks, seams and other obstructions are carefully removed from all materials used for SUNCLO Wiping Cloths. For the user of SUNCLO there is no fear of having the finest surface scratched or marred.

The SUNCLO TAG assures:

A Wiping Cloth that is cleansed and sterilized by the most efficient and scientific methods.

A Wiping Cloth that is soft and absorbent.

A Wiping Cloth that is standardized as to quality.

A SUNCLO Wiping Cloth is a revelation beside the old unsanitary, filthy rag, that probably came out of some dingy junk shop to you.

All those who boast of a modern plant, should first make inquiries as to the kind of Wiping Cloths used. If it is the kind used by some of the most progressive manufacturing plants in Canada—SUNCLO—it's all right.

SUNCLO WIPING CLOTHS

The LEVI'S

98 John Street

TORONTO

Revised Price Lists of Sunclo Wiping Cloths, giving grades and prices, will be mailed at your request.

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B B

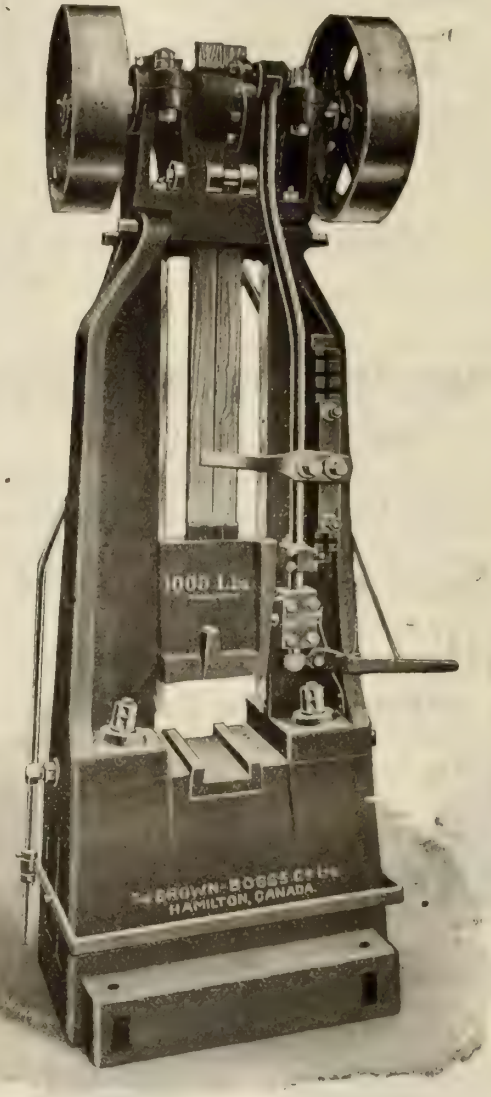
1000 lb. Board Lift
Drop Hammer

It pays to choose machinery which has a reputation for giving long, satisfactory service. The excellence of Brown-Boggs products is shown in the results which every "B-B" tool in use is attaining.

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METAL STAMPINGS

Many manufacturers are showing greater profit at less cost because they came to us.

You may be using expensive cast and machined parts which can be stamped economically.

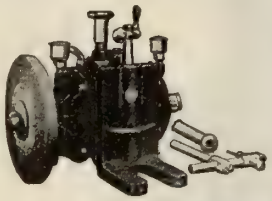
Our very extensive experience may be of immediate benefit to **your** production.

We are glad to be of service, without obligation, to manufacturers in helping them solve the problems that confront them in the use of metal stampings.

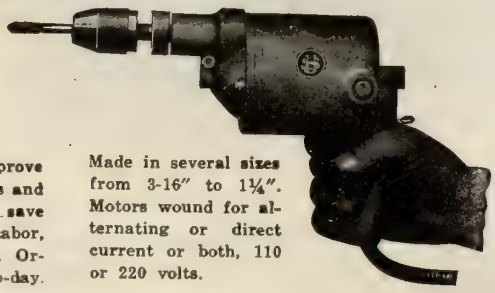
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Drills and Grinders
Can be Attached to any Lamp Socket



For drilling in metal these drills are the superior of every other kind of portable drill. Their operating cost is only half that of air drills. And they can be attached to any lamp socket.



A trial will prove that our drills and grinders will save you time, labor, and expense. Order a few to-day.

Made in several sizes from 3-16" to 1¼". Motors wound for alternating or direct current or both, 110 or 220 volts.

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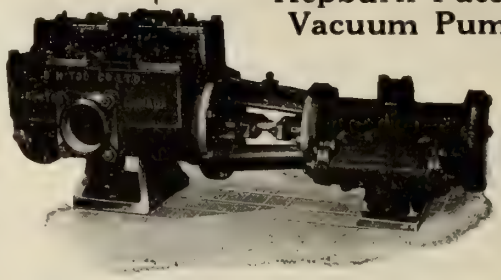
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Hepburn Patent Vacuum Pump



All Parts of This Pump Easy to "Get At"

Easy accessibility to all essential parts is a necessary feature in a modern pump. The design of the water end in this Hepburn Patent Vacuum Pump provides access to each valve without disturbing the pipe connections. As a result any trouble may be quickly remedied with no time lost. It is a self-draining type with long strokes.

Let us quote on Engines, Cranes, Winches, Power Presses, Planers, and Castings.

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Engineers and Iron Founders

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It's Time to Make Plant Repairs

NOW is the ideal time to make plant repairs and alterations. Many men out of work could be given temporary employment repairing roofs, floors, walls, windows, painting, and other work that must be done soon in any case.

Don't put off this important work. Do it now and make work for all. Let us quote on your requirements.



We are prepared to make prompt delivery on construction supplies of all kinds including:—

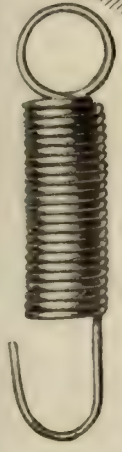
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Bar Iron **Cold Rolled Steel**
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Established 1847 **19 Victoria Street**

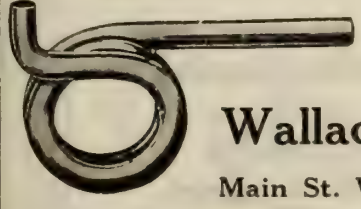
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Look Under the Surface!

Surface indications are not sufficient to tell how all-round dependable a spring is. **Therefore dig underneath!** An investigation of Wallace Barnes Springs discloses high efficiency made possible by over sixty years experience—correct materials—proper methods.

All styles and sizes, including Spiral Springs, Book Springs, Common, Coil Springs, Flat Springs and Special Designs.



Let us figure on your requirements or write us for our advice

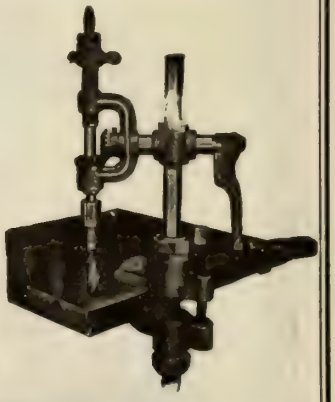
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Wallace Barnes Co.
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FIFTY YEARS OF QUALITY

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.





On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO



Write for the new No. 22"3" Starrett Catalog, free on request.

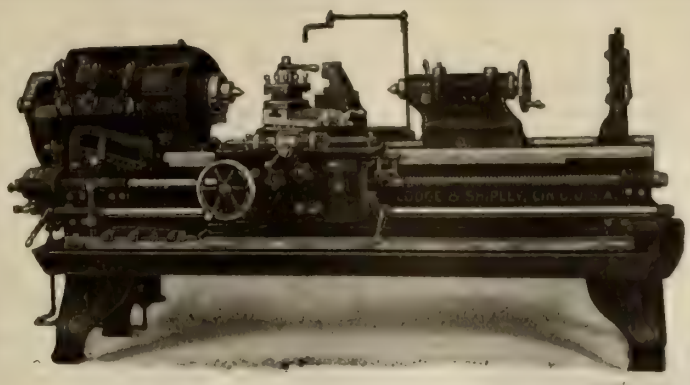


Inside Calipers

Made with spring or solid nut, hardened points, and fulcrum stud and extra strong Bow. Sizes: 2 inches to 12 inches.

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In the Hollow of the Hand

New Equipment—that's the answer. Replacing old time-worn machines with new ones is the sure and effective way of catching up with slipping orders. Simply close your hand on a pen and tell us your problems. We'll find the answer.

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For Service in Machinery



After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

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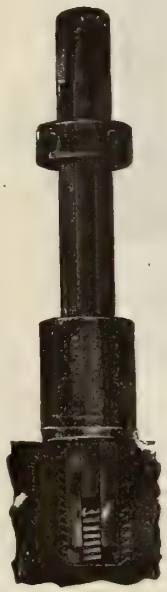
M. A. HANNA & CO.

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Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some make-shift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
Hartford, Conn.

STEEL CASTINGS

QUICK DELIVERIES

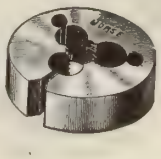
High Carbon Steel
Manganese Steel
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QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED
OWEN SOUND, ONTARO
ESTABLISHED 1860



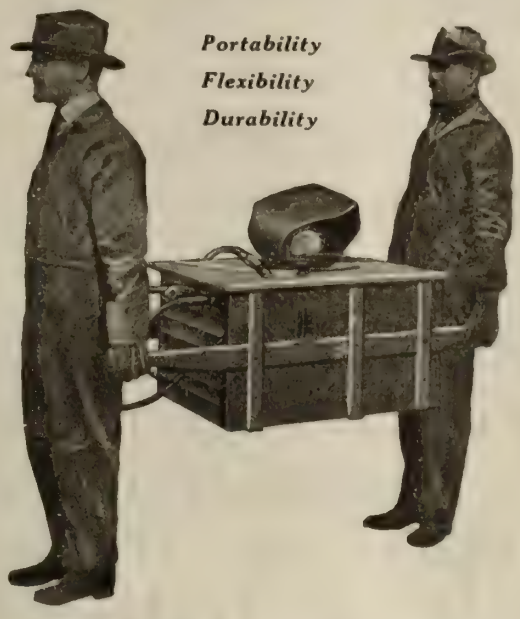




Every Time You Use A Morse Tap or Die you know that you will have ACCURATE CLEAN CUT THREADS, and if you order another Tap or Die you can duplicate the threads cut by the first.

MORSE TWIST DRILL & MCH. CO.
NEW BEDFORD, MASS., U.S.A.

"ALTERNARC"



Portability
Flexibility
Durability

Will Tackle Any Arc Job and Make Good!

Look at this one! A cast iron wheel broken clear **through** 3 spokes and flange. A heavy job. The "Alternarc" welded it **perfectly**. On cast iron A. C. will show superiority.

"Alternarc" is doing great things all along the line. And has the great advantage of being least expensive—to buy and to operate.



Don't decide before you have asked about the "Alternarc"

The Electric Arc Cutting & Welding Co.
152-58 Jelliff Ave. Newark, N.J.
Exclusive Representatives for Canada
INTERNATIONAL EQUIPMENT COMPANY
Transportation Building Montreal

KLEER-HEET

Kleer-Heet Electric Furnaces



For Heating Soldering Irons

Safer, Cleaner, Quicker, Cheaper and easier on irons than gasoline or gas. All sizes supplied with 3-heat regulation. Sizes 1 and 2 portable.

Size	Muffle dimensions.	Approx. cost.	Price
1	1½″ x 1½″ x 6″	1 cent	$25.00
2	2″ x 2″ x 7″	1½ cents	$35.00
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4	2½″ x 2½″ x 8″	4 cents	$55.00

(2 muffles each)

Designed and Made in Canada

R. H. CUNNINGHAM & CO.

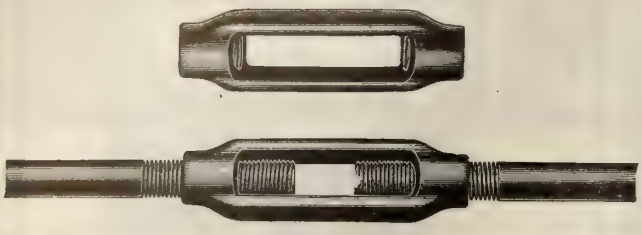
WALKERVILLE, ONT.

Toronto Montreal

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CANADA
FOUNDRIES & FORGINGS
LIMITED

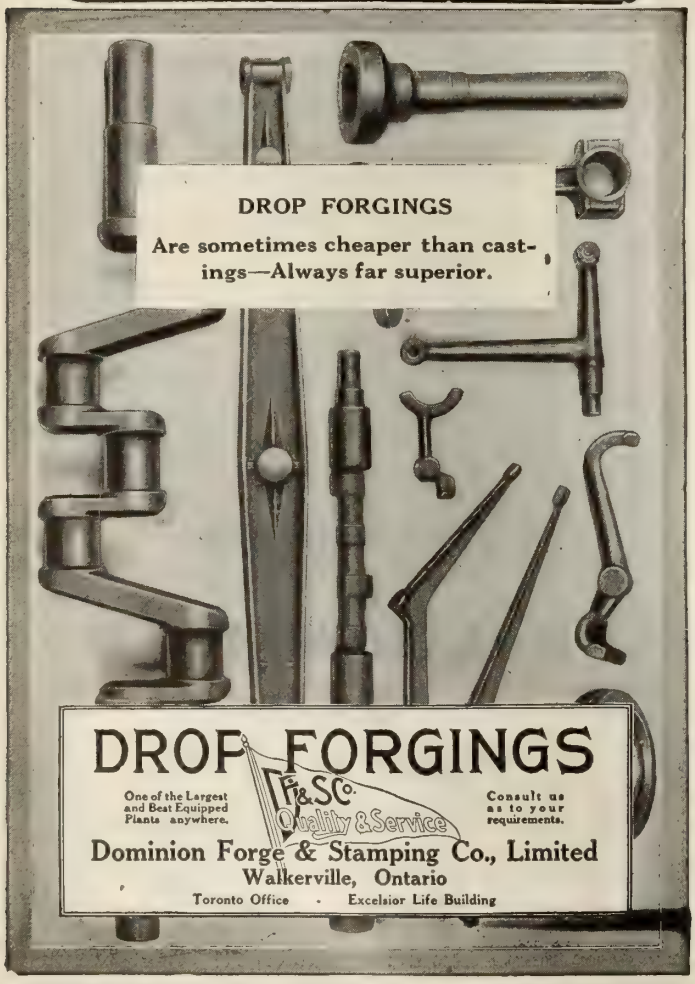
Drop Forged Steel



SOLID—NOT WELDED

16 Sizes with / without } Stubs

Canada Foundries & Forgings
Welland, Ont.



You pay your workmen well for their time and effort: don't waste this labor-element by keeping dull files in use.

A file ceases to be fully efficient as soon as it has begun to lose its keen-cutting edge. Replacing it costs only a trifle but means much in increased efficiency.

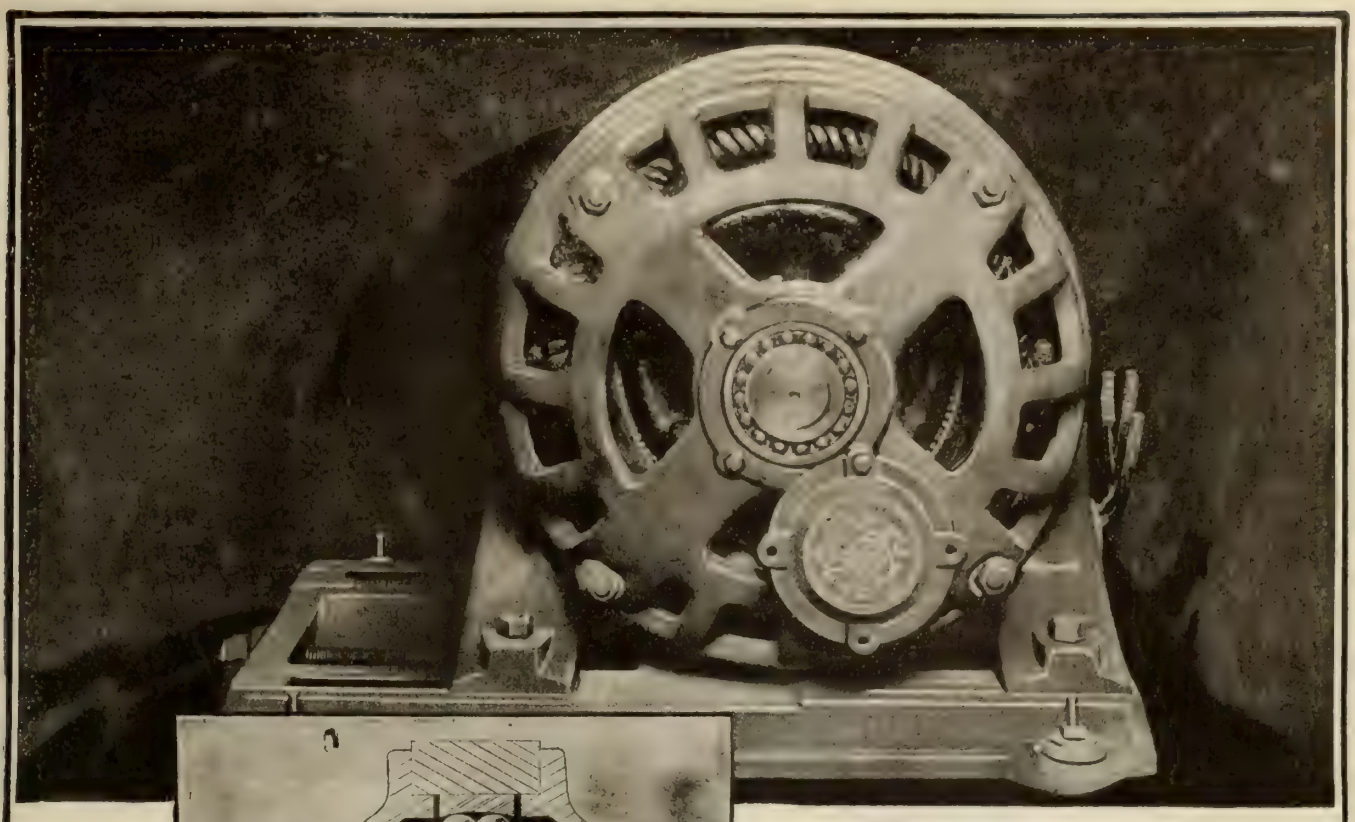
These brands, the standard for over fifty years, do not dull quickly:—

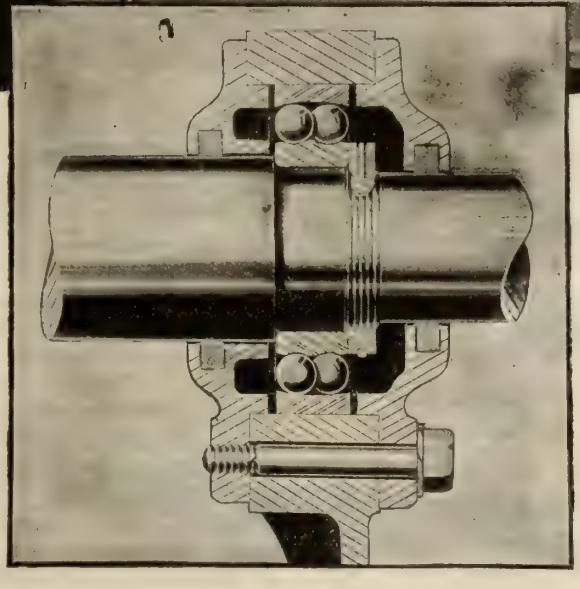
Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - [illegible] - Ontario





The twenty-horse-power induction motor with end cap removed showing the self-aligning ball bearing. Note that the ball bearings are contained within simply constructed bearing head brackets with liberal lubricant chambers, which are sealed on both sides by end caps. These end caps are fitted close to the motor shaft and are practically proof against leakage of lubricant, as well as the intrusion of moisture, dust, lint, grit and other foreign substances from without.

The use of ball bearings in electrical machines—

has been a continuous growth and is fast coming to be considered vital to the best mechanical practice in the design of electrical machinery. So marked is this fact that today the leading manufacturers of electrical machinery have a standard line of ball bearing motors.

Self-aligning ball bearings marked **SKF** are particularly adapted for motor uses and are so nearly frictionless that wear is practically eliminated. This insures perfect rotor alignment almost indefinitely with a constant high efficiency air gap for maximum motor life. And because they are wear-free, the bearings run cool and require a minimum of lubrication and attention.

The engineering experience of our organization is at your disposal. You are urged to submit your bearing problems to us for careful and impartial consideration.

CANADIAN SKF COMPANY, LIMITED

TORONTO - - MONTREAL

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At Less than Mill Cost From Stock

SEAMLESS DRAWN STEEL TUBES

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WELDED STEEL TUBING

500 lbs. ⅜" O.D. x 15 Ga.
3,000 lbs. ½" O.D. x 15 Ga.
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TORONTO, ONT.

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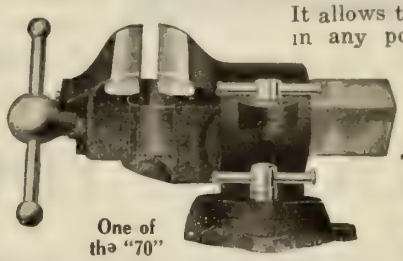


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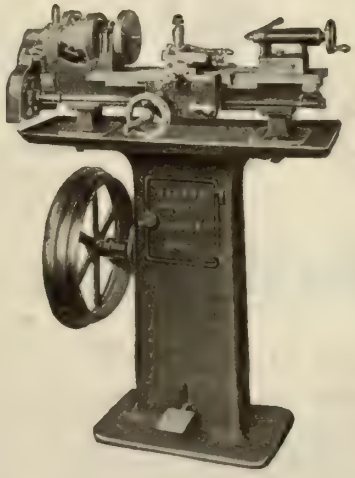
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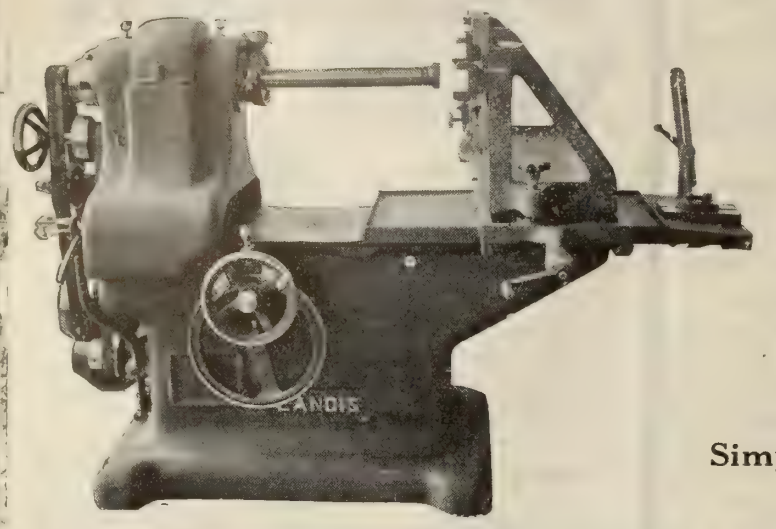
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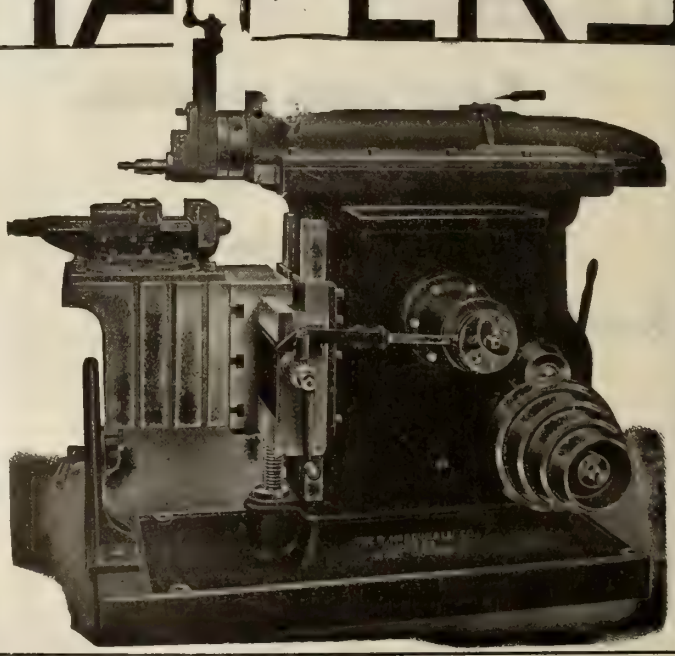
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII, No. 7. FEBRUARY 16, 1922

How to Use Milling Machines to Best Advantage

Machining Journal Box and Top of Special Table—Milling Large Chilled Rolls—How Gang Cutters Speed Up Production—Fixture Design Must Be Carefully Planned

By J. H. MOORE

SOME TIME ago the superintendent of a large manufacturing plant in Canada developed a case of walkitis. For days at a stretch he paced up and down the aisle of a certain department, always pausing at a group of milling machines, which seemed to be doing their utmost to produce parts as quickly as possible. "I know those tools are good for more production," he could be heard to mutter, and off he would start once more on his journey of thought. Later the chief draftsman was called into the superintendent's office, the upshot being the tool room soon had a brand new set of blueprints showing a special fixture and cutter which had to be made for the milling machines in question.

About two weeks transpired, and the same superintendent walked past those machines once more, but with a smile on his face, for production had increased over 100 per cent. "I knew they had it in them," he chuckled, and off he went to seek fresh fields of endeavor.

This story is told simply to push home the fact that existing equipment can often be made more efficient by a little careful thought. The writer has witnessed on many occasions a good sized milling machine busily (?) engaged, cutting a ⅜-in wide keyway, when that same tool should have been turning out much more important work. Even small shops should plan their milling work just as carefully as larger plants, though of course on a smaller scale. They cannot afford to spend a great amount of money on jigs, special cutters, and so on, but they can improve, at small cost, the clamp or vise method of holding. They can also set up the parts in gang fashion, doing many pieces practically in the same time as it would take to complete one.

At a Hamilton, Ontario, plant, they wanted to mill keyways on a number of shafts, and at first started to mill them one at a time. This method being too slow, they arranged twelve shafts on one jig plate, milling the lot by the aid of gang cutters.

The jig was simply a series of "V's," six shafts resting at each side of the jig plate. One strap held six shafts in place and the operator milled a batch of six, while he was loading the other end of the jig. The complete fixture cost a little over $12, but it made the difference between a profitable and an unprofitable job.

Study the Part

Just because a certain piece is at present being machined on a planer, or shaper, is no reason why it should continue to be completed on such a machine. Perhaps you would often like to use the shaper, or planer, as the case may be, but this particular piece prevents your doing so. How about the milling machine? Have you ever stopped to see if the operation could be switched?

If not, now is the time to do it. By all means bring the chief draftsman into the discussion. He is used to visualizing ideas, and will be able to offer valuable suggestions regarding the construction and simplification of any fixture. Tell him frankly your manufacturing troubles, so that he can hit

We are indebted to the Kearney & Trecker Co., Milwaukee Wis., for the use of Figs. 1, 4, 5, 6 and 7, and to the Browne & Sharpe Co., Providence R. I., for the use of Figs. 2 and 3.

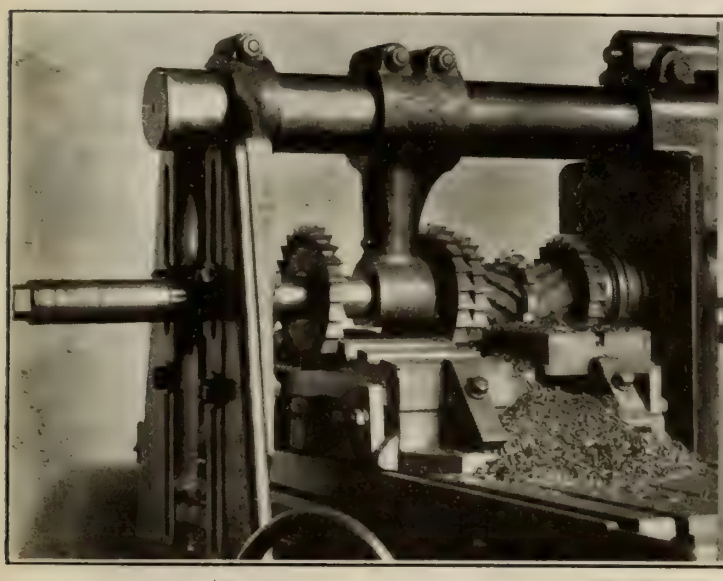


Fig. 2.—Milling top of special table.

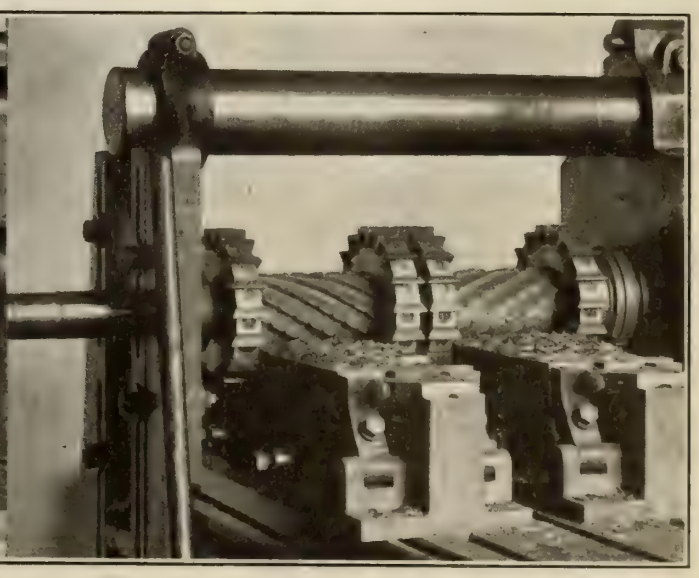


Fig. 3.—Showing the advantage of gang milling.

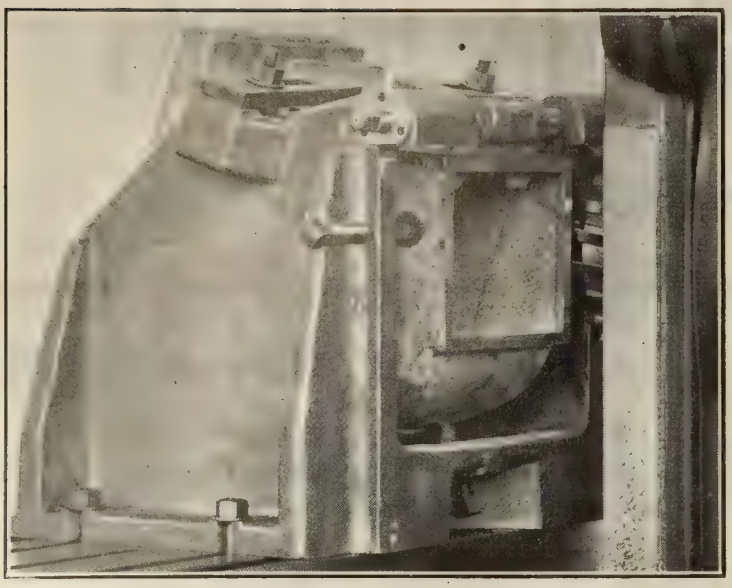


Fig. 1.—Facing large axle box on miller.

home at the weakest spots. Often he will be able to offer a most unlooked for suggestion, so that even should you think that a certain part cannot be machined on the miller, ask him anyhow, and he may surprise you by developing a method whereby you can place the piece on such a machine.

For example, many shops would be inclined to machine the part shown in Fig. 1, on a planer, but the North-Western Malleable Iron Co. felt it could be done on the miller, and proved their contention to be correct. The part shown is a journal box, and the fixture used for holding is both simple and effective. As the picture tells the story we will pass on to Fig. 2, which shows the top and bottom of a table for a special machine being milled.

The value of gang cutters is clearly brought out in this photograph, and it will be noted that the arbor yoke is used as a brace near the point of greatest stress. Where more than one operation of slab milling is performed, right and left hand spiral cutters are generally used to neutralize any end thrust, and it will be noted that this is done in both Figs. 2 and 3. The size of cutters used in Fig. 3 are a little larger than the usual run, and the work being milled calls for a combination of wide slab, and straddle milling.

Milling Notches in Rolls

The next four illustrations Figs. 4, 5, 6 and 7, shows a very interesting job for a milling machine, and emphasizes our former contention that the miller can often be used on work which was thought unsuitable for such a machine. The part shown is known as a chilled roll, and the machine in this case is fitted with a slow speed universal milling attachment. Special adjustable knee grooves are made to support the work. Due to the extreme hardness of these rolls, a cutter speed of one revolution every minute and a half is necessary, as any greater speed than this would soon break down the cutters.

The slow cutter speed is obtained through a set of reducing gears in the universal milling attachment, the spindle of machine revolving at the regular speed shown on speed plates.

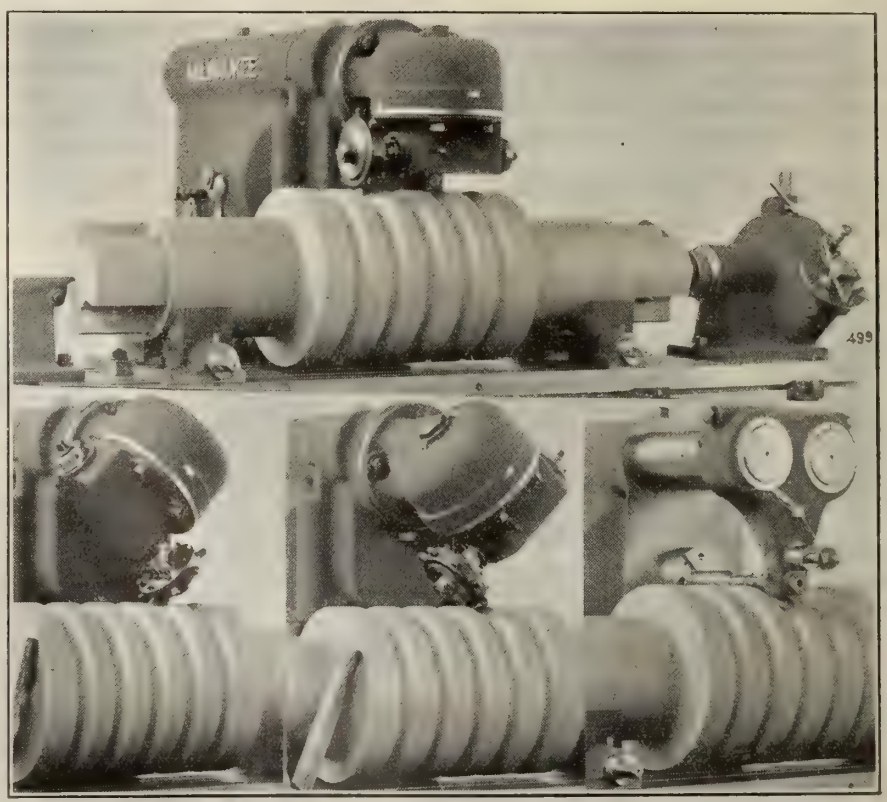
The method of supporting the rolls is clearly shown, and it will be noted that these blocks are adjustable. Indexing is obtained through the plain indexing head at the end and the notches on both sides of the feed groove are also cut on this machine. The versatility of the universal milling attachment is well brought out in these views, and the procedure of operation can be easily followed.

In concluding this short article, which shows only a few scattered examples of milling work, we again emphasize the fact that careful planning of jigs, fixtures and cutters is essential if the machine is to deliver its best work. Study your operations. Can they be performed to better advantage on the miller? If so by all means transfer them to such machines, for we are living in an age where efficiency counts.

On the other hand, if you feel the miller is not the proper place for the operation, decide to make a change, but above all make sure you are correct in your deduction. Give the machine a chance to make good. If you feel that it cannot, owing to the work being unsuitable, then take it off and clear the way, so that other parts can be handled, making your milling machines become as efficient as they possibly can.

An important factor to be considered in the successful production of work on Milling Machines, is the careful selection of lubricant for maintaining a keen edge on the cutters and obtaining the desired results on the surfaces being machined. The method of application is likewise a detail that should not be overlooked. It is nearly always advisable to have a good flow, particularly in the case of iron and steel, as this aids the washing away of the chips and presents a clear path for the cutter at all times.

The City of Peterboro, Ont., is having plans prepared for a pumping station. An electrically driven centrifugal pump will probably be installed. The cost will be in the vicinity of $200,000.



Figs. 4-5-6-7.—Showing various roughing and finishing operations on a chilled roll.

Examples of Modern High Speed Production

Methods Adopted At Ford Motor Plant—Mechanically Operated Wrenches Reduce Costs—Machining Countershaft Spool and Cast Iron Axle Housing—Operations on Motor Frame

By H. A. WILSON

PROBABLY more than any other single factor, the development in tool steels during the past twenty years has contributed to the general speeding up of machine shop operations. The greater speed and heavier feed that the steels could handle, was really a heavier burden than many machine tools could take care of. Thus, the design of machine tools became more rugged, distortion, strain and vibration being the influence of the greater capacity minimum. It is for this reason that all types of machine tools have been feeling the influence f the greater capacity of high speed steel. The size of lathe spindles, and the main bearings that carry these spindles, would cause exclamations of surprise from designers who had been out of touch with the industry for the last twenty years. Other factors that have each had their part to play in the drama of "Speedy Production" are, the development of steel for purposes other than tools, better bearing metals, and the increased demand for products which permitted manufacturing on a large production basis. This latter phase called for the development of the screw machine, the semi-automatic, and full-automatic lathe, and all other forms of automatic machinery.

Machines of varied designs have helped to speed up production from the raw material to the finished article. In the foundry, the sand mixers, the moulding machines, pneumatic rammers, air hoists, electric cranes, sand blasts, air chippers, etc., all contribute their share. Punch presses now work up steel sheets in a few seconds, into shapes and forms that were formerly produced in the foundry. Bar stock now enters a factory and later, when fed into screw machines is made into a variety of products very rapidly.

Thus, out of many rapid processes that are almost too numerous to enumerate, a few representative ones have been chosen The mechanical engineering profession has achieved so many wonderful things that it can be truly said that it has had a large part in the moulding of the civilization we enjoy to-day.

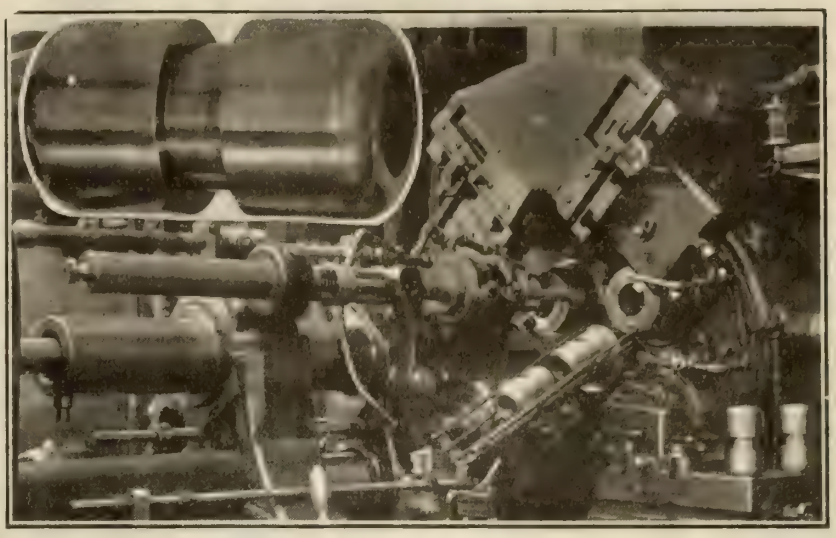


Fig. 1.—(Upper right)—finished countershaft spool.
Fig. 2.—Cut-off side of automatic machine showing chute for carrying away finished pieces.

High Speed Production

Mr. R Gage, of the Ford Motor Company of Canada, briefly sums up the high speed production activities of the Ford plant at Ford, Ontario, as follows:—"Without attempting to outline all of the many ways and means, by which the company I represent have, by years of study and careful planning, been able to speed up production, the folowing general summary is submitted:—

"There are certain fundamental principles which have been strictly adhered to, and carefully followed out all through the years, which have reduced the number of operations, and have cut overhead cost to a minimum. This has been accomplished by making the machines as nearly automatic as possible, and so positioned as to cut down repeat labor to a very fine point, and second, by installing a system throughout the shop and assembly lines, which practically abolishes confusion and delay.

"The Ford Motor Co. has taken every advantage of modern machinery. Many of the machines used are built expressly for a particular job and carry out many operations in one, all that is required of the operator being to change the part when finished and instal another.

"The large milling machines used to plane off the top of motor blocks holds fifteen pieces at one time. All that is

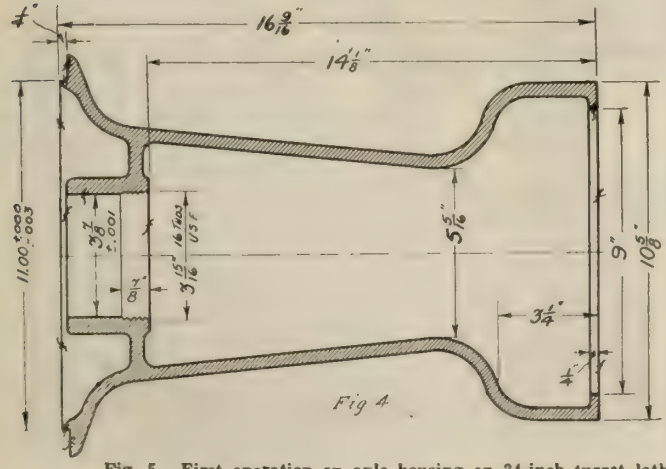


Fig. 5.—First operation on axle housing on 24-inch turret lathe.

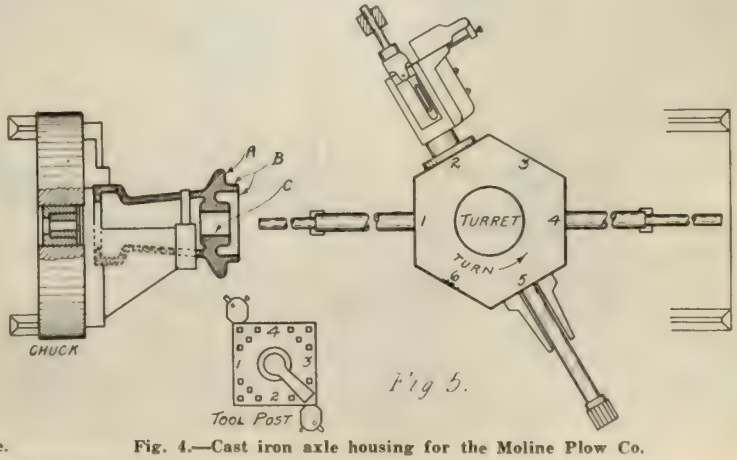


Fig. 4.—Cast iron axle housing for the Moline Plow Co.

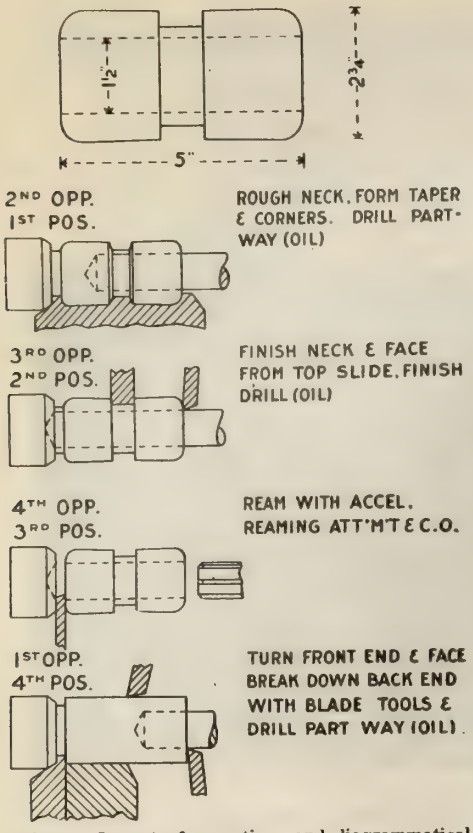


Fig. 3.—Layout of operations and diagrammatical representation of tools used.

required of the two attendants is to position the blocks, start the machine in motion, and take the blocks off as they come through. The machine that drills the holes in the bottom, top and sides of the motor block has 42 drills all operating at once, and when the part is taken from the clamping device, each hole is drilled to its required depth and in its exact place with no confusion, and in one operation. Much time is saved by this one machine alone. If it were not for a tool like the one described, the block would have to be placed on many different machines, or at least located in a number of positions on one machine, which would take much longer and not be nearly as accurate.

Cutting Gear Teeth

"The machine which cuts the teeth in the large differential drive gear is so automatic and reliable that one man can easily operate several at once. On the almost superhuman machines which

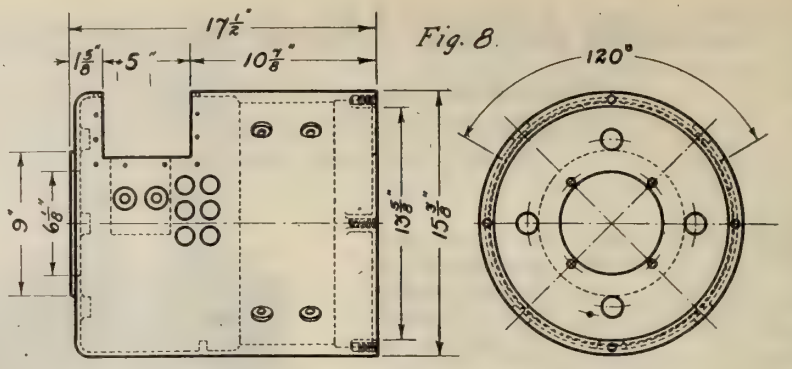


Fig. 8.

Fig. 8.—Cast steel motor frame.

shape and cut the threads on the different bolts used throughout the car, one man easily operates several machines for all he does is to shovel the bolts in a large hopper at the top. Each bolt is automatically fed into the machine and they are turned out, with almost lightning speed. By the use of huge punch presses weighing many tons and exerting a working pressure of 900 tons, the engine crank cases are stamped from cold sheet steel in one operation.

"The system of conveying pieces from one machine to another plays an important part in fast production. Running throughout the shop are huge overhead tracks on which operate electric cranes. These quickly carry parts from machine to machine and to all parts of the yards where needed. Between machines short tracks have been installed on which are small lifting hoists which save exertion and time on the part of the operators. Then again, numerous small electric trucks on which are installed cranes, also raising and lowering platforms wend their way at high speed to all parts of the building, and as they steer from both front and rear they can get into almost inaccessible places to receive or discharge a load. These trucks carry parts from the machine shop to the assembly floors and stockrooms. An efficient elevator system also plays an important part in carrying trucks, etc., to the different floors.

"Perhaps the most impressive and efficient is the motor and final assembly lines. For instance, in the motor assembly line the bare block enters one end, and as each successive operation in turn presents itself, it is taken care of by a workman who is trained to do that particular job. His training consists mostly of being able to do his part in a given time. In a surprisingly short period a complete motor emerges from the other end of the line ready for testing.

"The final assembly is equally efficient. It is composed of a number of assemblies starting with the frame, and as the chassis proceeds down the line smaller assemblies are added until the car is driven to be tested under its own power. The workmen have their own particular parts to assemble and soon become very efficient and speedy in the use of the tools required for that job.

"Wherever it is possible, high speed electric and compressed air speed wrenches are used. These save considerable time over the hand wrench system. Throughout the shop the different operations are made so simple that a new man can be taught an operation within a very short time. On the packing and shipping floors we see the same system employed as throughout the shop and assembly floor. By installing system and machinery, and cutting down the human element in this way, production is considerably increased and the quality of the work turned out improved."

Producing Parts Rapidly

In connection with the production of actual parts at high speed on the automatic screw machine, the following article has been prepared by Mr. G. S. Tracy, of the National Acme Co., Cleveland, Ohio, and illustrates operations on Acme multiple spindle automatic screw machines.

"Producing work at high speed is, of course, a matter of comparison—it is a relative, rather than an absolute, phrase. For instance, what would have been considered high speed 20 or even 10 years ago, is to-day only mediocre. In all probability another 10 or 20 years will bring further important changes in machine tool design tending towards increased production and increased efficiency—higher speed. It is with this in view that these observations are being made.

"We might have chosen a small brass piece and pointed out how we could handle the various operations on our new style 9/16 in. Gridley multiple spindle automatic with such speed that a complete piece from bar stock to the 'tote-box'—was only a matter of 3. 4

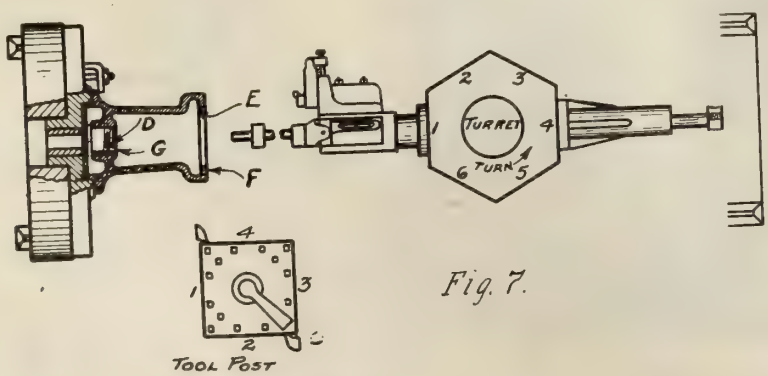


Fig. 7.

Fig. 7.—Second operation on cast iron axle housing.

or 5 seconds as the case might be. We are rather proud of the production attainable on these new style machines, but after all it merely illustrates the application of a speedier type of the same kind of machine that has always handled work of this sort. On the other hand, the part which we have chosen to illustrate brings out the application of a new type of machine to a general class of work whose size has heretofore required the use of a turret lathe or at best of a single spindle automatic.

"The screw machine job shown is a spool supplied on the counter-shaft by a manufacturer of heavy machinery. While the outside diameter of the finished piece is 2¾ in. it might for all practical purposes have been 4 in. For the National Acme Co. now has on the market machines of this type capable of handling round stock up to 4 in. in diameter. The piece is 5 in. long and has a 1½ in. hole drilled through its entire length. It should be borne in mind that since all the tools work at once the time necessary to perform all the operations on any piece cannot exceed the time necessary for the longest single operation or fraction thereof. Hence, much of the idle time usually consumed in the swinging of tools between cuts has been entirely eliminated, and the four indexing positions of the stock carrying cylinder, as well as the movement of tools up to the point of cutting, are all controlled by accelerated cams.

Machining the Spool

The machining operations on this piece shown in Fig. 1 were performed on a 3 in. automatic. As is customary on large machines of this type, the finished piece is cut off in the 3rd position, thus making possible the use of the two lower slides for the heavy turning and drilling operations. This is somewhat different from the usual method of automatic screw machines, but Fig. 2, showing the cut-off side of the Acme Automatic, should give a clear understanding of the general tooling methods employed.

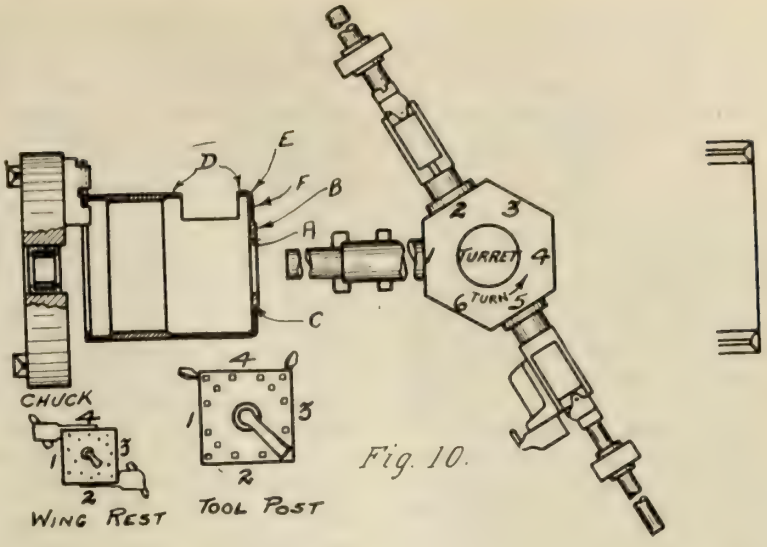


Fig. 10.

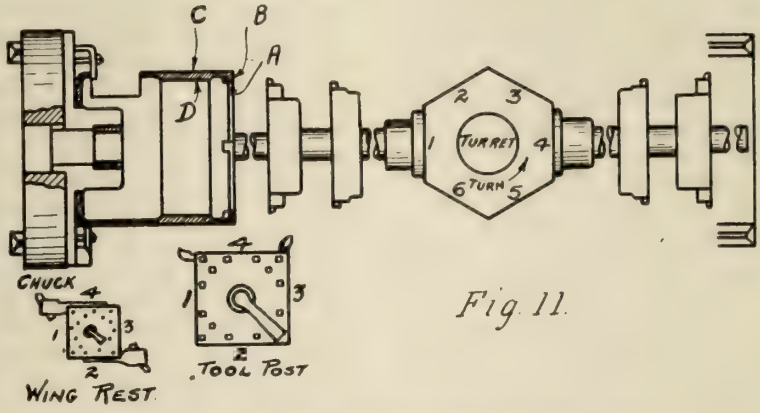


Fig. 11.

Fig. 10.—Tooling layout for first operation on motor frame.
Fig. 11.—Tooling layout for second operation on motor frame.

"The first operation, which is performed in the fourth, or usual cut-off position, is to turn the outside diameter of the stock, face the front end of the spool, break down the back end with blade tools from the cut-off slide and drill part way with an oil drill. All of these operations will be made clearer by a glance at the layout of operations in Fig. 3 which includes a cut showing the tools used at the end of this article.

"We now turn to the so-called forming side of the machine. In the 1st spindle position the 2nd series of operations are performed. These consist of rough necking the groove, forming the corners of the piece, and forming the taper by means of a forming tool mounted on the forming slide. It is necessary to use a forming tool for this work in-

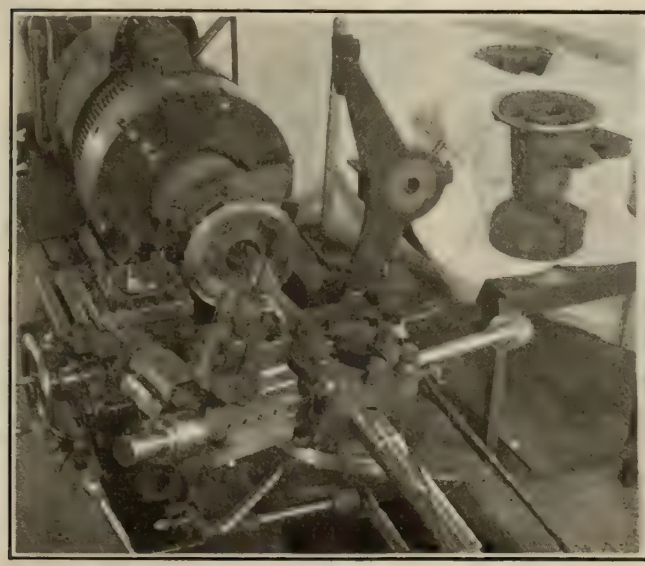


Fig. 6.—Cast iron axle housing in 24-inch turret lathe.

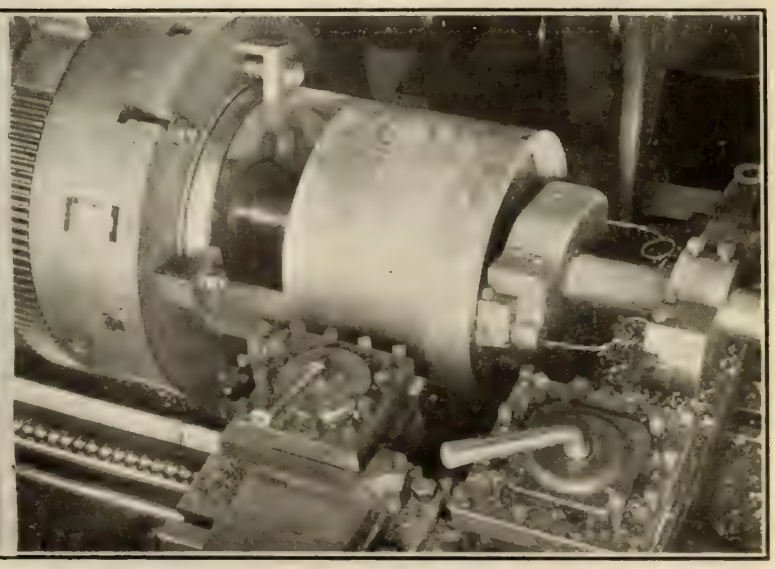


Fig. 9.—Motor frame in a 24-inch turret lathe tooled for second operation.

asmuch as there is a slight taper of the outside diameter of the piece extending from either end towards the groove or neck in the center. In this position the drilling operation is also continued.

"In the second spindle position the groove or neck is completed and the final facing of the outer end also accomplished by the use of tools mounted in one of the top slides. This slide is clearly shown in Fig. 2. Notice that the top slide furnishes extra side tool positions for both the second and third top slide are usually light finishing cuts —just as in the present instance—where a high finish is required for the work. The drilling of the hole is also completed. In the third spindle position the hole is reamed with an accelerated reaming attachment shown in Fig. 2, and the finished piece cut off by a blade tool mounted in the top slide.

"Particular attention is called to the fact that while the drilling operation is split up over three different tooling positions, the whole length of the hole is reamed in one position. This requires the use of an accelerated reaming attachment, shown at left center of Fig. 2. You will notice the long arm of lever, which, actuated by a kicker or dog running free on a stationary rod, gives to the reamer a speed greater than that of the tool slide on which it is mounted. The reamer holder, of course, runs free in the end slide tool holder.

Chute To Carry Away Work

"A point which may be of interest to our readers is the chute for conveying the finished piece away from the tools after the completed piece is cut off. This is shown clearly in the picture of the cut-off side of the machine. In the case of heavy parts of this nature it is desirable to keep the finished pieces from damaging tools or themselves by falling promiscuously.

"The foregoing discussion of the various methods employed on this particular piece should give our readers an idea of how the application of multiple spindle automatic screw machines to a large variety of heavy parts made from bar stock means not only efficient production, but more than that, it means producing at high speed."

High Speed Turret Lathe

We have considered the field of operation of the automatic screw machine and will now turn to some examples of the turret lathe on high speed production. The first article we will discuss is a cast iron axle housing for plow machines. The work on this and the following example is performed on a 24 in. turret lathe. The axle housing is illustrated in Fig. 4. The machining is done in two operations and the total time consumed in the two operations is eleven minutes. The first operation and diagrammatical sketch of the tooling, is shown in Fig. 5. The casting is held in a cradle and special hardened steel jaws which are shown in Fig. 6. The first sub-operation is to rough face surfaces "A" and "B." This operation is done with the tool in side No. 1 of the tool post. The tool post works up to stops, the automatic feed being used. The next detail is to rough bore the internal surface "C." This operation is accomplished by a double blade boring tool in the bar in side No. 1 of the turret. When boring, the bar extends into the chuck where it is steadied in a special casting. The turret is next indexed and the tool in side No. 4 is brought to the work. This double blade boring tool finish bores the interior surface "C." Next the turret is swung around and the reamer in side No. 4 is used to ream "C" to size. The last turret sub-operation takes place when the tools in the head mounted on the bar projecting from side No. 2, are used to finish the surface "B." A roller guide in "C" is used to steady the operation, and suitable stops are provided to insure uniformity of the operation. The final detail operation is the finishing of the surface "A" by the tool in the side No. 3 of the tool post.

In the second and last operation on the axle housing it is turned "end for end" when clamped to the chuck plate with specially bent straps. The diagrammatical layout of this operation is shown in Fig. 7. Surface "F" is rough faced with the tool in side No. 1 of the tool post. Next "E" is bored and chamfered with cutters in the head, and bar mounted on side No. 1 of the turret. The following sub-operation is the finish facing of "F" by the tool in side No. 3 of the tool post. To give proper length to the casting the tool post is placed against a stop which accurately determines the finished length of the axle housing. The final detail is the tapping of "D" with the tap in the side No. 4 of the turret. This completes the machining of the casting and after carefully studying the dimensions shown in Fig. 44 it is really remarkable that these operations can be completed, including two set ups, in the short period of eleven minutes.

Machining Motor Frame

The next example of turret lathe work is the machining in two operations of a motor frame of cast steel for the Cleveland Armature Works. This work was also done on a 24 in. turret lathe. The piece is shown in Fig. 8. The piece set up in the lathe is shown in Fig. 9. A diagrammatical layout of the tooling for the first operation is shown in Fig. 10. The frame is chucked in special hard jaws. The first sub-operation is to rough face surfaces "B", "C", "E" and "F" with the tool shown in side No. 4 of the tool post. Next the surface "D" is turned with the tool in the tool holder of side No. 1 of the turret. Following this the surfaces "B" and "C" are rough faced with cutters in the head on the bar in side No. 2 of the turret. Then "F" is finished with the tool inside No. 3 of the tool post. The surfaces "B", "C" and "E" are finished with cutters in the head and bar on the side No. 5 of the turret. It will be noted that a double support is used to steady the bar, one in the bushing in the chuck and the other with a roller in "A." This prevents distortion and the consequent inaccurate work. The last detail in the first operation is to finish "D" with tool in the holder on side No. 2 of the wing rest. The total operation is completed in 57 minutes. The second operation requires that the motor frame be chucked "end for end," shown in Fig. 11. It is held firmly on the chuck plate by clamps, after being centered. The surface "B" is rough faced with the tool in side No. 4 of the tool post. Next the surface "C" is rough turned with the tool in the holder on side No. 4 of the wing rest. Following this the surfaces "A" and "D" are rough bored with cutters in the boring heads carried on the bar on side No. 1 of the turret. The finish boring of these surfaces immediately follows, with tools carried in the boring heads on the bar on side No. 4 of the turret. The next sub-operation is to finish face "B" with the tool in side No. 3 of the tool post. The final detail in the second operation is to finish turn "C" with the tool in the holder on side No. 2 of the wing rest. This second operation is completed in 60 minutes. Thus the total machining time of the motor frame is 117 minutes, which is a remarkable achievement.

With these few examples we are forced to close the article feeling that the examples of high-speed production in the shop are "legion."

AVOIDING CRACKS IN CASTINGS

Speaking on "Cracks in Aluminum Alloy Castings," Mr. R. J. Anderson of Pittsburgh, Pa., in the course of a paper, says that the melting temperatures should be low; overheating in the furnace should be avoided. Open-flame furnaces should be run with a non-oxidising atmosphere in order to avoid the formation of much aluminum oxide, and consequently occluded dross in the alloy. Skimming should be adequately and carefully done and the melting practice should be conducted as cleanly as possible. Foundry floor sweepings should not be charged into the furnaces unless sieved and foreign materials should be kept out of the furnace charges. The pouring temperatures should be as low as is consistent with filling the mould readily with metal; high pouring temperatures should be avoided.

Damage to the extent of about $250,000 was caused by a fire this week in Montreal when a moving picture theatre, the premises of the National Stove Manufacturing Co., and a number of dwellings were destroyed. Defective wiring is supposed to have caused the fire.

The Leonard Medal, given for the best annual paper presented before the Engineering Institute of Canada of the Canadian Institute of Mining, was presented recently to Col. R. W. Leonard. The medal is in the shape of an irregular moulding, resembling a nugget, smoothed out, and is worth intrinsically about $60. It might be stated that the medal was made from the product of Col. Leonard's own mine, the Coniagas.

How to Reduce Manufacturing Costs

Heads of Various Organizations Tell How They Have Managed to Cut Production Costs—This Story of What Others Are Doing May Enable You to Solve Your Own Problems

THE BUSINESS man's chief problem at the present time is to reduce the cost of producing his merchandise and so be able to offer it at a price which will induce his customers to buy. Various methods have been given by production managers as effective ways of lowering production costs, among which are:—"Greater production per man," "Reducing the varieties of products," "Solving Transportation difficulties," etc.

In Forbes, Alexander A. Field relates how he has asked the heads of several organizations what methods they have found most successful and he gives their replies.

"Perhaps no better example of the solving of the common problems of the smaller plants can be offered," says Mr. Field, "than the system in use at Bush Terminal, in Brooklyn. Not only may the manufacturer rent his space foot by foot, as he needs it, but he may also secure metered power, light, extra service, warehousing by the foot, trucking by the hour, the use of cars which are handled on the company's own switch yards and which are run up beside his own loading platforms, stevedore service, and many other conveniences usually out of reach of the small manufacturer.

Keeps Workers Satisfied

"Robert R. Gerstner, vice-president of the Oil Products Company and president of the Merchants' and Manufacturers' Association of Bush Terminal, said:

"'One of the great factors in production costs to-day is the enormous labor turnover. Manufacturers are making a constant effort to eliminate from their ranks the 'floater,' the employee who looks for another job during the lunch-hour.

"That a partial solution of the labor problem in production will come with the 48-hour week, divided up into five days' work, is the opinion of Henry Nias, president of the Public Service Cup Company, who has tried it out very successfully in his plant.

"'Efficient help, properly trained,' said Mr. Nias, 'will deliver as much—if not more—production in a 48-hour week, proportioned at 9½ hours' work a day, as they will in 52½ hours, working six days. Saturday is a broken day anyway, if worked as a half-day and efficiency is low. I believe that if our workers have all day Saturday and Sunday they will do better and more rapid work, they will be happier and more contented and their production will increase. Rapid work with more production per man or woman lowers costs all the way down the line—lights, power, supervision, office costs, wear and tear on machinery, etc.

"'We have a rigid plan of maintaining the highest grade of help. There is no shifting of responsibility, no dragging. Each section of our operating floor is under supervision. When we train new girls, we select them for speed and efficiency and the machine they use is geared to an exact setting for their speed. As their speed increases we reset the machine. The operator then keeps up to the speed set by the machine she is using, and her output is steady and even.

Maintenance of Raw Materials

"'A great cost reducing system is the careful stacking and placing of our raw material; so that we always have a standing inventory. I can tell very quickly whether it is wise to buy or not because in five minutes I can have an exact statement of what we have on hand. The maintenance of raw materials in an accessible and orderly condition is a vital cost reducer to any manufacturer, not only because it eliminates waste, but also because it prevents careless buying. Immediate knowledge of his stock enables a man to take quick advantage of a lowered market or to 'stand pat' on one that is going up, if he is properly supplied. Since we know exactly how long a certain amount of stock will last us under normal conditions, with an inventory right at hand, we cannot make a very serious mistake.

"'Because we are subject to seasonal demands, due to our large business with drug stores and ice cream parlors, we have found it desirable to have all our machinery installed in exact duplication on the two floors of our plant. We can now shut off one floor entirely when production is low.'

"'We have found several systems effective in reducing our production costs,' said J. K. Zitz, treasurer of the Agar Manufacturing Corporation, manufacturers of corrugated cartons.

"'By inaugurating a bonus system based on the production of each man, we have materially increased our production per man. The bonus is based on an estimate of the worker's normal output for a given period. Anything over normal production is subject to a bonus. If a man running a machine has one or two helpers, all share in the bonus in proper proportion to their work. Our labor turnover has very materially decreased since this system was installed, and our production has been greatly increased.

"'Another thing that keeps costs down is our system. Once a month we meet to discuss our budget and to make comparisons of previous costs. We use the utmost care to keep our machinery up-to-date, replacing it wherever necessary.'

Labor Turnover

"Inspection of other plants revealed many economies which might be generally adopted. If every factory could successfully concentrate on higher production per man; reduction of labor turnover; decreasing the varieties of the product; and the elimination of waste by better methods, salvage, and the utilization of by-products, said a production manager, there is no doubt they would find an enormous decrease in their production cost per unit. Every worker should be encouraged to produce to his full capacity, by offering proper labor conditions, a well cooked mid-day meal at the plant, co-operative stores where wholesome food can be bought at a minimum, proper labor-saving machinery kept at the highest point of efficiency, and added inducements in the shape of a bonus or some profit-sharing system.

"The question of labor turnover is gradually adjusting itself as business swings back to normal. But few organizations have even been able to boast of the three-generation labor conditions which have made the Henry Disston plant famous. Such methods as those used by the Studebaker Corporation where employees receive a bonus in proportion to their length of service, have, however, proved satisfactory. Other plants have reduced their labor turnover by the creation of goodwill and a family spirit among their people. Far-famed for this spirit is the Endicott-Johnson Shoe Company, whose employees have a Spotless Town of their own. Many other instances might be cited where the manufacturer has so considered the personal interests of his people that he has bound them together more as a family than as an organization. In such plants labor turnover is a negligible quantity.

"Efforts to reduce the varieties of the products manufactured have opened the eyes of executives to many things heretofore unknown. One manufacturer discovered in analyzing his output that 75 per cent. of his business was centred on a few items. He hesitated to concentrate on these few, fearing that by diminishing his line he would reduce his sales; but after testing the matter out he discovered that he could so reduce his cost of manufacture by specializing on these

(Continued on page 43)

Developing Turret Lathe Toolholders

Method of Holding Cutting Tools—Showing Improvements In Design—Advantages of Modern Type—Adjustment Facilitates Tool Setting

By HUBERT BENTLEY, A.M.I., Mech.E.

THE efficiency of a lathe is largely governed by its tool and toolholder. However powerful the driving headstock may be, the results attained can be largely nullified by the cutting tool employed or the method of securing the same. While these remarks have general application, they apply with considerable force to the hexagon turret lathe, on which type of machine it is quite easy to spend a considerable sum in tool equipment. During recent years a considerable number of lathes have been built, more or less standard engine lathes but fitted with hexagon turrets in place of the ordinary slide rests and minus the loose headstocks. These lathes can be employed quite satisfactorily in works where the quantities of repetition work are not sufficient to warrant the introduction of the more expensive modern capstan and turret lathe.

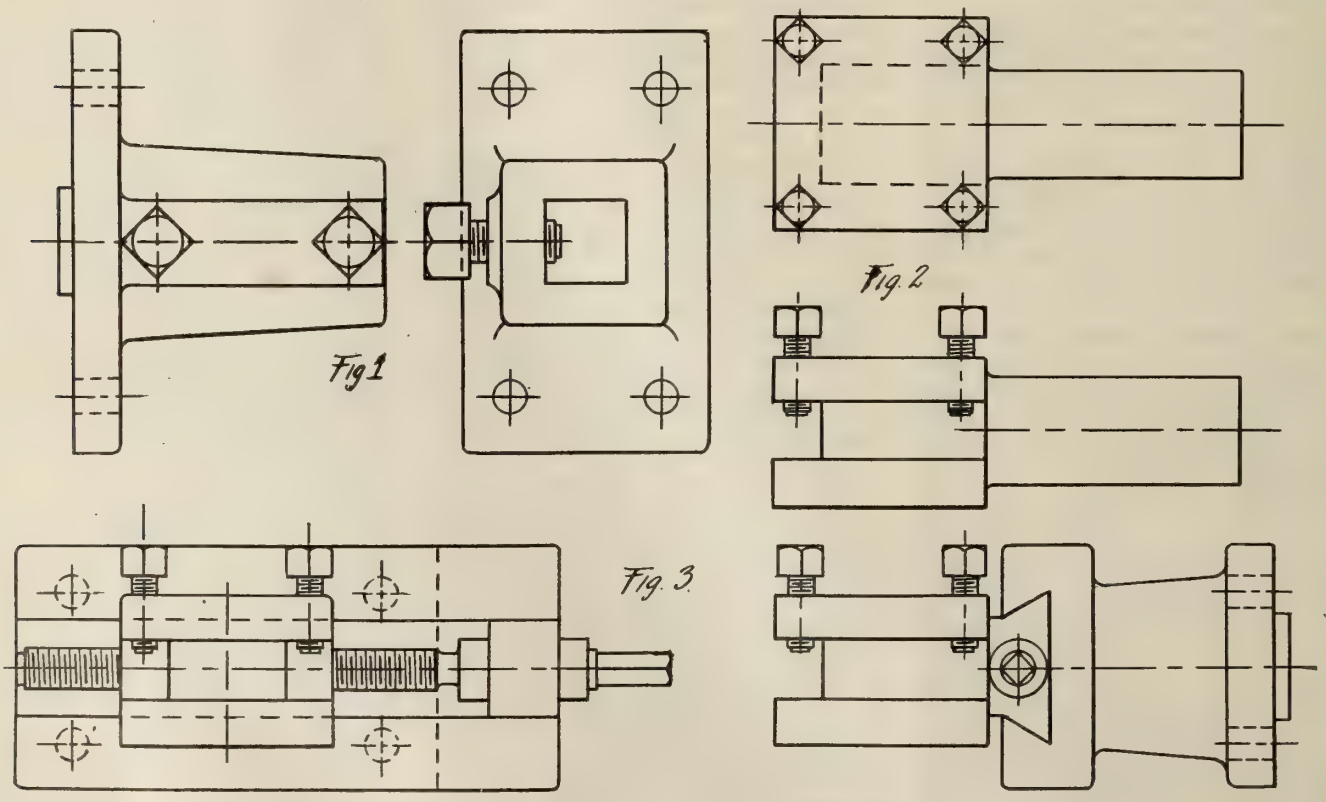
Many of these machines were built for war time service and are now available for other work, and works managers are frequently called upon to utilize one of these tools when probably a standard engine lathe would be more suitable. In the type of lathe where the hexagon turret is fixed permanently in regards to cross traverse, the necessity will soon arise for some degree of tool adjustment, if facing operations have to be made on the work being chucked. Where the turret has a cross traverse motion the difficulties of having to continually set and reset the turret in its different positions after each operation also make it advisable to provide independent tool adjustment.

Fig. I represent the simplest form of toolholder. This is secured to one of the turret faces by four screws and in the best practice also dowelled. The tool used in this case may be of the ordinary lathe form held in place by two hardened steel square head screws. In the fixed turret lathe the tool itself would be set-up in the holder to give the required bore. Fig. 2 is a development on Fig. 1 in so far, that three tool positions are provided in one tool holder. If the left hand tool is reversed two tools can be in operation at the same time. The round shank of this holder fits the hole bored in the hexagon turret face.

Difficulties occur with this type through lack of adjustment as in Fig. 1 and eventually from these two was developed the toolholder shown in Fig. 3. This provides a simple screw and nut adjustment to the tool holder which not only facilitates tool setting, but also enables facing operations to be carried out by hand independent of the turret. A preliminary cut taken across the face of a wheel boss or similar job to remove the black will extend considerably the life of the boring cutters that follow.

The steel toolholder itself provides three positions for the tool and it is machined to the desired shape from the round bar. The inner end is vee-shaped and is carefully fitted to the planed vee-ways of the toolholder casting which is screwed up and spigoted to the turret face. A square thread screwed is mounted in this casting and engages with a nut cut in the toolholder and by this means the holder may be traversed from end to end of the slide. To facilitate planning, the bearing for the screw is made separate and firmly secured by pins. Suitable collars take the end thrust while the end of the screw is squared to fit a spanner or handle as desired. It will be noticed that the front end is extended to increase the amount of traverse.

In each case the tools are secured by two hardened steel screws. It might be stated that the toolholders shown were all employed on a 20 ins. swing surfacing and turret lathe, the size of the turret faces being 7 ins. by 4 ins., and the tool steel employed was high speed, ½ in. square section. The design of toolholders grows with experience as shown by the elaborate equipment of the modern turret lathe.



Illustrating development of turret lathe toolholders.

Manufacturing Cylindrical Machine Brushes

Saving Metal From Soldered Joints—Design of Brush Body—Proper Securing of Bristles Essential to Long Life—Rebuilding Brush Bodies—Opportunities For Small Repair Shops

By DONALD A. HAMPSON

THE MANUFACTURER of tin cans has assumed such proportions that, besides the immense plants of specialists, hundreds of consumers operate their own can making departments. Automatic machinery has reduced can manufacture to a science. After leaving the presses, only one or two attendants are required to watch the long lines of parts being rapidly formed and assembled down to the point where workmen remove the newly made cans, tested and cleansed, from the conveyor, and place them in storage.

Cans intended to hold liquids are soldered at the joints. Solder, therefore, is one of the big items of expense in the manufacture of this class of cans and any means by which even the fraction of an ounce may be saved on each can results in a considerable reduction in the cost per year. Solder-saving machines have become a recognized unit in the "assembly line."

Operating Principle

Fig. 1 shows the principle of solder-saving machine operation. Here, "C" is the can which, on entering the machine, is caused to roll along the runway "A" by the belt "B" traveling in the same direction and so controlled that it exerts sufficient driving pressure on the entire row of cans in the machine. Two guides "G" position the can, as well as prevent skewing.

During passage of the can through the machine, it rolls in contact with the cylindrical brush "H." This brush may be any length from 18 inches up and it is geared to revolve at a high rate. The length of the brush insures contact twice around the can, or more, and contact with thousands of bristles in the process. The position of the solder-saving machine is close to the delivery end of the soldering machine so that the solder on the joints has not had time to set—it is still hot and soft—and in this state practically all the solder that hasn't penetrated the joint may be removed by the brush.

Selection of Bristles

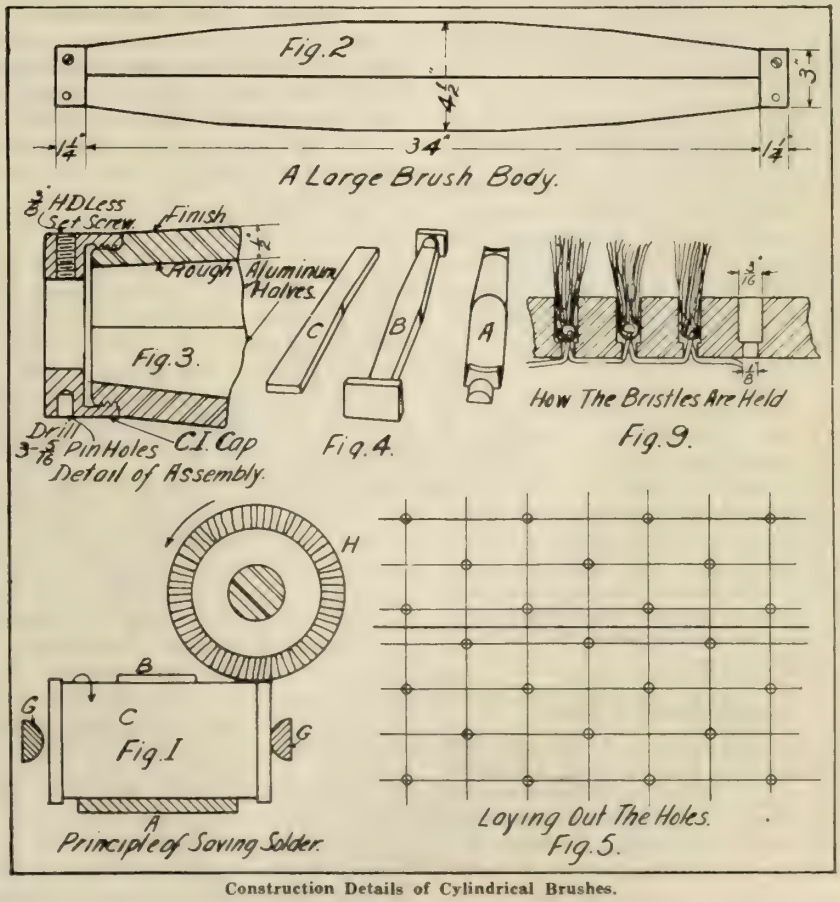
The making of cylindrical brushes for this particular service has been a rather closely guarded business. Using the term "bristles" to cover whatever material goes into filling the brush, the three requisites of a good brush are—long wearing life, resistance to burning, and bristles with a maximum of springiness. Of these, resistance to burning is hardest to obtain and most brushes are found burned off toward the starting and long before the majority of the bristles are worn down too short. A brush with either animal (bristles) or vegetable (fiber) filler will answer for ordinary brushing purposes, but will not do for the exacting solder work because animal bristles alone soon glaze over with bits of soft solder, while fiber burns away under the heat and is too weak to throw as heavy material as solder. It is not unusual for a brush maker to proportion his stock and experiment for several years, drawing largely from Asiatic markets, before obtaining a successful mixture but when he finds this latter, he is assured of a profitable re-fill business for years to come.

Running on the average 500 r.p.m., a cylindrical brush will last about one month in continuous ten hour operation. Then they are returned to the brush maker to be re-filled, but the cost of this is made up in less than two weeks by the amount of solder saved. In fact, the saving is so large that most plants save the cost of the entire machine in less than a year and the cost of a new brush body (when needed) in a month. The brush body and re-filling charges are quite high and many attempts to remove the superfluous solder by other means have been made; the most successful have been the belt removers but these have often failed because they did not have the "snap," or spring found in bristles and so necessary to prevent glazing and to throw the solder free.

Rebuilding Brush Bodies

Large numbers of brush bodies are overhauled and made over every year, work often being sent long distances to someone who has done it before when local shops could handle it fully as well if they went after it. In these times when business is scarce, contract shops would do well to solicit brush body work from some can plant in their vicinity, starting in this way where there is a community of interest and later reaching out, acquiring thereby a trade which is steady and profitable year after year, even though the amount of business is not large.

Fig. 2 shows a typical brush body of the larger size. The body proper is made of aluminum to avoid the stress-



Construction Details of Cylindrical Brushes.

es set up by heavier material revolving at a rapid rate; it is made hollow, in two halves divided longitudinally, and joined at the ends by cast iron caps, as shown by the section in Fig. 3. These caps have reamed holes to fit the brush shaft and after the body halves are so joined, the exterior of the body is turned concentric with the shaft.

The brushes here shown are larger than the average—smaller brushes are reduced in proportion. Sometimes the exterior is turned straight but more often it is crowned as shown, either in a true arc or, preferably, by turning a flat in the middle and a double taper each side of this, made by two settings of the lathe. Aside from accidents, brush bodies have to be renewed following failure of the threaded ends and when some casting imperfection, coupled with the wear of renewal, make it no longer possible to retain the inserts.

Making New Bodies

The pattern cost for a new size of bodies may be excessive unless carefully planned. Unless a large number of castings are made, it is cheaper to form the halves by use of a dry sand core than to go to the expense of a shell pattern. The patterns shown in Fig. 4 illustrate this point—they were made up for the 34 inch brushes shown in Fig. 2. Here, A is the semicircular pattern, including the core prints. It will be noted that pieces are cast at each end—these are bearing pieces when the casting is set up for milling the center flats; by their use it is possible to have the casting rest solidly at each end and bear at the crown in the center, making an easy set up and preventing inaccuracy through distortion.

The core is swept up by means of B and C which are shaped to the inside contour and include the prints. The runner in B is built up and of sufficient depth to insure its remaining straight. Such a pattern outfit is comparatively inexpensive and answers every purpose.

After the halves and caps are assembled and turned, the holes must be laid out. This operation may be reduced somewhat but when there are several brushes and each with a thousand or more holes, it still remains quite a task. Fig. 5 shows the typical layout. It shows the spacing as laid out in both directions and how the holes are prick punched in staggered order from the lines. At the middle joint, the adjacent rows are slightly closer, for experience has shown that, commercially, there is apt to be a light spot there, noticeable even when this is done to a slight degree.

Laying Out The Work

The simplest method of laying out the longitudinal lines is on a planer or surface plate, using index centers and marking with a surface gauge. For the circumferential lines, the body on a mandrel in the lathe and a sharp pointed tool form the natural method but instead of spacing off the divisions first with dividers, one shop conceived the two-man method in connection with the carriage feed. The operator feeds in the tool at the word from the index man, who sits at the end of the lathe and turns a gear on the feed rod or lead screw a predetermined number of turns which give the desired spacing. The lathe is running all the time but the feed is disconnected. Three-quarters of the old time is thus saved in marking the rings and a more accurate layout is secured.

An automatic (hammerless) prick punch is used to mark the holes for drilling. A girl operator will punch the brush body in Fig. 2 in about an hour; some idea of the task and of the layout may be gained from the number of lines—28 one way and 67 the other. With a crowned brush, the holes near the ends run much closer together; this is the governing factor in the spacing. To build a brush of uniform density, the brush maker puts fewer bristles in the holes toward the ends—this is a simpler method than a spacing which would give uniform density with an equal quantity of bristles making up each insert.

It might be argued that laying out could be avoided entirely by drilling the holes in a milling machine, as indexed. But it is seldom possible to speed the miller to an efficient rate for small holes in aluminum, even if advisable; then, the means of feeding the work on the miller are not nearly as fast as the rack and pinion.

Drilling Holes for Bristles

Simple fixtures of wood are used for drilling brush bodies on a friction drill. More permanent fixtures would be similar but in metal. The mandrel is laid in two vee blocks which are tied together at a distance to just receive the brush and caps. This assembly may be slid lengthwise in a channel formed by a 2 inch by 4 inch piece of maple with sides and bolted to the drill press table so the center lines are coincident. Two drillings are necessary—for hole and counterbore. The best kind of depth gauge for the latter, it has been found, is a piece of wood surrounding the drill this gauges all holes to a uniform depth from the outside regardless of the body contour.

Following the drilling, burrs are removed and the bodies sent to the brush maker. The method of securing the bristles is shown at Fig. 9. It is the same as found on all first-class brushes regardless of shape and has remained practically unchanged throughout the history of brush manufacture. Brass wire is used to tie the bristles—a loop is pushed through from the inside of the body, a bristle insert slipped half way through the loop, and the latter drawn taut. This wire passes throughout the line and back again. As a row is filled, it is trimmed off to the proper height from the body by bench shears fitted with a gauge for the purpose; on solder saving brushes, this height averages 1 inch.

Assuring Firm Bristles

An interesting point in brush manufacture is the means for removing loose bristles. After the brush is filled and the wires tied, the inside is flushed with plaster of paris. Then with caps screwed home, the workman takes the brush to a lathe where an ordinary cylindrical brush on a wood body is revolving at a high rate. Applying the new brush to the one in the lathe, turning it and moving so all parts are brought in contact, effectually pulls out and discards all bristles that will come out. The customer is thus assured that his brush will remain "full" throughout its life and that this solder when collected will be free from foreign matter.

Solder saving brushes represent the most elaborate form of machine brush. There are many other uses for cylindrical brushes, so that practice in this exacting field may serve as a guide for designers and mechanics who may come in contact with them in other fields. Principles are the same but less expensive construction is usually followed.

Cylindrical brushes are used to advantage for cleaning brushes in automatic machines, for feeding or placing sheets of paper or magazines in presses and folders, for polishing, and for a great variety of experimental work. The printing and allied trades are large users of cylindrical brushes. Where brushes handle liquids or paste, metal bodies must be employed and these are constructed along the lines just detailed. In other cases, the half bodies are made without caps but with a chamber throughout all but the short ends, which latter are finished to fit the shaft and then the two halves are screwed the shaft instead of to each other.

Various Types of Brush Bodies

For some work, the cheapest way is to use a piece of tubing, divided longitudinally, and having bushings in each end; four counterbored screws passing through the bushings fasten the brush to the shaft. But for average machine work, the brush body must have a relatively thick wall, otherwise there will not be bearing enough for the insert when under pressure to form a "strong" brush.

Wood brushes appeal to the buyer of experimental work because of their lower first cost and the possibility that the brush in its present form will not be ultimately used. Wood brush bodies should be made of maple or birch; there is nothing gained by using poor wood even for a temporary brush. The chambered inside is retained in the wood brush though for a brush of small diameter wire grooves may be cut with the point of a knife.

Some wood brushes are constructed with an extended body at one end. This extension is grasped in a socket or chuck at the end of the machine spindle.

(Continued on page 35)

Manufacturing Spacing Collars for Millers

Commercial Production—Disadvantage of Cast Iron for Collars —Danger of Breakage—Various Methods of Manufacture Considered—Selection of Material—Some Production Figures

By G. BLAKE

MANY OF the spacing collars supplied with milling machines are only cast iron, others are of mild steel left soft, and a few are case hardened and ground to size. The subject of this shop article is the manufacture of last-mentioned type on a commercial basis. The fault of cast iron collars is that they are liable to get burred up at the edges and even broken if accidentally dropped. They also get loaded up wtih small chips on the working faces and so ultimately bend the arbor out of truth. The fault of the soft collars is pretty much the same as that of the cast iron ones, omitting the danger of breakage, but accentuating the capacity for loading up with small chips on the working faces and thus bending the arbor.

Generally speaking, the job of making extra collars is relegated to the toolroom—a costly job these days. The methods employed there would in most cases be on the lines here below, viz., cutting the material to length (rough), chucking in 3-jaw chuck, centreing, drilling, boring, turning outside diameter, facing, recessing, radiusing the edges inside and outside and parting off, gripping in 3-jaw chuck, facing second end to length plus grinding allowance. For example, a spacing collar 1¼ in. long for 1 in. diameter arbor would take at least an hour, exclusive of overhead charges. Then the casehardening and grinding would also come out expensive, as toolroom costs are very high for both these items.

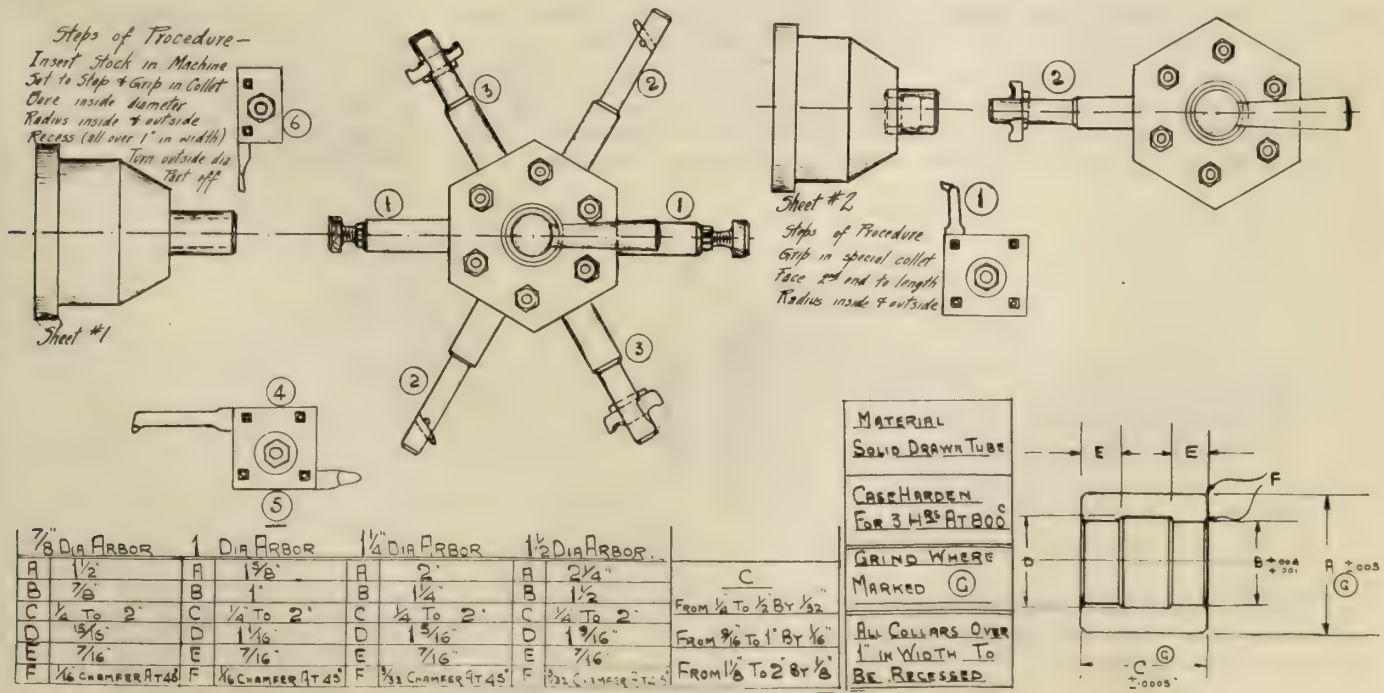
Now let us consider the methods employed in the manufacture of these collars. First of all material used is bright drawn tubing, the bore of which is practically size, requiring only a slight skim with the boring tool. The outside diameter also, being about size, requires only a skim over with the turning tool in the tool post on the cross slide. A capstan lathe is used for thi job. The layout sheets Nos. 1 and 2 show the method of procedure. The master schedule covering the whole series of operations clearly furnishes all information from the raw material to the finished article. As will be noted in layout No. 1 all idle movements are cut out by having two sets of tools in the capstan head. The rate of production for the 1st operation is 12 per hour for collars with recesses; for collars without recesses 20 per hour; for the 2nd operation 30 per hour. 3rd operation, stamping size on each collar, 48 per hour. 4th operation carbonize in batches of 50 in two boxes for 3 hours: 5th operation grinding diameter to size plus and minus .005 in. and length to size plus and minus .0005 in. 9 per hour. 6th operation: gauging bore, outside diameter and length: 120 per hour. The total cost, excluding overhead charges and material, works out at 11 cents per collar approx.

USE AND CONSTRUCTION OF CYLINDRICAL MACHINE BRUSHES

(Continued from page 34)

Generally, brushes of this type are for lighter service where it is possible to dispense with the counterbored, hole and wire method of fastening. This makes a simpler construction, for the body is then a solid round bar or, in some cases, the wooden body is made up of two halves screwed together. Non-hollow wooden brushes are drilled with a plain hole; the brush maker inserts a filling of half length straight in these holes and sets them in melted resin.

Mr. C. J. Smith, manager and secretary of the Montreal Warehousing Company, a subsidiary of the Grand Trunk Railway Co., has stated that his firm is calling for tenders to increase the capacity of the Grand Trunk elevator "B" at Windmill Point. The proposed additions, alterations and improvements will consist of an annex for storage of a million bushels, which will bring the total storage capacity of the elevator up to three million bushels. It is also the intention to install a car-dumping machine for unloading cars, as the present method of unloading by air shovels is not all that is to be desired. A second carrier is also to be built for delivering grain to ocean vessels. The project is to be rushed so that it will be ready for the opening of navigation.

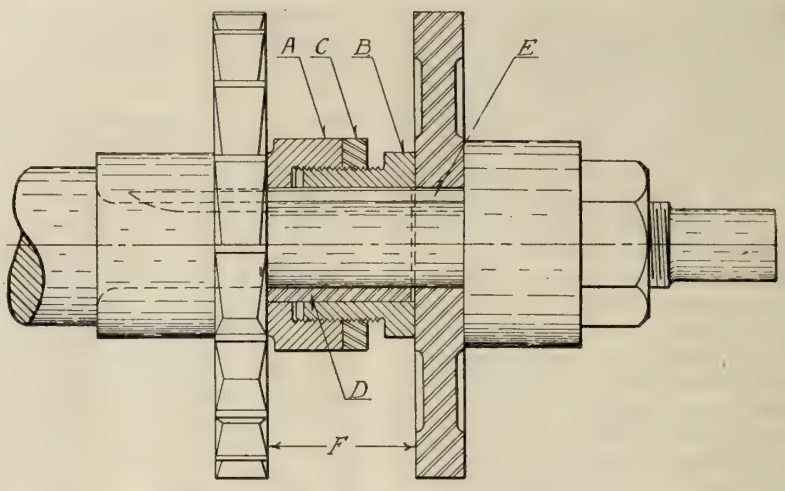


Tooling layout and data making spacing collars.

Practical Ideas from Practical Men

ADJUSTABLE DISTANCE COLLAR

The accompaning sketch illustrates a simple but effective way of adjusting side or face milling cutter to set dimensions. The regrinding of cutters naturally alter the diameter and width of face slightly, and where two or more cutters are used on a job, and must be accurately located on the arbor, the use of a collar such as here shown is quite valuable. The collar is made in three pieces, the width "F" being obtained by movement of the screw "B" in the nut "A," the collar being rigidly locked by means of lock-nut "C." The split bushing "D" is placed on the shaft so that adjustable collar will revolve freely while cutters move endwise over the key "E."



Adjustable distance collar for milling machine arbors.

MILLING SMALL RACKS

An interesting method of constructing a small cutter, for milling small brass racks, is shown herewith. The cutters "C" were made from sheet cast steel, bored, turned and teeth milled and backed off. After hardening, the cutters were assembled on the arbor "A," the intervening distance pieces "L" being made of sheet metal of a gauge pitch when firmly secured in position. In cutting the keyway, allowance was made so that teeth of cutters would be staggered when assembled. "R" shows the rack, and to the right is seen the method of holding a number in a small vise while the rack teeth are being cut.

NO ILLUSTRATIONS REQUIRED

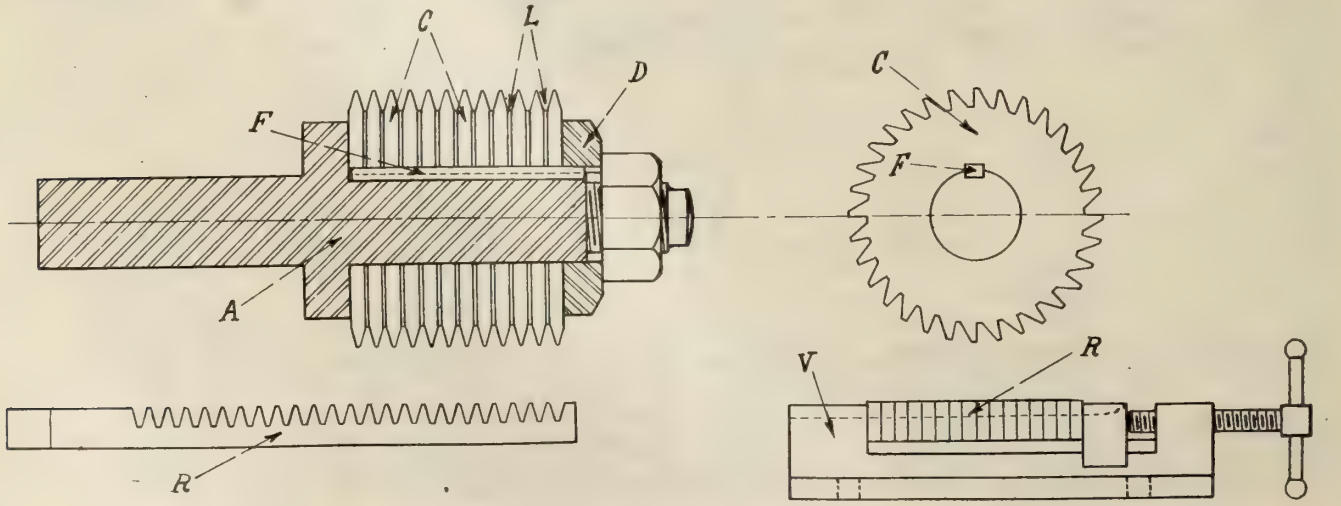
By D. A. H.

THE EFFECT of automobile practice upon machine shop and general factory work may be seen in the increasing use of ordinary grease cups in place of the old drilled oil hole. Cups of ⅛ in. and ¼ in. pipe size are the most common and these of sheet steel formed to shape. One objection to grease cups is the squeezing out of grease upon the fingers—it seems to be easier for it to work out through the loosely fitting threads of the cap than to exit through the ⅛ or ¼ hole that is pierced through the thread end. Such is the actual fact; the force exerted by screwing down the cap must overcome the resistance to entering the small hole in the end, must first compress and then finally push along any other grease in the bearing which is very apt to be hard and mixed with grit. Naturally, a line of least resistance is out under the cap.

If that little exit hole is drilled out to double its size, it will be found that the grease then follows the path that was intended, better lubrication results, and the unpleasant smeariness disappears. This grease cup trouble is most noticeable at locations where the movement is slight, such as rocker pins and shackles and center bolts, and not enough friction is generated to soften the grease.

A Hint About Bolts and Nuts

Planers, boring mills, drill presses, and millers have a bolt problem, all their own. We make a practice of going over these bolts periodically—sawing off poor threads to an even inch length shorter, dieing the bruised threads, and straightening bent bolts. They are returned to the rack with good nuts on and threads oiled. In spite of instructions to the contrary, machine hands are prone to put their full strength on a nut which is not all the way of a bolt—and this practice is hard on bolts and nuts. All the nuts on one machine are of the same size and we furnish a case hardened solid wrench to



Built-up gang cutter for milling small brass racks.

fit those nuts. In going over the bolts, the nuts are examined also. A poor thread condemns a nut. A nut with half-striped thread will ruin a number of bolts, and voce versa. We found it difficult to keep poor nuts from creeping back into service, either on the same size of bolt or tapped out a size larger. A re-tapped nut immediately slows up the machine hand for he then has two sizes to contend with and wastes time hunting or borrowing extra wrenches.

We adopted the plan of drilling the threads out of old nuts using a drill of the next larger bolt size—as a ¾ in. drill for a discarded ⅝ in. nut. The nuts were then put back in service for packing pieces and collars. Used as collars, they take the place of the heterogeneous collection that once filled the spaces between clamps and nuts and, having faced surfaces, there is now less bending of bolts and clamps. Drilled in this way there is little danger of the nuts being again tapped out for even an apprentice would not try to make a ⅞ in nut out of a ⅝ in. body.

Pipe Threading Practice

Pipe threads taper ¾ in. in diameter per foot of length. Although special machinery is used to considerable extent in threading cast iron fittings, the largest part of this work over 6 in. is done on lathes, thread cutting with chasers. The lathe makers supply manufacturers with headstocks that are built "set over" to half the taper and this produces the correctly tapered thread with the normal carriage travel. An interesting variation from this practice is followed by at least one pipe fitting manufacturer. His lathes are set to produce a finished thread tapered ½ in. to the foot. Then he gets the rest of the taper by setting the chasers at an angle of ⅛ in. to the foot instead of parallel to the line of travel of the carriage. The theory is that the extra scraping of the chasers tilted thus produces a better finish on the thread—and the product seems to bear this out.

Repairing a Chuck

A good 14 in. combination lathe chuck had been cracked through some carelessness—cracked clear across the face and the two edges. It was decided to try and repair the chuck by shrinking on a steel bar the full width of the edge. Accordingly one was made of ½ in. x 3 in., bored with an allowance of 0.003 in. per inch of diameter, and shrunk in place, wrench holes having first been drilled. The result was a true running chuck and one that appears as strong as in the original.

LARGE PULLEYS OFTEN HELP

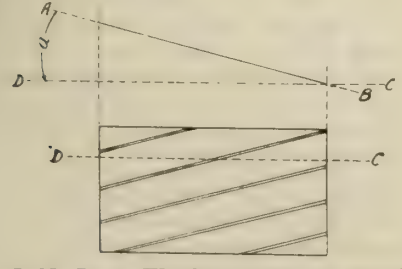
The belt reaches the shaft pulley. The strain drops to almost nothing and it runs back slack to the machine pulley. But, if this machine is not running smoothly, the belt is alternately let down and tightened up on the slack side, and each tightening makes a sharp sudden strain tending to tear the belt to pieces more and more, the slacker the belt is, acting just like a whip in its sudden tautening. One can readily see how this destroys the belt at fasteners and joints.

The size of the pulleys makes a difference in favor of belt service. The larger they are the less the strain and the better they hug the additional length of pulley surface. If a belt on 5-inch pulleys breaks down frequently, the pull on the same belt running over 10-inch pulleys will be just one-half, and the pulley adhesion just twice as great. Of course, the speed of the belt may be used on the enlarged pulleys to convey still more power, if necessary, where such a double belt would quickly wear out on small pulleys.—Belts.

Have You Ever Met Problems Like These?

TOOLROOM PROBLEMS

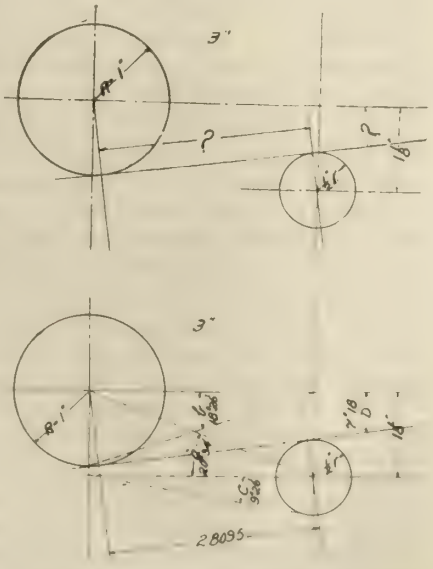
"Is there any method of finding the head of a spiral milling cutter," asks a reader, "this to be determined from the cutter itself?"



I. N. B. of Windsor, sends us the following solution. In order to determine the head it is first necessary to find the angle between the teeth and the axis of the cutter. Wrap a piece of plain white paper around the cutter and rub the cutting edge of one of the teeth with the handle of the file. This will make an impression on the paper which will be a straight line A-B when the paper is taken from the cutter. With the paper lying flat, draw the line D-C at right angles to the "roll" of the paper, this line D-C representing the axis of the cutter. Measure this angle with a protractor. Suppose the angle to be 15 degrees, the cotangent will be 3.732. This, multiplied by the circumference of the cutter gives the head. With a cutter 2½ in. diameter and angle "a" 15 dedegrees the head would be 2½ x 3.1416 x 3.732=29.3 inches, or one turn in 29-3/10 inches.

"Can the distance between the points of tangency on a line with the circles shown in the accompanying sketch be calculated?" asks a toolroom reader. "It is also desired to find the angle formed by the line of tangency with the horizontal line. How can these dimensions be found?"

I. N. B. of Windsor, sends us the answer herewith. First determine the angles a, b and c. Angle "a" is found by dividing the distance 1⅛ inches by the horizontal centre distance 3 inches, obtaining .375 the tangent of the angle, which form a table is seen to be 20 degrees 34 min. Angle "b" is found in a similar manner; 1 divided by 3 equalling .333, this being the tangent of angle 18 deg. 26 min. Likewise, the angle "c" is found to be 9 deg. 26 min., the tangent .166 being derived by dividing .5 by 3.



Angle of tangency or angle "D" equals (ang. "b" + ang. "c") — angle "a," or 7 deg. 18 min. Sine of angle "D" x 1 + sine of angle "D" x .5 = .1905 in. Horizontal centre distance 3 in. — .1905 in. equals 2.8095 in., distance between points of tangency.

* * *

We all have problems at some time or other, some of which we cannot solve. This department is being created to act as a clearing house for ideas, and co-operation of every reader is requested. The maximum benefit can only be derived through an interchange of opinions.

Have you a problem which is yet unsolved? Or have you solved some difficult proposition, which you believe others would like to hear about?

If you can answer "Yes" to either of these queries, then by all means send your story in to the Editors of Canadian Machinery. They will not only thank you for the interest shown, but will pay for all accepted ideas. Every plant has its problems. We expect a regular deluge of replies. See that we are not disappointed.

The Editors.

New Things in Shop Equipment

HYDRAULIC FORCING PRESS

A hydraulic press that is intended especially for forcing, pressing and bending operations in railroad and large machine shops has recently been placed on the market. The design of the press is that of the reversed cylinder type. The pump that is used in connection with the press, is only employed to actually supply the pressure, as a handwheel is used to quickly bring the ram to and from the work. The press is provided with gauges which indicate the pressure in tons. The press is manufactured by the Watson-Stillman Co. of New York City.

SQUARE ANVILS FOR FORM GAUGES

For some time past a truss form of snap gauge has been marketed, but this gauge is now appearing on the market with large square head anvils. The adjustment and locking devices are the same as employed with the other types of heads, namely two opposed headless set screws working in the frame pulling against each other. The desirable feature of a square anvil is that it permits of working up to a shoulder and gives a larger wearing surface. This square anvil is interchangeable with the round head type, thus new anvils may be substituted at any time. These gauges are manufactured by Pratt & Whitney Co., of Hartford, Conn.

FURNACES, BURNERS AND FORGES

A new line of burners, furnaces and forges has recently been placed on the market. The general design of these products is for the general run of shop work. It includes high-pressure, high-and-low pressure, and intermediate pressure burners. There is also a portable oil burning rivet forge which employs compressed air for atomization, an oil fired furnace that is designed for use in tempering punches, dies, tools and knives; a crucible furnace that employs either gas or oil as fuel, and intended for use in a variety of ways such as lead or cyanide hardening, soft metal melting, tinning baths and galvanizing; a forge for use in welding and miscellaneous forging work; and a furnace for handling of large forging work. The above products are manufactured by the Chicago Flexible Shaft Co., Chicago, Ill.

PORTABLE TAPER BORING BAR

A portable boring bar which has been developed primarily for taper boring operations has recently been placed on the market by the Pedrick Tool and Machine Co., Philadelphia, Pa. The design is such that straight boring operations can also be taken care of as well as tapered boring. The most interesting features of the tool lie in its portability, and its adjustability to suit any taper. The bar is equipped with two cross-heads upon which the same is supported on the part being machined. These cross-heads each have four adjusting set-screws which permit of the final and accurate centering of the bar. By preventing the hand wheel operating, constant and automatic feed may be brought into use, and gearing of the device may be driven by belt, electric motor or air drill. When a facing arm is used with the boring bar, the latter is held by spiders inserted in the bore of the work.

SPIRAL FLUTED EXPANSION REAMERS

A line of spiral fluted expansion hand reamers has recently been developed and placed on the market. All the desirable features of the ordinary straight fluted adjustable reamer as to range of sizes are contained in the new tool, and the advantage lies in the free and clean cutting qualities of the spiral fluted tool. These reamers are equipped with a lock nut to hold the size, and a safety stop which prevents over expansion, and indicates positively when the maximum limit has been reached. They can be obtained in all regular sizes. One of the distinct advantages of the spiral fluted tool is that holes with keyways can be reamed, with the same accuracy as a plain hole. These reamers are manufactured by Messrs. Pratt & Whitney of Hartford, Conn.

LARGE TRILOCK PLUG GAUGES

Some time ago references were made to the construction of large plug gauges made hollow for lightness. Such gauges are now on the market, manufactured in sizes of 2½ in. diameter and larger. The hollow construction feature applies particularly to the "Go" plug being lightened by a web and flange construction. This plug is of wider face than the "No Go" plug and therefore this feature of design is useful only at this point. Two disc type rings are forced into the "Go" plug from opposite ends of same, and into a tapped bore. This is done before grinding. These rings grip the central tube and hold the parts securely together. This provides a means of reversing the "Go" plug, or changing it end for end on its own end of the central tube. This reversible feature provides unusual wearing surface. Three prongs on the handle are forced into three grooves in the bushing, providing a three point self-centering tripod support, without rock or shake, the usual trilock method. A washer at one end and the handle at the other end bear on both the stay tube and the discs, binding the assembled gauge head to the handle. The gauge plugs are of course renewable, as well as reversible. These gauges are manufactured by the Pratt & Whitney Co. of Hartford, Conn.

AUTOMATIC THREADING LATHES

To meet the demand for increased production on automatic threading machines a new type of machine has recently been developed that is capable of taking extra heavy cuts. It is equipped with a geared head that will drive the work for anything from .002 to .020 in. chip feed per cut. Friction drive is replaced by positive clutch drive control on the back shaft. Tool slides have been broadened to accommodate heavier cuts and higher speeds. Tooling arrangements have also been improved. These machines are being manufactured by the Automatic Machine Co. of Bridgeport, Conn.

SPARK PLUG GAUGES

A new set of limit spark plug thread gauges is being placed on the market at the present time. It is made to S. A. E. standard limits and consists of a double end limit plug gauge of the Trilock reversible end type, a "Go" and "No Go" templet in one unit and a setting plug for the templet, consisting of two threaded members and one cylindrical plug for checking root diameter. The pitch diameter of the plugs are .841 in. and .843, the tolerance for tapped holes being .002 in. The templet pitch diameters are .836 in and .839 in., giving .003 tolerance on spark-plug body threads, and a neutral zone of .002 in. between maximum plug and minimum hole. The templet is of the improved adjustable type. The taper screw permits very fine adjustment of pitch diameter and when both locking and adjusting screws are tight the threads of the adjusting screw form a perfect dowel in both planes. The "Go" and "No Go" ends are placed very close together, for convenience in spinning onto work, and the unit is handled more readily than two separate templets, either handled separately or secured together, as is usual when gauging to limits. The "go" side of the templet is cut away for quick identification when using the gauge for rapid inspection. The reversible plug ends provide double the usual wearing surface. These gauges are manufactured by The Pratt & Whitney Co., of Hartford, Conn.

WATCHMAKER'S DRILL CHUCK

A tiny chuck designed for use on watchmakers' lathes and jewelers' drilling machines is a recent development in small tools. It is also for use in multiple drilling and tapping operations on these small sized machine tools. The

chuck is designed to hold drills as small as No. 80 which is 0.013 inch in diameter. The chuck has to operate at speeds up to 20,000 r.p.m. in order to obtain the efficient cutting speeds of such small drills. The body of the chuck has been machined with a tolerance of 0.0005 of an inch in order to obtain the correct balance to permit of such high speed operations. The chuck is ⅞-inch outside diameter, 1 5/16 inches maximum over-all length and weighs about two oz. The key or wrench is of the bevel pinion type, the chuck being similar in design to the "Super" type of chuck manufactured by this firm, the Jacobs Drill Chuck Co., of Hartford, Conn.

HAND FEED SURFACE GRINDER

There has been offered on the market a hand feed surface grinder that has, in addition to the swivel arrangement of the plain table, a provision for tilting it. These little grinders are precision machines and take care of a large volume and wide variety of work in the tool room. The tables are provided with "T" slots to accommodate a magnetic chuck, a vise, or other fixtures. An efficient trueing device, conveniently located on the wheel hood, dresses the grinding wheel, straight or at any desired angle, without removing the work from the table. A Radial trueing device which operates from the grinder table can also be furnished. In the new type of machine, provision is made for tilting the table at any desired angle, the apparatus being graduated in degrees. This tilting arrangement does away with the customary shop practice when grinding at vertical angles on a magnetic chuck, of tilting, or blocking up one edge of the chuck. This practice gives an uncertain support to the chuck which is conducive to vibration. The tilting table provides a rigid method of clamping the chuck directly to the solid table. This machine is manufactured by the Wilmarth & Marmon Co., of Grand Rapids, Mich.

SWING CUT-OFF SAW

There has recently been placed on the market a swing cut-off saw driven by an electric motor directly on the saw arbor. The advantages of such a design are obvious, because there are no belts, no pulleys and no countershaft. The arbor revolves on ball bearings and the guard is self contained. The type of motor used as standard on this design of swing saw is furnished only in two or three phase, 60 cycle, 220 or 440 volts, A.C. to 3 horse power at 300 r.p.m. The motor is of the shaftless type assembled on the saw arbor. A 16 in. diameter saw with a guard and handle integral with the frame is furnished. There is no power lost in transmission through the pulley belt and countershaft, as these parts are eliminated. Thus, as the moving parts are reduced in number, efficiency is obtained, there is less to get out of order, and the machine requires a minimum of attention. Another feature is that the operator is not exposed to the danger of a broken belt, which might cause direct injury or throw odd blocks around. The control of the motor is through the medium of a push button located directly above the motor in the frame. The machine is manufactured by the Oliver Machinery Co. of Grand Rapids, Mich. and is known as their saw No. 36. This same saw can be furnished motor and belt driven in the old design.

UPRIGHT DRILLING MACHINE

A 32 inch electric drilling machine, driven by a motor of the vertical shaft design, is a recently developed tool. The motor is mounted on the top of the column. The armature shaft is hollow and the spindle of the machine extends through the hollow shaft. The hollow motor shaft does not drive the drilling spindle directly but through a train of plain and sliding gears which gives nine spindle speeds. The feeding mechanism provides for six feeds ranging from six one-thousandths to thirty-five one-thousandths per spindle revolution. The table is equipped with the usual facilities and adjustments, and can be supplied in either round or rectangular types. The standard motor supplied is of the reversing type, which feature is useful in tapping operations. Either alternating or direct current motors are provided, 3 h.p. for ordinary work, and for rapid work a 5 h.p. motor running 1,800 r.p.m. is recommended. Some of the principal specifications are as follows: Maximum distance from base to spindle nose, 56 inches. Minimum distance from base to spindle nose, 15½ inches. Vertical traverse of table, 16 inches. Maximum distance from table to spindle nose, 37 inches. The machine is capable of driving a 3-inch high-speed drill through steel, and weighs about 3700 pounds. Placed on the market by Prentice Conradson of Green Bay, Wis.

NEW CHAIN PIPE WRENCH

An improved design of drop forged, double jaw, chain type of pipe wrench has recently been placed on the market, in seven sizes with capacity suitable for use on pipes and fittings from ⅛ inch to 16 inches diameter. Two types of chains can be provided, either the cable or flat link chain. Several weak points, developed in extensive use and exhaustive tests of previous designs were taken into consideration, and it is claimed that the undesirable features have been eliminated in the new design. The tendency of the jaws to work loose on the bar with the resultant spreading of the rear end of the jaw and the wedged or jammed chain, has been done away with. The jaw-sockets are provided with considerably increased bearing surface. Two hardened chrome nickel steel bolts hold the jaws rigidly in place under conditions of severe use.

The rear bolt is located directly under the chain socket where the spreading is greatest. Chain guides are provided on the jaws to protect the finished end of the bar from wear and tear of the chain, and also to make the adjustments of the chain easy and convenient. In addition, the guides prevent the chain from jamming in the end slot of the bar. The handles are forged from high carbon steel and have the stiffness and spring needed to stand up under hard service. The drop forged jaws are made from special steel, treated, hardened, and tested for toughness and lasting qualities. The chains are of the best quality and tested to insure proper service. This wrench is manufactured by the Armstrong Bros. Tool Co., Chicago, Ill.

TOOL ROOM LATHE

A 14-inch tool room lathe which is driven either by a cone pulley or an all-geared head has recently been developed. In the all-geared head all gears run submerged in oil. The spindle speeds are arranged in geometrical progression from 13 to 326 revolutions per minute. The speed changes can be accomplished while the machine is in motion. The spindle is equipped with a friction clutch which stops the spindle immediately when the clutch is disengaged. The spindle bearings are oiled from a reservoir. The quick change gear box is equipped with a tumbler and eight gears, the setting and operating of which is by means of a lever. This gear cone permits of 48 different threads and feeds. The feed box is easily disengaged. Extra gears are provided which when used, permit of an extremely wide range of feeds and threads.

The apron is of a box construction and all gears are enclosed by a plate on the rear side. Provision is made for disengaging the rack pinion from the rack when desired. A sensitive clutch for throwing in both the longitudinal feed and the cross feed is located in the apron. A separate feed rod and reversing rod are provided. The lever for reversing the feeds is located on the apron. Collars that can be set in any desired position on the feed rod provide automatic stops for the carriage. The lead screw is directly connected to the cone of gears in the feed box. Micrometer stops are provided on the cross slide. The tail stock is clamped by a device at the back but which is conveniently operated from the front. Boring and counter-boring operations are facilitated by the provision of a collar on the tail stock which is graduated to 0.001 of an inch. A relieving and a taper attachment are both provided. The latter is so arranged that no strain is placed on the attachment, which is graduated both in degrees and in inches per foot. When it is desired to drive the lathe by a motor, it is supported on a bracket attached to the back of the left hand leg and thus the necessity of an idler pulley is eliminated. Manufactured by the Rockford Tool Co., of Rockford, Ill.

A large amount of construction work is projected, much of which will be proceeded with during the present year. The greater part of the new tonnage now being placed is for structural steel. The various industries are buying moderate tonnages as necessity dictates.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron Steel, and Metal Working Industries.

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Prices Are Coming Down

THE CANADIAN markets show over twenty price changes this week. Scrap metals are hit worst of all. It is significant that every change is downward, and not upward, as dealers often hint is likely to happen, but for which Canadian Machinery has had no hope whatever. There can be no real revival of business until costs and production get to the same low prices as our basic industry, agriculture.

This is worse than a buyers' market, because at present prices consumers positively refuse to buy excepting for a few necessary requirements. Dealers are beginning to realize the foolishness of resisting the inevitable, and are again making an effort for buyers, by a further reducing of prices.

The losses incurred by dealers in iron, steel and scrap, not to consider other lines, have been very heavy, amounting to hundreds of thousands of dollars. In the meantime, the consumer is having his revenge for the days when he had to plead, figuratively speaking, on his knees for any desired material.

Let Us Save All We Can

THE AMOUNT of material wasted annually in machinery plants is enormous. A casual walk through the warehouses and yards of any large scrap metal establishment would convince even the most skeptical of the value of scrap reclamation.

We recently visited the premises of one such firm and while expecting to find a considerable amount of scrap, the actual conditions were even worse than we had anticipated. One pile alone contained over 60,000 pieces of scrap which were only five thousandths under size. What the pieces were originally intended for is immaterial. The point is that carelessness was costing this plant an immense amount of money. Unfortunately these particular articles were so constructed that reclamation was impossible and the loss was thus a double one.

Many pieces, however, reach the scrap yard which could easily be reclaimed. In one scrap warehouse we visited, special piles, consisting of material purchased as scrap, were being saved to sell at a very large profit.

Railway shops are now firm believers in scrap reclamation. The C. P. R. have a very complete reclaiming department at Montreal which is more than paying for itself. In the summer, when haulage is most favorable, the scrap is sent to the reclaim section to be carefully sorted over. The various parts are reclaimed, arranged and reassembled into articles which can once more be used. Those interested in this matter can refer to our September 2, 1920, issue, which gives a detailed account of the department we speak of.

Every plant cannot go into the reclaiming business on as large a scale as the C. P. R., but any firm can adopt a method of recording the percentage of scrap passing through the factory, and arrange to have scrap material sorted over. Those who have never done this will be agreeably surprised at the results. Instead of a miscellaneous pile of material, commonly termed junk, being placed on the scrap dealer's wagon, any plant can see to it that when a dealer calls for junk, that is what he gets, and not valuable material. Some metals command a better price than others, and a man's time is well spent sorting the material over.

Employ an intelligent man for the purpose, otherwise you may defeat your object. A good man may cost more per hour, but he will in turn save more. A conscientious man is necessary, one who feels an interest in his work, and enters into the spirit of it. A bonus on the value of material salvaged is one good method of securing efficiency, this value to be determined by the foreman.

Coal Prices Must Come Down

ON PAGE 50 appears an article on "How Dear Coal Costs Railroad Jobs." It shows that so called loyalty to one's business or union may often be bad for one's own personal interests. An alliance between the United Mine Workers and the railroad brotherhoods would be an unwise step for both parties. To pool the wage question would only make matters worse, and the railroad unions would be putting their finger in their own eye.

Even at the present time we find railways all over Canada and the States laying off employees owing to lack of traffic. To fight the much needed wage reductions would only aggravate existing unsatisfactory conditions and force the railways to further curtail their staffs.

Loyalty is all right in its place if the cause is just, but to be loyal to a union, society, firm or other concern merely because you have a sentimental interest in the matter is the height of foolishness. The biggest men in the public eye have at times stepped aside when they felt their party, or firm, was not serving the country as it should. This is true loyalty.

Concerns of a speculative character would do almost anything to have the names of such men on their lists of directors for stock selling purposes, but they know how futile any attempt to secure their consent would be. Loyalty, tempered with common sense, is an ideal combination.

A census taken of manufacturers in the United States shows that in 1919 there were 289,768 manufacturing establishments employing an average number of 9,103,200 employees. The factory value of the products turned out represented the total of $62,910,000,000 or $25,537,000,000 more than the cost of materials used.

Recent Developments in Mechanical World

Scrap Metals Show Drop in Price

Non-Ferrous Metals Taper Off In Montreal—Steel Market Weak In Toronto and Montreal—Machine Tools Considerably Brighter—Small Tools and Supplies Continue Active

BETTER FEELING IN ALL MARKETS

TWENTY-three reductions in price have taken place on the Canadian market this week. Scrap metals have been hard hit, boiler plate, heavy melting steel, scrap rails, malleable scrap, cast iron No. 1, wrought pipe car wheels, cast borings, and stove plate all being affected. It is an effort on the part of dealers who are carrying big stocks to stimulate business on rumors of the withdrawal for an indefinite period of one of the most important buyers.

A larger discount on several milled products is now in effect. Iron pipe fittings are also cheaper.

Pig iron is not much in demand, but sheets are fairly steady. The steel market locally is none too brisk, and this same condition holds good for Montreal. Competition continues keen, price shading being the rule. No reasonable bid is turned down.

Machine tools locally continue to improve. They are even better than noted in last week's report. Dealers are discovering prospects in unsuspected territories, and are following up such business closely with the result that some much needed orders are being secured. Montreal reports machine tools to be very quiet.

A decided improvement has taken place in the demand for small tools and supplies. Garage dealers, and the automotive trade generally are both responsible for the increased sales. Compared with the peak days, sales are far from normal being around 45 per cent., but the volume of existing business is encouraging under the present circumstances.

A spirit of confidence exists on all markets which is worth noting. This feeling is getting stronger every week, and dealers are sure the turn has been reached, and that once spring opens up, so will business.

Toronto Markets

SO FAR this week, twenty-three price reductions have taken place on Canadian markets, the majority being in scrap metals.

Scrap boiler plate dropped $3, being now quoted at $9; heavy melting steel is down $2, to $12; scrap rails are selling at $12; malleable scrap at the same figure, and No. 1 machine cast iron at $19.

Wrought pipe is quoted at $6, in place of $8, and car wheels are selling at $18. Stove plate is quoted at $16, and cast borings at $6. Compared with 1914 prices, these figures range from 10 to 40 per cent. above the price existing at that time. The demand in these lines has been so slight, that dealers decided to make the move in an effort to stimulate business. Manufacturers are purchasing only for immediate requirements, this preventing dealers unloading their large stocks of scrap. The great majority of this material was purchased at high prices so that dealers will simply have to wipe off their losses. Following are the new prices in table form.

Boiler plate	9 00
Heavy melting steel	12 00
Axles (wrought iron)	20 00
Rails (scrap)	12 00
Malleable scrap	12 00
No. 1 Machine cast iron	19 00
Pipe, wrought	6 00
Car wheel	18 00
Steel axles	18 00
Mach. shop turnings	6 00
Stove plate	16 00
Cast boring	6 00

Pig Iron.—This market is still quoted at $27.15, but even at this figure the demand is very light. Until foundries open up, no change is expected.

Non-ferrous Metals. — Local prices remain firm, but demand is very light. Montreal made a few changes to this section of the market, lake copper, electric copper, and spelter being the metals changed. However, the reduction made in Montreal field merely brings them more in line with local prices.

Machine Tools.—Increased business is reported in this section. Orders have not been for large quantities, but several dealers are quite sure the worst is over. The majority of orders secured have been obtained by very hard work, and close follow up. In fact the most out of the way fields are being combed for business, with surprisingly satisfactory results. One dealer aptly expressed the situation by remarking that in the present market you can never tell where your next order is coming from.

Milled Products.—Several new discounts have come into force on milled products. Below are given the different changes.

Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 2 in.	Less 25%
Semi-finished nuts 1¾ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins	Less 60%
Planer bolts without fillet	Plus 25%
Planer bolts with fillet	Plus 35%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 60%
Thumb nuts	Less 85%

Small Tools and Supplies—Business in the small tool market continues to improve. The volume of orders received last month was much better than even the dealers themselves expected, and the present month is also showing up to good advantage. Prices remain steady, no change is expected, as several reductions have already taken place.

Steel Market.—A little better feeling exists in the demand for steel. Nothing is featured, any call being general in character. Prices remain unchanged, but shading exists in some lines. February is never a bright month for the steel trade, but it is a little better than was expected under present conditions.

Miscellaneous.—Pipe fittings show several changes this week. Cast iron fittings record a larger discount, also malleable bushings, unions, and plugs. Following are the new discounts.

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

Oils and greases are not much in demand, manufacturers only purchasing for immediate requirements. This same condition holds true in other lines, but apart from the changes recorded in this letter, and on the quotation pages, other prices remain firm.

The proposed new machinery hall for the Toronto Exhibition may not be erected this year. In fact it is hardly likely that it will be. Location and plans seens to be the chief difficulties at present, and in about a week this matter will be discussed and probably settled. Plans for the new structure

will be gone into, and it is very likely that somewhere near the Strachan Ave. entrance will be chosen as the new location.

Montreal Markets

THERE has been no marked improvement in the Montreal field during the week. Steel is listless, no drop in steel prices has occurred, but owing to scarcity of orders, shading continues. Jobbers are experiencing keen competition with the sales representatives of the mills, and do not appreciate the situation.

Pig Iron.—The price reduction which occurred a few weeks ago on this metal has not helped the volume of business. The effect of the reduction may not be felt for some time yet, and generally speaking, things are very quiet.

Non-Ferrous Metals.—This section continues weak, and several prices have been shaded a little. Lake copper has dropped from $17.50 to $17.25; electric copper is down to $17.00; copper castings to $16.75, and spelter $7. Apart from these figures the other metals remain the same.

The large users of metals are operating at only a small fraction of their capacity, and little raw material is being purchased. There is no prospect any change. Following are present quotations:

Lake copper	17 25
Electric copper	17 00
Castings, copper	17 25
Tin	35 50
Spelter	7 00
Lead	6 50
Antimony	6 50
Aluminum	24 50

Scrap Metals. With pig iron, steel, and non-ferrous metals all quiet, it is only to be expected that the trading in scrap would be light. Little or no business is offering and prices are weak.

Machine Tools.—Conditions are very quiet on this market. Machines are being purchased more intelligently than heretofore, but orders are not frequent. Dealers are scouring the territory for prospects, in the hopes of stimulating this branch of the market.

Small Tools and Supplies.—Dealers are securing good business in the above mentioned lines. Competition is keen, but clean cut. Garages are proving a good source of business, and have helped to increase the sales. As manufacturing plants are not very active at present, the volume of business is bound to increase when things start to open up. This means that for the next few months we can look for a gradual, but steady improvement in demand.

Miscellaneous.—Plates are very quiet, also merchant bars while sheets are fairly active. The prospects for a busy building season look rosy, in fact construction is going on in many quarters at the present time. Apartment building is being pushed, and the Foundation Co., are actively engaged on the preliminary work on the new Provincial Government Building.

The G. T. R. have announced that they will increase their elevator capacity at the Port of Montreal by building an addition to the Windmill Point Elevator, capable of accommodating an additional million bushels of grain. They also intend to install a car dumping machine, and a second carrier for delivering grain to ocean vessels. C. J. Smith, manager of the Montreal Warehousing Co., under whose jurisdiction the G. T. R. elevators come, has already called for tenders. The present intention is to have the car dumping plant, and the additional loading facilities completed and in operation by the time navigation opens. The addition to the elevator should be ready for grain about the first of June, or in any event in plenty of time to take care of any demands made upon it by the 1922 crops. These various projects all have their bearing on the steel trade and are supplying a small amount of business all the time.

Pittsburg Markets

PITTSBURGH:—(Special to Canadian Machinery.) Steel ingot production in January shows that the steel demand was heavier than expected. As noted in previous reports, while there was sharp competition for months, it became more widespread and vigorous right after the first of the year. Apparently the condition was, that each mill preferred not to let its competitors know how much business it was doing, lest still sharper competition would be provoked, and assumed that its competitors were not doing well or they would not make such close prices on small orders.

It was an increase in demand, rather than an absence of demand, that increased the price competition. That is according to precedent in the steel market. In a dull market, when there is no business, the mills "sit tight." When there is business, and they have not enough, they go for it. The character of the steel market for some time to come is plainly shown. There will be a moderately fair demand, decidedly better than the demand in 1921, and the orders placed will be small individually, but numerous, all for prompt shipment. It will be hand to mouth buying, the kind mills frequently refer to of being not much account, but what they mean is that it does not give them a chance to schedule their rollings efficiently or advance their prices. Given a certain consumption, the tonnage of steel is the same whether the purchases are for prompt or extended delivery.

Steel Production.—Reverting to the report on January steel ingot production, the American Iron and Steel Institute reports each month the production of 30 companies, which make something like 85 per cent. of all the steel ingots, and a close estimate can be made of the production of the industry. In approximate figures, the industry produced steel ingots at the rate of 22,750,000 gross tons a year in January, 19,750,000 tons in December, 23,000,000 tons in October and November, and 11,000,000 tons last July, viz, the low point, when there was extensive liquidation of stocks of steel in the hands of jobbers and manufacturing consumers, and liquidation of stocks of manufacturers of steel.

The increase in the rate from 19,750,000 tons a year in December, to 22,750,000 tons a year in January does not tell the story of the rapid increase in demand. It will be understood that in a market like this, when purchases are deferred to the last moment and mills fill orders very promptly, the rate of steel ingot production reflects accurately and quickly the volume of buying of rolled steel. During December, with an average for the month as indicated, the rate was going down, and was below 18,000,000 tons at the close of the month. Starting from this low rate and making an average as indicated for January, the rate at the close must have been well above 23,000,000 tons. That is, the rate increased in one month by fully one-third.

The low demand for a while was due chiefly to its being winter, for when buyers are buying only as they are forced to do so, holidays and inventory would not stop them. The spring demand is beginning to develop, and there is ever reason to believe that its top point will be well above what has been shown. Last autumn's demand, which came after liquidation of stocks was practically completed, brought a rate of ingot production for two months of 23,000,000 tons. This spring will no doubt witness a rate of between 25,000,000 and 30,000,000 tons.

As underlying conditions gradually improve, each wave of demand should rise higher, and next autumn should see something heavier still. In the past, seasons have not made much impression on steel buying and steel production, because the steel capacity was smaller and the mills had to run more steadily, while buyers anticipated their requirements, out of season, to make sure of deliveries. Now they need have no concern on that head, and so steel production will rise and fall with the season.

Prices Irregular.—The steel market as a whole cannot be quoted. There are certain regular, nominal, or asking prices, which have not changed for nearly two months, but week by week departures from these prices have become more frequent, in two ways, by concessions being made on smaller tonnages than formerly, and by mills in various sections departing from "Pittsburgh plus" or the system of having a standard Pittsburgh price and quoting delivered prices at that figure plus the rail freight from Pittsburgh to point of delivery.

The regular prices, for leading commodities, are: Bars, shapes and plates, 1.50c.; standard steel pipe, 71 per cent. basing discount; plain wire, 2.25c.; wire nails, $2.50; blue annealed sheets, 2.25c.; black sheets, 3.00c.; galvanized sheets,

(Continued on Page 43)

4.00c.; tin plate, $4.75. The sheet prices are quite well held, while all others are shaded more or less. On moderate sized lots 1.40c. can be done on bars, shapes and plates, and $2.40 on nails, for instance. South of the Ohio river, on account of the Ironton district mills, the Pittsburgh basis is commonly ignored. In bars, shapes and plates, Chicago has had a market of its own for a long time, and Buffalo for a shorter time, while the east generally now has its own prices when anything like large lots are involved.

Tonnage.—The Steel Corporation's unfilled tonnage at the end of January is reported at 4,241,678 tons, showing a decrease of 26,736 tons during January, against an increase of 17,872 tons during December. The important point is how much steel the corporation is permitted by customers to ship, it being of no consequence whether the shipment is against a contract placed in 1920, or a new order placed the day before. The corporation's shipments in January were about 650,000 tons, or approximately the same as in December, representing 47 or 48 per cent. of capacity.

Pig Iron can hardly be said to be quotably changed but the market appears to be somewhat easier. Regular quotations remain at $19.50 for Bessemer, $18 for basic and $19 for foundry, f.o.b. valley furnaces, with $1.96 freight to Pittsburgh. A lake front furnace has sold 500 tons of foundry iron for delivery at Pittsburgh at 50 cents less than the cost of valley iron would have been at $19, furnace. Lake front furnace competition is generally more or less a factor in Pittsburgh when demand is light.

Connellsville coke has been stiffening, doubtless on account of the general belief that there will be a suspension at the union bituminuous coal mines, April 1, which would throw still more coal demand upon the Connellsville region. It is difficult to pick up spot foundry coke now at $3.75, at least for a fair grade, while one favorite brand, long held at $4.25, is temporarily withdrawn from the spot market on account of the requirements of holders of regular contracts for the brand.

SECURE CANADIAN PLATE BUSINESS

A NOTICEABLE improvement has taken place in the British tinplate trade, according to H. M. Trade. Commissioner, Toronto, and it is estimated that the present output is about 75 per cent. of the normal pre-war capacity. The number of mills now in operation is said to be sufficient to absorb all the available labor and quite a number of works have enough orders to last them for a few months. Buyers are showing much greater confidence in the market and a feature of the last few weeks has been the number of option contracts placed by merchant firms for forward deliveries.

The Welsh tinplate makers were recently able to secure, in the face of American competition, an order for 150,000 boxes of tinplates for the British Columbia packing industry. Their success was in no small measure due to the low freight rates now ruling direct from Swansea to Vancouver. The British Columbia market has practically been a preserve of the U.S. tinplate manufacturers for the last ten years.

Stainless Iron

Referring to developments regarding stainless iron, it was pointed out that experiments have for some time past been conducted with the object of producing material possessing the rust and stain resisting properties of stainless steel, but so ductile that it can be employed for purposes for which stainless steel, by reason of its hardness is unsuitable, especially for cold working in articles of intricate shapes, and for articles where. although they may len themselves to manufacture in stainless steel, it is impracticable to apply the heat treatment which rustless steel requires.

GREAT BRITAIN LANDS MANY CONTRACTS

"DEVELOPMENT WORKS have been held up all over the world since 1914, and although the economic situation is still retarding normal progress, demand is accumulating and must be satisfied sooner or later," says Albert S. Spencer, member of the Steel Structural Committee of the British Engineers' Association.

"In Great Britain we have structural materials of all kinds ready to hand," continues Mr. Spencer, "but steel has forced its way to the front as the most reliable and economical of them all for the main structural parts of industrial and other important buildings. This is true of most countries abroad, as well as at home, since steelwork, apart from its low cost, can be imported all ready for assembling by local labour. In pre-war days the structural steelwork for a multiple-storeyed building was obtainable for about 20 per cent. of the total cost of the building. To-day, owing to the relatively low cost of structural steel as compared with other building materials, the proportion is nearer 10 per cent. These figures are eloquent of the economy inherent in structural steel, whose other advantages are:

"I. Area for area steel will support 35 times as much as stone and 140 times as much as brick; therefore a steel-framed building is considerably lighter than one of brick or stone. It is the only possible material where a multiple-storey building is to be erected on a limited site.

"2. The steel-framed building, although having less mass than one of brick or stone, has greater stability if properly designed, and is better able to withstand such natural forces as wind pressure and the strains set up by earthquakes and similar disturbances.

"3. Structural steel work can cover large spans. Compare almost any steel-framed building with one of reinforced concrete, brick, or stone. In many cases the lower storeys of the latter have the appearance of a series of alleys rather than the spacious rooms obtained by the use of steel. This advantage is very great when rent value is being determined.

"4. Other advantages of steel-framed buildings are: Better facilities for utilising natural light; ease of reconstruction when internal rearrangement is necessary; and speed of erection, enabling the variaus trades to operate on any part of the structure, even to the point of working from the roof downwards."

Mr. Spencer goes on to point out that Great Britain has landed many important contracts abroad recently, and mentions the following:—A fifteen-span bridge over the Ganges, involving 30,000 tons of steel; the steel structural work of the market at Johannesburg; the railway station at Retiro, Buenos Aires, involving 2,150 tons of steel; the power station at Melbourne, involving 5,000 tons; a railway viaduct for Bolivia, 240 metres long and 93 metres in height; the wharf sheds and jetties at Rangoon (this was a contract worth about £250,000); and the structural steel and bunkers for a generating station in Alaska.

METHODS OF REDUCING MANUFACTURING COSTS

(Continued from page 31)

items that he was able to undersell all his competitors and still increase his profits.

Elimination of Waste

"In the elimination of waste each plant has its own problems. Waste may result from low production, an interruption of production or idle machines. Improper buying, idleness in certain sections of the plant, improper sales policies, all have their share in augmenting waste. Labor turnover, the hiring of unskilled workmen, the prevalence of disease among the workers, are all factors. Waste may be lessened by the use of labor-saving machinery, greater thrift in power, the use of proper lubricants, covering the pipes with insulated material to conserve heat in its transmission, better bearings, the adjustment of leaky valves, and keeping the machines free from dust and dirt so that they will operate smoothly.

"The use of conveyors or chutes to carry articles from floor to floor cuts costs on both labor and power. One organization which finds it necessary to use elevators, times its one-man trucks so that they load an elevator to capacity without delay.

"How do you keep your department always moving so rapidly and at such a high grade of efficiency? I asked one man.

"'My department is always overpaid and understaffed!' he replied sententiously.

"Modern methods of cost accounting have enabled us to put our finger on many of our troubles but they have not solved them all."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—

Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago.	**30 00**
Standard low phos., Philadelphia.	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$ 2 90
Steel bars, base, Toronto	2 90
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	**6 00**
Band steel, No. 10 gauge and 3-16 in. base	3 40
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points	C.L.	L.C.L.
Montreal	**58**	**78**
St. John, N.B.	**84½**	**106½**
Halifax	**86**	**108**
Toronto	**38**	**54**
Guelph	**38**	**54**
London	**38**	**54**
Windsor	**35**	**50½**

Current surcharge, 3 per cent.

METALS

	Montreal	Toronto
Lake copper	*$17 50	$17 50
Electric copper	*17 00	17 25
Castings, copper	*16 75	17 00
Tin	35 50	34 50
Spelter	*7 00	7 50
Lead	6 50	6 75
Antimony	6 50	8 00
Aluminum	24 50	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT
Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.08	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C
Per 100 feet.

Size	Below Dividing Line—Price Steel Blk.	Steel Galv.	Pre Foot. Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	**6 00**	**6 00**
Red brass turnings	7 00	6 00
Yellow brass turnings.	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	*$9 00
Heavy melting steel	9 00	*12 00
Axles (wrought iron)	**20 00**	**20 00**
Rails (scrap)	8 00	*12 00
Malleable scrap	12 00	*12 00
No. 1 machine cast iron	22 00	*19 00
Pipe, wrought	8 50	*6 00
Car wheel	22 00	*18 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	*16 00
Cast boring	3 00	*6 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	*47½
Coch and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine screws, fl. and rd. hd., steel cut thread	**37½ & 10**
Machine screws, o. and fil. hd., steel cut thread	**30**
Machine screws, fl. and rd. hd., brass cut thread	**15**
Machine screws, o. and fil. hd., brass cut thread	**30**
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	*75v.
Nuts, hex., tapped off net list	75c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	*$5.50
Structural rivets, as above	*5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	* Less 40%
Square and hexagon head cap screws	* Less 50%
Round head cap screws	**Plus 10%**
Fillister head cap screws	**Less 10%**
Flat head cap screws	**Net list**
Button head cap screws	**Plus 10%**
Studs	* Less 35%
Semi-finished nuts up to and including 1-in.	* Less 60%
Semi-finished nuts 1⅛ to 1¼ in	* Less55
Semi-finished nuts 1⅜ to 2 in.	*Less 25%
oiunplCg $y wkfg foghm fafhm dfffm	
Coupling bolts	* Less 10
Taper pins, No. 2 to No. 5	* Less 60%
Planer bolts without fillet	* Plus20%
Patch bolts	* Plus 50%
Hollow set screws	* Plus 10%
Thumb screws	* Less 85%
Thumb nuts	* Less 60%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 90
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb.	*0 07
Packing, square braided	**0 38**
Packing, No. 1 Italian	**0 44**
Packing, No. 2 Italian	**0 36**
Pure Manila rope	*0 23
British Manila rope	*0 19
New Zealand hemp	*0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto **Net**

*—Star Denotes Price Change

Solder, strictly	$ 0 25
Solder, guaranteed	0 27
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
S.S. drills for wood	*10
Wood boring brace drills	*55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	*20	*28
Class C	*13	*20

Cast iron fittings, *30%; malleable bushings, *32%; cast bushings, *32%; unions, *47%; plugs, *30% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 50	....
Galvanized sheets, No. 28		*5 55
Queen's Head, 28 B.W.G.	7 25	.....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	*5 55
Premier 10¾ oz	6 50	*5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sixes resjectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	*37 50
Black oil, per gal.	*21 00
Cylinder oil, Capital	*66 50
Petroleum fuel oil. bbls., net	*10 40
Pure turp., single bbls. gal	1 35
Linseed oil, raw, single bbls.	1 00

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Popular	9
Standard	10½	Keen	7½
No. 1	13	Fancy	13½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored. 13
Mixed colored. 14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

An order-in-council has been passed authorizing the expenditure of $35,000 on steel rails for the Government railway.

General contract for electrifying a saw-mill at the cost of $60,000 for Thurston, Flavelle, Limited, Port Moody, is awarded to a Vancouver firm.

Preparations are being made for an early break up of winter in the Northern Ontario mining districts, and provision will be made by the Northern Canada Power Company to have plenty of power available for active operations, which are expected to surpass those for some years back.

Ontario has an overwhelming lead in the production of rubber goods, employing 7,655 persons as against 826 in Quebec province. Quebec leads in the manufacture of rubber footwear with 4420 employees as against 2,410 in Ontario. In all there are 24 rubber manufacturing plants in Ontario and only eleven in Quebec.

At the February meeting of the Toronto Association of Purchasing Agents an interesting talk on "How to Buy Coal" was given by the guest of the evening, E. C. Hanson The subject was received with great interest, in view of the threatened coal strike on April 1st. The annual election of officers of the association will take place at the March meeting.

The waterworks commission of Brantford, Ontario, plans for an addition to their pumping station including installation of three gauge centrifugal pumps with electric motors. The cost will be about $250,000. The city council of Goderich, Ont., plans improvement to waterworks system including erection and equipment of a new pump house, cost to be about $40,000.

To complete the plans for the successful manufacture of Saskatchewan lignite on a commercial basis, Hon. Charles Dunning stated that it would require an additional $250,000 to carry out the work. About $800,000 has been expended to date. It is expected that the required money will be granted jointly by the Federal Government and that of the Provinces of Manitoba and Saskatchewan.

The volume of trade between Canada and the United States was reduced approximately 45 per cent. during 1920. The value shows a decline of over $200,000,000 on Canada's exports to the States and a drop of nearly $400,000,000 on imports, representing a reduction in each case of about 60 per cent. The difference in volume and value rate is accounted for by the average drop in price of merchandise, which has been around 27 per cent.

The appointment of Mayor Robert McKnight, C. E., to the position of engineer for the county of Grey has been announced.

Messrs. Phillip J. Turner and A. J. Hazelgrove, architects, have removed their offices from 241 to 284 Beaver Hall Hill, Montreal.

A Dominion charter is being secured by the Peninsular Flour Mills of Dunnville, Ont., which has its head office in that town. A flour mill and elevator is to be erected.

As a sequel to the concentration of General Motors Corporation on export business at the Oshawa plant, the Oakland Motor Car Co., of Canada is being incorporated under a Dominion charter. A considerable proportion of the production of the newly organized company will be for export purposes only.

The feature of the February meeting of the Quebec branch of the Engineering Institute of Canada was an informal talk on the value of forest survey work and photography in connection with pulp and paper companies' timber limits. The chief speaker was R. H. Nisbet, forest engineer in charge of the aviation service of the firm of Price Bros. Mr. Nisbet stated that all aviation work was done in conjunction with the ground surveyers, and that in taking photos for map making purposes, as many as 300 an hour could be taken. The speaker intimated that while aviation would prove of great benefit to surveying, it would never eliminate the ground engineer.

Mr. E. N. Williams, Toronto, Ont., a few days ago, showed us a new invention which he calls a "Non-Slip Cable Socket." This socket goes inside the regular cable clevis, holding it securely, and lengthening the life of the cable. Instead of the usual babbitting process, the socket consists of two or more parts, these interlocking over the strands of the cable without injury in any way.

Mr. Williams showed us a letter signed by the master mechanic of the Hydro Electric Commission, proving that his idea was used for over two months on No. 2 shovel, which had a capacity of 12 cub. yds. During the time it was in use 94,412 cub. yds. of rock were lifted from cut, the natural strain on cable being approximately 87 tons. According to P. R. Reid, the master mechanic, the socket held the cable firmly and without trouble.

It is Mr. Williams' intention to start manufacturing this product in Toronto, and he has patented his device in Canada, at the same time having made his application to the U. S. Anyone interested can write him at 84 Massey St., Toronto.

The International Transit Co., Sault Ste. Marie, Ont., is contemplating ordering five one-man safety cars.

The Canadian Finance and Trading Corporation, 211 McGill St., Montreal, plans to build a two storey ice arena on Atwater Avenue, the cost to be about $400,000.

A. St. C. Ryley has been appointed general manager of the Montreal territory of the Trussed Concrete Steel Co. of Canada, Walkerville, Ont., succeeding G. B. Reynolds.

The London Street Railway management states that it is using every available car during the rush hours and that the service cannot be improved without the purchase of additional cars.

An inspection tour of the western lines of the C. N. R. is now being made by the Hon. W. C. Kennedy, the newly appointed Minister of Railways, and a number of the executive officials of the road.

The Mueller Mfg. Co., Sarnia, expect to have extensions to their line of steam valves perfected about April 1st. This will enable them to place on the market a complete line in this department, representing a new development in their industry.

The H. M. Lane Co., Detroit, have completed extensions, involving an expenditure of about $100,000, to the foundry of Hiram Walker and Sons, Metal Products, Walkerville. The foundry is now equipped to handle motor car parts on a production basis.

The H. H. Robertson Co., Sarnia, are completing the erection of a phosphate house for the Scotch Fertilizer Co., Welland. The structure is entirely of Robertson protected metal in which layers of asphalt and asbestos are combined, assuring resistance against chemical action.

The appropriation for construction and betterment for this year has been under consideration by the management of the Canadian Pacific Railway at Montreal. The result has not been announced, but a press report states that the estimates presented call for an expenditure of about $25,000,000.

James Shand, for many years superintendent of the Dodge Manufacturing Company, of Toronto, died recently at his home in that city. Mr. Shand was born in the north of Scotland 62 years ago. He came to Canada as a young man, and all his life has been connected with machinery production. For a while he was connected with the A. R. Williams Machinery Co., but left that concern to take over the duties he held, until his death, with the Dodge Manufacturing Co.

Mr. John Campbell was recently appointed engineer of the Water Works Department, at Dresden, Ont.

Arthur H. Laurent, formerly assistant deputy minister of the Public Works Department has been appointed chief engineer, to succeed the late E. D. Lafleur.

Furniture of Canadian manufacture is not subject to a great deal of competition. The recent exhibition afforded a chance to size up the quality of the Canadian factories.

The Canadian shoe manufacturers have the domestic market without much opposition. It is estimated that imported footwear amounts to not much more than 5 per cent of the total.

The Preston Woodworking Machinery Co. of Preston, Ont., has recently issued a revised edition of their catalogue covering wood-working tools and equipment. The book is 9 x 12 and of the loose leaf style.

The construction program of the Transportation Commission for the City of Toronto, for the coming season will take care of an expenditure amounting to $12,000,000. Over 50 per cent. of this total will be used for the purchase of new track work.

The furniture industry is likely to buy more liberally in the coming months than at any time since the end of the boom period. The makers of furniture are producing on a more active basis at the present time than they have been doing for the past sixteen months at least.

Information has been received from Brantford that quite a few new companies have established plants in that city during the past year. Among these are the following: Canadian Automatic Conveyor Co., Lockwood Textile Co., Parisian Knitting Mills, Schuler Button Co., The Brant Foundries, Ltd., Ruddy Manufacturing Co., a 100,000 bushel grain elevator for the Dominion Flour Mills, and other smaller concerns.

Metal works, wrought iron stairway, elevator enclosure with general iron work required costing eight million dollars, for the Mount Royal Hotel Co., Montreal, will be supplied by the Western Supply Mfg. Co., Winnipeg, Man. Contract for ornamental iron is placed with the Canadian Allis-Chalmers, Limited, Montreal.

A Detroit manufacturing concern has made an exhaustive study of the reflecting values of different colored paints and their relation to the work. From a purely technical standpoint, their reflecting values relative to white paint are as follows:—White, 100%; Light Green, 53%; Light Yellow, 49%; Light Buff, 44%; Light Grey, 27%; Brown, 6% and Red, 5%. It would seem that these figures would indicate the superiority of white paint for industrial uses. Seeing that quite a number of foundries are being sprayed with this white industrial paint, why not decorate the interior of all metal-working shops with this paint?

The town council of Wiarton, Ont., plans the installation of an electric pump and engine for the waterworks plant to cost $10,000.

The knit goods trade is enjoying active business for spring delivery. Some of the woolen manufacturers are fairly busy on piece goods for the new season's trade.

The Toronto Transportation Commission's order, given the Canadian Car and Foundry, Montreal, for 140 motor cars and 16 trailer cars, has been completed and the cars delivered. Of the 50 motor cars ordered from Canadian Drill Co., Preston, Ont., 8 were delivered by January 14, and further deliveries are being made at the rate of four or five a week.

Inquiries made of Canadian Chamber of Commerce in London, Eng., and other sources, reveal slow but steady improvement in the Canadian export trade to Great Britain and the continent. The recent improvement in Sterling exchange in dollar values and the gradual exhaustion of surplus stocks have caused a turn for the better.

Opinion as to the outlook regarding building was the keynote of several speeches the other night. Speaking of the recent convention of building and construction men in Hamilton, Mr. Carswell said: "I feel sure that the depression in our line is over, and in that I express the convention of three hundred men who met at that convention." Touching on the money situation as relating to trade between one country and another the speaker remarked. "As soon as the exchange rights itself and money can come here without loss there will be an improvement."

Canadian Merchandise is occupying a more favorable position in the home market than it did four of five years ago. There is no question that the people of Canada are more appreciative of the merits of goods of domestic manufacture. That fact is demonstrated by the actual figures compiled by leading retail merchandisers of this country. The statement made recently by Sir John Eaton of the T. Eaton Co., that 80 per cent. of the goods sold by his organization were of Canadian produc[illegible] came as rather a surprise to industrial and wholesale men.

Louis de Ibarra, a business man of Mexico City, and at present visiting Ottawa, interviewing the Minister of Trade and Commerce regarding better trade relations between Canada and Mexico, emphasizes the fact that the Government needs trade representatives on the spot, while Canadian houses should send their own men with power to conclude agreements without delay. If they speak Spanish, so much the better. Improved transportation is also a necessity.

Mr. de Ibarra states that the country is on a gold standard, and excellent banking facilities include branches of the Bank of Montreal. Better shipping facilities on both the Atlantic and Pacific Coasts are sought.

The International Burr Co., of Watertown, N. Y., will be the seventh new industry to locate at Belleville, Ont., within a year. The product of the plant is largely used in pulp and paper mills.

Mexico, wants cars, steel equipment, agricultural implements, flour, timber, paper, breeding cattle, and meals. Mexico exports vegetables, fruits, oil, coffee, tropical woods, and great quantities of sisal, of which binder twine is made.

The U. S. Cast Iron Pipe and foundry Co. announces that it has purchased from a Canadian syndicate, headed by Gordon Perry, in the U.S., the exclusive right to use the De Lavaud patent in the manufacture of cast iron pipe by the centrifugal process in the U.S., its possessions and in Cuba.

Reports from Russia are to the effect that three hundred and ninety-four oil tanks have been received here from Canada and 304 are en route. The steamers Canadian Seymour and Canadian Roger brought tanks, as well as miscellaneous cargoes of shoes, foodstuffs and agricultural implements.

Mr. E. A. Lunderville, formerly purchasing agent and comptroller of the Canadian Ingersoll-Rand, Sherbrooke, Que., has been appointed as sales manager of the Bawden Machine Co. of Toronto. Mr. Lunderville resigned from the Rand Company in 1917 in order to enter business on his own account. He then entered the Colonial Machinery Co. in Cowansville, Que., and became president and manager of that firm, but recently sold his plant to local competitors and moved to Toronto.

The Ontario Department of Highways has arrived at the conclusion that the present is a good time to get the market for structural steel. Indications are that a considerable amount of British construction will be proceeded with this year, and placing of orders is expected within the next few weeks. The structural steel men believe that when spring opens up there will be a good demand for steel for constructional work. The ordinary seasonal quietude will prevail until about April, according to the present outlook.

The British-American Fuel & Metals Ltd., McKinnon Bldg., Toronto, are representing in Canada, sixteen mines of the Pittsburg and Younghiogheny districts, also the West Penn. By-Products Co. The object of this company is to give a direct service between the mines and the consumer. In their fuel departments they have a production of bituminous coals of nearly 10,000 tons per day. The directors include some well known steel manufacturers and coal producers on this continent. The general manager, Major S. Snell, A.M.E.I.C., late Royal Engineers, states that the company has successfully sold fuel to consumers in Canada upon a technical basis, and that they are in a unique position to supply consumers with a fuel most suitable for their requirements and thus secure for them, the greatest economy and efficiency.

During the year 9,297 permits were issued for 11,291 buildings, having a value of $23,878,240. Compared with 1921, the number of permits was greater but the value less, namely, 7,378 permits, 8,574 buildings, value $25,784,732. The increase in value over 1919 was about $4,000,000.

Architect Price of the City of Toronto, in his 1921 reports is quite hopeful for the future. He states that the requirements of commercial enterprises were giving an increasing impetus to the construction of office buildings, and industrial interests were urging more warehouse accommodation.

B. Schuyler Edsall, son of Samuel S. Edsall, of the Bowmanville Foundry Co., of Bowmanville, Ont., has been appointed to a responsible position with the Norwich Union Indemnity Company of New York. Mr. Edsall is a safety engineer and is now in charge of the engineering department of this company.

German competition has practically destroyed Canadian trade with Great Britain in such lines as enamelware, aluminum goods and toys, but representations are now being made to the Board of Trade with a view to obtaining tariff protection for such goods against the German products. Trade as a whole, however, is picking up.

New construction in Canada during January reached a total of $8,392,600. The value of building and engineering work reported amounted to a total of $22,391,600, representing 529 different projects. During 1922, it was pointed out, residential building will undoubtedly be active, at approximately the same level of cost. There will also be much better activity along the lines of railroad and public utility rehabilitation.

Speaking of the possibilities of the shipping industry in Canada, an optimistic note was sounded by Robert W. Reford, president of the Robert Reford Co., Canadian agents for the Cunard Line, in stating that "I believe that there will be great improvement next year. As far as Montreal is concerned, normal conditions practically returned there during the past season, when more grain was shipped through that port than in any previous year. It was a record year for grain carrying steamers."

The consummation of negotiations that have been going on for a number of years between Canada and Australia, for some form of reciprocity, may be announced at any time. This is the substance of a statement recently made by Sir Joseph Cook, former Prime Minister and now High Commissioner in London for Australia. He remarked that, "the time is now ripe for a real effort to be made to adjust the fiscal differences between Canada and Australia." He stated further, that at present Canada sells to Australia nine times the value of goods purchased from Australia and that it would probably be only a short time when trading between the two countries would be on a more equal basis.

The annual report of C. W. Kirkpatrick, Commissioner of Industries for Hamilton, Ont., states that twenty-four manufacturing plants located in Hamilton during the past year. Four other companies established headquarters there but so far have not commenced manufacturing.

It is reported from Montreal that plans are now under way for the construction of an elevator with a capacity of ten million bushels at that port, and it is likely that building will be commenced this summer. The huge increase in the volume of grain handled in and out of Montreal has made more elevator space essential.

It is thought that in another month the Canadian Locomotive Works will be open at Kingston, Ont. The company was reorganized and grew to its present proportions under the former liberal government. There is a great future for this industry and its future lies in the progressive and constructive policy of the present government.

In common with most other Ontario municipalities Welland is for new industries. There have been some additions during the last year. Industrial Commissioner B. J. McCormick, of Welland, considers that the future in this respect is particularly bright. He finds that American manufacturers are making their plans to take advantage of the revival of business that is expected to begin next Spring. There is a prospect accordingly, that branches of United States plants will be located in good numbers this year and that important steps will be taken by Ontario cities to order industrial expansion.

The concession granted by the Government of Peru to R. W. Dunsmuir, in connection with the construction of a railroad from the Pacific coast to the interior is of no little interest to Canada, inasmuch as Mr. Dunsmuir is the son of a former Lieutenant-Governor of British Columbia, and a coal magnate of that province. The contract will require great quantities of railway construction supplies and equipment, and as there are coal, iron and petroleum areas along the route, a great deal of mining machinery for these special purposes will also be required.

Many lumber concerns in British Columbia report a scarcity of logs and it is stated that there are only about 97 million feet of logs in the water in that province. This figure is said to be the lowest for many years, at this season. It is claimed that the snow which fell in November after a month of rough stormy weather reduced the number of mainland camps to a very low figure. The scarcity of cedar logs is giving the shingle mills considerable worry and shingle manufacturers are investigating to ascertain the quantity of cedar that is going to Japan in the large camp form and in logs. Approximately ten million feet of cedar logs and camp have entered Japan during the first six months of the year from points on the Pacific coast.

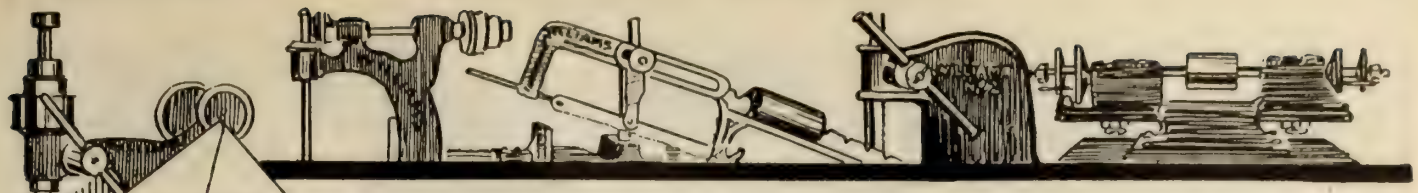
According to a recent report a reduction in railroad charges has become effective in Great Britain, this decline being 12½ per cent. and applying to such goods as coal, coke, and patent fuel, lime stone, pig iron, iron and steel in the raw, and semi-finished state. This situation is expected to influence the engineering branches of industry with a corresponding increase of building and manufacturing activity.

Following the collapse of the roof of a Washington theatre recently, engineers in several Canadian cities have been giving considerable thought to the possibility of like accidents to similar buildings here in Canada. It is believed that ample provision has been made in this northern climate for adequate protection along these lines, but as an additional safeguard the authorities are looking into the matter.

In speaking at a banquet recently held at Longueuil, Que., Sir Lomer Gouin Minister of Justice, referred to the proposed bridge, to parallel the Victoria bridge over the St. Lawrence River. In his statement he said: "The construction of this bridge is not only imperative to the Province of Quebec, but to the whole country. It is a measure not only of national but of international importance."

GOVERNMENT MAY BUY "JOHN D. HAZEN"

It has been officially announced that the contract for an ice-breaker placed by the late Meighen Government with Canadian Vickers Ltd., has been cancelled, and that the ice-breaker "John D. Hazen," built by the Vickers Co. in 1914 and sold to Russian Government has been purchased from the French Government, who apparently have obtained title to her. The price to be paid is stated to be £95,000 sterling. It has been ascertained that the vessel, which is now lying at Cherbourg, France, has been surveyed by Lloyds and also that an independent survey has been made by a firm of naval architects and that a full report of the condition of the vessel is in the hands of the Department at Ottawa. Thus a reasonably accurate estimate of the cost of the repairs can be made. Although the reports have not been officially confirmed in the case of the following statements, it is stated that the wear and tear on the steamer and her machinery is negligible but that maintenance has been neglected. Reports vary as to the actual service performed by the steamer and also as to her present state of repair. It is understood that the steamer will have to undergo certain tests at sea at the expense of the French Government before the sale is finally completed. The move on the part of the new government has deprived the local shipbuilding firm of a contract that was expected to very materially help the unemployed in the east end of the city. However, if a very large saving is accomplished for the country, the best course has been taken.



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64 Front St. W. Toronto

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

You Received Full Value

It is easy to judge the size and quality of a visible commodity. There are certain recognized standards that have been universally accepted to which purchased articles may be compared.

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The Canadian Machinery circulation is measured by the A.B.C. In buying advertising space in its columns you receive dollar-for-dollar value.



THIS IS TO CERTIFY THAT

Canadian Machinery and Manufacturing News

HAS SUBSCRIBED TO THE STANDARDS OF PRACTICE AND IS ENTITLED TO THE PRIVILEGES AND BENEFITS OF MEMBERSHIP IN

THE ASSOCIATED BUSINESS PAPERS, INC.

SIMONDS



Metal Slitters

In many Machine Shops and Metal Working Industries the Simonds Metal Slitter is used as a universal saw. It is a high-grade saw, made of exceptionally tough steel, hardened and tempered to the proper degree for efficient cutting.

Write for catalog and prices.

Simonds Canada Saw Co. Ltd.

"The Saw Makers"

Montreal, Que.

St. John, N.B. Vancouver, B.C.

DEAR COAL COSTS RAILWAY JOBS

JOHN L. LEWIS, president of the United Mine Workers, proposes to the railroad brotherhoods an alliance with his union to fight jointly any and all attempts at wage reductions for members of their organizations. The railroad unions may decide to pool their wage question with that of the coal miners, but if they do they will walk into such an alliance with their eyes wide open as to the enormously important part the cost of coal plays in their own chance to earn a living.

Nobody knows better than the railway engineers and firemen that the fuel they burn under the locomotive boilers is, after labor, the largest single item in railway operating expenses. They know what it meant to roads to have their coal bills go up, as they did go up, from $209,000,000 in 1916 to $673,000,000 in 1920, when nearly eleven cents out of every dollar taken in by the roads went for locomotive fuel.

But this is not all that the cost of coal means to the roads and to the workers on the roads. Nobody knows better than the railway trainmen that the greatest item of railroad traffic in normal times is coal. It is the bulk of the business of most of the carriers in the United States. But even this is not all that coal means to the railroads and their workers. If the coal bills of the carriers were up from $290,000,000 in 1916 to $673,000,000 in 1920, think how the coal bills of the industries of the country went up in the same time on annual consumption of between 500,000,000 and 600,000,000 tons!

When coal is hauled in its normal volume it makes harder work for all railroad men, not only because of the coal haulage itself but because of the haulage of products from industries to which the coal goes for power. But when the cost of the coal is excessive, as it is now, the volume of coal haulage falls to a low-water mark, where it is now, because thousands of productive industries cannot operate at a profit with prohibitively dear fuel. When coal shipments to those industries run down or stop, and in consequence return freights from those industries run down or stop, train crews that must go off the railroad payrolls all over the country number tens of thousands.

When nobody has a bigger stake than the railroad workers in cheap enough coal to enable American industries to turn out freight for the American transportation system to haul, the hard headed railway brotherhood chiefs may think twice before they form an alliance with the coal miners to keep the price of fuel so high that it will cost railroad workers their jobs, as it will cost the coal miners their jobs, just so long as the price of coal does not come down where it needs to be to permit industrial America to do business on the American scale.—From New York World.

New Catalogues

The Cleveland Electric Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O., is circulating an illustrated folder in which an electric tramrail system is illustrated. The illustrations show the use of this overhead system of trucking in a number of actual installations.

The Bickford-Switzer Co., Greenfield, Mass., has published a 4-page leaflet in which a newly designed counterbore is described. This new counterbore has two lips, ample clearance and spiral flutes. The body is circular between the cutters. Sizes carried in stock by the company are given.

An 8-page illustrated booklet has been published by the Sprague Electric Works of the General Electric Co., Schenectady, N. Y., in which electric dynamometers are described and illustrated. These dynamometers are built in a number of sizes, varying from a nominal rating of 2 horsepower at 1,000 revolutions per min., to a nominal rating of 500 horsepower at 1,000 revolutions. All sizes have a wide range of speed above and below their rated values. They are adapted for testing both high and low speed apparatus.

A bulletin pointing out the dangers incidental to the freezing of fire extinguishing equipment has been issued by the National Fire Protection Association of Boston. It is stated that a very small "freeze-up" may destroy the efficiency of a large installation, and that constant vigilance is required to avoid temporary disarrangement of the system. Emphasis is laid on the necessity of all manufacturing plants taking early precaution to protect such equipment against the possibility of freezing.

BLACK DIAMOND OVENS

"OVENS

Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co. Ltd.

Brantford, Canada

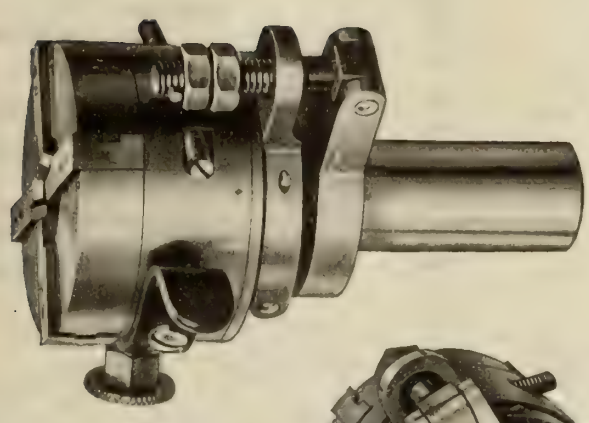
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Machine Tools for SHIPBUILDERS & IRON & STEEL WORKS

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Fetherstonhaugh & Co.,
The old established firm. Patents everywhere. Head office, Royal Bank Bldg., Toronto. Ottawa office, 5 Elgin St. Offices throughout Canada.
Booklet Free.

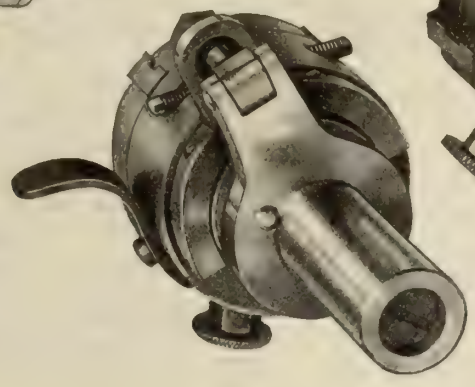
The High Mark In Screw Cutting

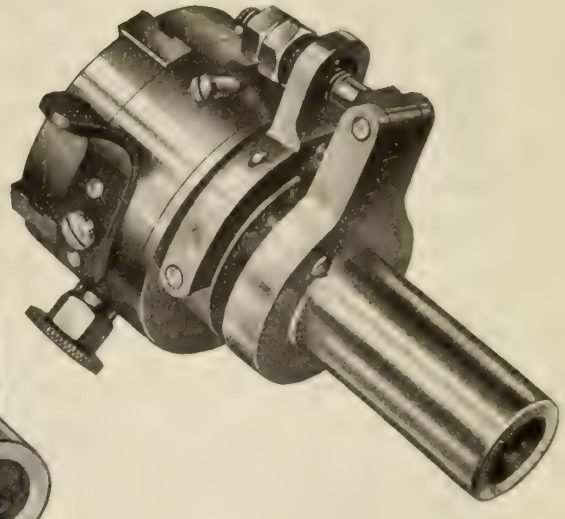
The Geometric Style DS Die Head touched High Mark in popularity at a time when Buying was at Low Mark.



Self-Opening!
Adjustable!
Reliable!

It Fills the Requirements —That's the Reason





Brown & Sharpe Automatics, as well as other single spindle machines, needed just such a Screw-Cutting Die Head—and the Geometric DS is it. With a DS Die Head on the machine there is:

No reversing of the spindle to back the Die Head off the threaded work.

No stripping and shaving of threads, for the Die Head floats to suit the thread being cut, and does not depend on the turret feed.

No burden of tripping the Die Head, because of the easily adjustable lever trip, which lightens the reaction on the threads as they are cut.

No shock and wear, even when closing the Die Head rapidly, because of the spring closing attachment.

No face plate necessary, allowing the use of projecting chasers when cutting is close to shoulder.

No cutting of taper threads for the chasers have long bearings in the Die Head skeleton and are supported by hardened keys, which prevent tilting.

Consider the economy of these Die Heads with micrometer adjustment, over the use of a button die with no adjustment.

Geometric Die Heads are sent on trial to reliable concerns.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal

The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B.; Halifax, N.S.; Vancouver, B.C.

SPECIAL OFFER of MACHINE T

SHAPERS

No.
1046 1—Gould & Eberhardt 20″ Shaper, complete with vise.
1097 1—Smith & Mills 15″ Shaper, complete.
653 1—McGregor-Gourlay 24″ Shaper, complete.

MILLING MACHINES

673 1—Ryerson Owen No. 3 Universal, complete.
671 1—Briggs, Type A, 22″ traverse, Manufacturing Miller.
2089, 1050, 1062 3—Chicago Pedestal type, Hand Millers.
2088, 2088A, 618 3—Standard do
1061 1—Garvin No. 2 do
1072 1—Barber-Coleman No. 3 Thread Miller.
1074 1—Hendey No. 4 Plain Miller with vise and dividing head.
2075-2086 11—Burke No. 1 Hand Millers, bench type, table 12″x3½″.
2087 1—Toledo Hand Miller, table 23″x5″.
876 1—Plain Dividing Head for No. 3 Miller.
877 1—Vise for Milling Machine.
1055, 1056 2—Pratt & Whitney 4½″x12″ Thread Millers, with C/S.
642 1—Castellating Attachment for Miller.

BENCH LATHES

1029 1—Hardinge (Cataract) 7″x32″ Bench Lathe, with head and tailstock, compound rest, plain rest.
734 1—Hardinge (Cataract) 7″x32″ Bench Lathe, with head and tailstock, compound rest, plain rest, chasing attachment.

PRODUCTION LATHES

2005-2012 8—LeBlonde 17″x8′ Heavy Duty with C/S.
1098-2004 6—LeBlonde 17″x6′ Heavy Duty with C/S.
2013-2016 3—LeBlonde 17″x6′ Rapid Production, with C/S.
2017 1—Reed 14″x6′ Extra Heavy Duty, with C/S.

TOOL ROOM LATHES

1075 1—C.M.C. 16″x6′, chuck, face plates, C/S.
1083 1—Hendey 14″x6′, S.B.G., Q.C.G., chuck, face plates, C/S., taper attachment.
1078 1—Monarch 14″x6′, D.B.G., Q.C.G., chuck, face plate, C/S., taper attachment.

PLANER

1089 1—Bertram 30″x30″x8′, single head on rail, worm drive, motor driven, vise.

HACK SAWS

891 1—Racine No. 10, 8″x8″.
661 1—Peerless, 6″x6″.
951 1—Perfect No. 3, 6″x6″.
881 1—Millers Falls, 6″x6″.

TURRET LATHES

1036 1—Small Foster-Kimball, C/S.
1031-1040 4—No. 3 Foster, capacity 1⅝″ in spindle, C/S.
1041-1044 4—No. 2 Foster, capacity 1 1/16″ in spindle, C/S.
2023-2043 20—16″x6″ Bliss Heavy Duty.
2044-2054 10—No. 2 Foster with round turret, capacity 1 1/16″ in spindle, C/S.
2055-2060 5—No. 3 Foster with round turret, back geared, capacity 1⅝″ in spindle, C/S.
2061-2065 4—No. 3 Foster, with hexagon, turret, back geared, capacity 1⅝″ in spindle, C/S.

No.
2066 1—J. & L. 15″ Turret, round turret, 1¼″, hollow spindle.
2067 1—16″x6′ McGregor-Gourlay Turret Lathe.
2068 1—18″x6′ McGregor-Gourlay Turret Lathe.
2069 1—20″ No. 4 Bullard with hexagon turret.
2070, 2070A 2—16″ Warner & Swasey, Geared Head.
2073 1—17″x6′ Davis Lathe with round turret.
819 1—Oliver 18″ Turret with C/S.
818 1—B. & O. 16″ Turret with C/S.
815, 816 3—Davis 24″ Turret Lathes with power cross feed.

GRINDERS

590 1—Bench Type Double End, two-step cone pulley on spindle, no C/S.
1067 1—Bench Type Double End, single pulley on spindle, no C/S.
1068 1—Woods Eng. Co. No. G265 Tool Grinder.
1069 1—Gardner No. 24 Grinder.
1070 1—Double End Emery Grinder on pedestal, two-step cone pulley on spindle, 1″ diameter spindle, C/S.
1071 1—Double End Emery Grinder, on pedestal, single pulley on spindle, 1″ dia. spindle, C/S.
1079 1—Wells Tool Room Grinder.
1095 1—Walker 6″x36″ Surface Grinder, complete with all attachments.
2109, 2110 2—Perfect No. 6 Pedestal Grinders.
2117 1—Sellers 5/16″x3″ Drill Grinder.
939 1—Landis 12″x42″ Plain Grinder.
890 1—Globe Universal Tool Room Grinder.
898 1—Lafayette Universal Motor Driven Tool Grinder for lathe work.
640 1—Double End Pedestal Emery Grinder, two-step cone pulley on spindle, C/S.
1064 1—Symington Plain Grinder, C/S.

GAP LATHES

656 1—C.M.C. 20″x38″x12′, D.B.G., Q.C.G., face plate, chuck, C/S.
1091 1—McDougal 20″x6″x12′, chuck, face plates, C/S.

DRILLS

1048 1—Barnes 15″ Sensitive.
1065 1—Perfect 14″ do
1066 1—Mechanic's 24″ B.G. Drill Press.
1085 1—Perfect 15″ Sensitive.
1088 1—Langelier 10″ Bench Type with C/S.
1096 1—Ford Smith 22″ Back Geared Drill Press.
1086, 1087 2—Rego Bench Drills with Nerlington tapping device, ⅜″ cap.
2074 1—Colburn D-1 High Speed Heavy Duty.
947 1—Silver 3 Spindle 20″ Gang, one spindle with tapping attachment.
945 1—Edlund 15″ High Speed Ball Bearing Drill Press.
839 1—Fosdick No. 2½ Radial Drill.
675-678 4—Woodward 4 Spindle Drill Presses.

SCREW MACHINES

1057, 1058, 1059 3—Acme No. 55 4 Spindle Automatics.
1093, 1094 2—Garvin No. 1 Wire Feed, C/S.
2071, 2072 2—Warner & Swasey No. 6 with geared head, automatic chuck, C/S.
1018 1—Warner & Swasey No. 1 Screw Machine.

ENGINE LATHES

1047 1—Cincinnati 16″x8′, D.B.G., screw feed, chuck, 2 face plates, C/S.
1049 1—American 18″x6′, S.B.G., rod feed, chuck, 2 face plates, C/S.
1073 1—LeBlonde 17″x6′, S.B.G., Q.C.G., rapid production, rod feed, chuck, face plate, C/S.
1076 1—Pratt & Whitney 10″x4′, S.B.G., rod feed, chuck, face plate, C/S.

GARLOCK MACH

163 Dufferin Street, Toronto

OOLS, PRICED for QUICK SALE

No.
1077 1—LeBlonde 17″x6′, D.B.G., Q.C.G., screw cutting, chuck, face plates, C/S.
1078 1—Lodge & Shipley 14″x6′, S.B.G., Q.C.G., chuck, face plates, C/S.
1081 1—LeBlonde 16″x6′, S.B.G., Q.C.G., chuck, face plates, screw feed, C/S.
1082 1—Hamilton 16″x8′, S.B.G., Q.C.G., screw feed, chuck, face plates, C/S.
1084 1—Davis 12″x6′, S.B.G., Q.C.G., chuck, face plates, C/S.
1092 1—Reed 16″x7′ Plain Lathe, S.B.G., no feed, head and tailstock only, good for wood turning.
2018 1—Stevens 16″x6′ Engine Lathe, screw cutting, C/S.
2019 1—McGregor-Gourlay 16″x7′ Engine Lathe, screw cutting, C/S.
2020 1—Stevens 16″x8′ Engine Lathe, screw Cutting, C/S.
2021 1—Stevens 18″x8′ do
2022 1—Lodge & Davis 18″x8′, screw cutting, with C/S.
812 1—Putnam 36″x18′, S.B.G., screw cutting, face plates, C/S.
810 1—McKechnie-Bertram 20″x10′, S.B.G., face plates, C/S.
809 1—McGregor-Gourlay 18″x12′, S.B.G., face plate, C/S.
666 1—Rae 18″x8′, D.B.G., Q.C.G., face plate, C/S.
639, 643, 646 3—Speed Lathes.

BUFFING MACHINES

1051-1054 4—Perfect 36″, Pedestal Type, 1¼″ spindle.
627 1—24″ do 1″ spindle.

TAPPING MACHINES

1063, 1086, 1087 1—Ricker Schaefer ⅜″, friction feed.
733 2—Rego Bench Drill Type Tappers, ⅜″ capacity.
602 1—Burke Bench Type, horizontal, ¼″ capacity.
1— do ¾″ capacity.

PRESSES, PUNCHES AND SHEARS

1035 1—Brown-Boggs No. 90 Kick Press.
944 1—Greenerd No. 3½ Arbor Press.
742 1—Niagara No. 3 Arbor Press, pedestal type.
741 1—Niagara No. 3½ Arbor Press, pedestal type.
761 1—Laurie No. 19 Punch Press.
822 1—Stiles No. 172 Punch Press.
1020 1—Bench Type Punch.
1021 1—Bench Type Shear.
2108 1—Toledo No. 57½, Back Geared, Power Press, 4 tee rods, 12″ stroke, 140-ton capacity, 6″ crank shaft, 24½″ between uprights, weighs approximately 35,000 lbs.
Also a number of Bliss and Brown-Boggs Inclinable Presses.

BLOWERS

A number of Buffalo, Sheldon, Root Blowers of varying sizes and capacities.

PUMPS, ACCUMULATORS

884 1—Vertical, 2 plunger, hydraulic, 2½″ dia. x 6″ stroke, 1¼″ inlet and discharge.
813 1—Northey Duplex, 6″x4″x7″.
780 1—Goldie-McCulloch, 2″ suction, 1½″ discharge.
779 1—Smart-Turner 4½″x2¾″x6″.
2090 1—West Tire No. 3, 2 cylinder plunger pump.
2091 1—Gould Triplex Plunger Pump.
2092 1—Perrin Triplex Plunger Pump.
2093 1—Small Size Two Plunger Pump.
2119 1—Hydraulic Accumulator, 6″x8′ ram, capacity 10 imperial gallons, 1,500 lbs.
2137-2147 A number of Lubricating Pumps for use on Lathes, etc.

MOTORS AND ELECTRICAL EQUIPMENT

830 1—C.G.E. Generator Set, type, A.P.B., class 8-125-900 K.V.A., 125-575 volts, 3 phase, 60 cycle, 125-5 amps., 900 r.p.m., complete with 1—5 H.P., D.C., Exciter, type M.L.4-5, 40 amps., 125 volts, speed 1,800 r.p.m
1—Switchboard, type ATG-64-150 amps, 600 volts, complete with rheostat, voltmeter and ampere meter.
835 1—Can. Allis-Chalmers 5 H.P., 3 phase, 25 cycle, 550 volt, with base and pulley.
1031 1—Lincoln 20 H.P., 3 phase, 60 cycle, 220 volts, 1,200 r.p.m., with base and pulley.
660 1—Tor. & Ham. 12 H.P., 3 phase, 25 cycle, 220 volts, 1,500 r.p.m., with base and pulley, no starter.
634 1—Can. Allis-Chalmers, 5 H.P., 3 phase, 60 cycle, 550 volts, 1,200 r.p.m., with base and pulley.
1090 1—Chapman Walker 20 H.P., 3 phase, 25 cycle, 550 volts, with base and pulley.
2094 1—Robins & Myers ½ H.P., 3 phase, 25 cycle, 550 volts.
2095 1—Robins & Myers ½ H.P., 1 phase, 25 cycle, 110 volts.
2097, 2098 2—Westinghouse 50 H.P., 3 phase, 25 cycle, 550 volts, with base and pulley.
2096 1—Chapman Walker 40 H.P., 3 phase, 25 cycle, 550 volts, 750 r.p.m., with base and pulley.

MISCELLANEOUS

2099-2102 3—Strong-Carlisle-Hammond Continuous Annealing Furnaces, 22″ long x 3′x2½′ opening.
2103-2106 3—Strong-Carlisle-Hammond Furnaces for heating drop forge work.
2107 1—Lead Annealing Furnaces, pot space 20″x24″ deep, for gas or oil burners
2128-2136 8—Singer Factory Sewing Machines.
2127 1—Brown Pyrometer, 2000° Fahr.
2148 1—Heavy Double Galvanizing Iron Tank, inside dim. 4′3″ long, 2′6″ wide, 2′6″ deep, outside dim. 5′3″ long, 3′6″ wide, 3′ deep.
2149-2150 2—2″ Cypress Wood Plating Tanks, inside dim. 5′8″ long, 20″ wide, 20″ deep.
2151-2152 2—2″ Cypress Wood Plating Tanks, inside dim. 3′ long, 18″ wide, 18″ deep.
2153-2154 2—Southwark Hydraulic Physical Testing Presses, 2,000 lbs per sq. in. pressure, 2 column type fitted with intensifier ram, revolving table guard and suitable drain basin, mounted on pedestal and arranged for single lever control.
2155 1—Metalwood Hydraulic Testing Press similar to above.
1032 1—Jardine No. 50 Power Hammer.
1030 1—C. B. & [illegible]. No. 734H Blacksmith Forge.
1019 2—Sand Riddles.
946 1—Bellevue Oil Furnace.
888 1—Gas Furnace, 12″x15″x8″, two burners, size of door opening 10″x8″.
848 1—Ham. Motor 6″x6″ Double Cyl. Air Compressor with 6′ tank.
841 1—One Ton Portable Crane.
840 1—Two Ton Portable Crane.
689 1—Gas Furnace, 18″x11½″x8″, 2 burners, door opening 10″x8″.
605 1—Sand Blast, 30″ dia. x 36″. long, complete with attachments.
2111-2114 3—Bertram Stenciling Machines.
2115 1—Holden Morgan Stenciling Machines.
2116 1—Burring Machine.
2118 1—Four Pt. Tapalog complete (Wilson-Maulin).
2120-2123 3—Brantford Counter Scales.
2124-2125 2—DeVilbiss No. 13 S.M. 152 Internal Varnishing Machines.
Quantity of Wood Split, Steel Split Pulleys, Hangers, Belting, various sizes.

INERY, LIMITED

Montreal Branch: 356 Hingston Ave.

Classified Opportunities

MACHINERY WANTED

THE FOLLOWING MACHINERY IS WANTED by one of our foremost technical schools:—
5 lathes, 6 ft. bed, 14 inch swing (one of these will be a tool room lathe with quick change gears).
1 16-inch shaper,
1 drill press,
1 Universal milling machine,
1 power hack saw,
forges, anvils, vises,
1 combination cut off and rip saw,
1 band saw,
1 tool grinder,
1 glue stand,
1 electric glue pot,
1 pony planer,
3 wood turning lathes of different sizes, all machines to be motor driven,
1 blue print machine.
Please address all replies to Box 862T. Canadian Machinery.

WANTED — A LATHE AND GEAR CUTTER. Must be in good condition. Advertiser desires to get in touch quickly with any person who is able to offer same. Apply Beaver Machine Shop, 1110 Center St., Calgary, Alberta. (c5mlg)

MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W H Sumbling Machinery Co., Toronto. (etfm)

EQUIPMENT WANTED

CAFETERIA EQUIPMENT — RANGE, STEAM table, glass shelving, urns, Cash register, etc. Must be in first class condition. Give description and prices. State where may be inspected. Box No. 801L, Canadian Machinery.

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

Modern Marine Machinery

Automatic Steam Towing Machines, Ship Windlasses, Cargo and Deck Winches, Steam Capstans, Dock Gypsies, Steering Engines, Hydraulic Freight Hoists, etc. Grey Iron and Brass Castings. Special machinery built to order. The Corbet Foundry & Machine Co., Limited, Owen Sound, Ont. (52)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

SITUATIONS WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

AGENCIES WANTED

IF YOU ARE LOOKING FOR A HIGH-GRADE firm to handle through the hardware jobbers and consuming trade throughout the Dominion, write us. It will be worth your while to investigate the special features of our marketing proposition. We know what co-operation means. Write to Box 860T., Canadian Machinery.

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

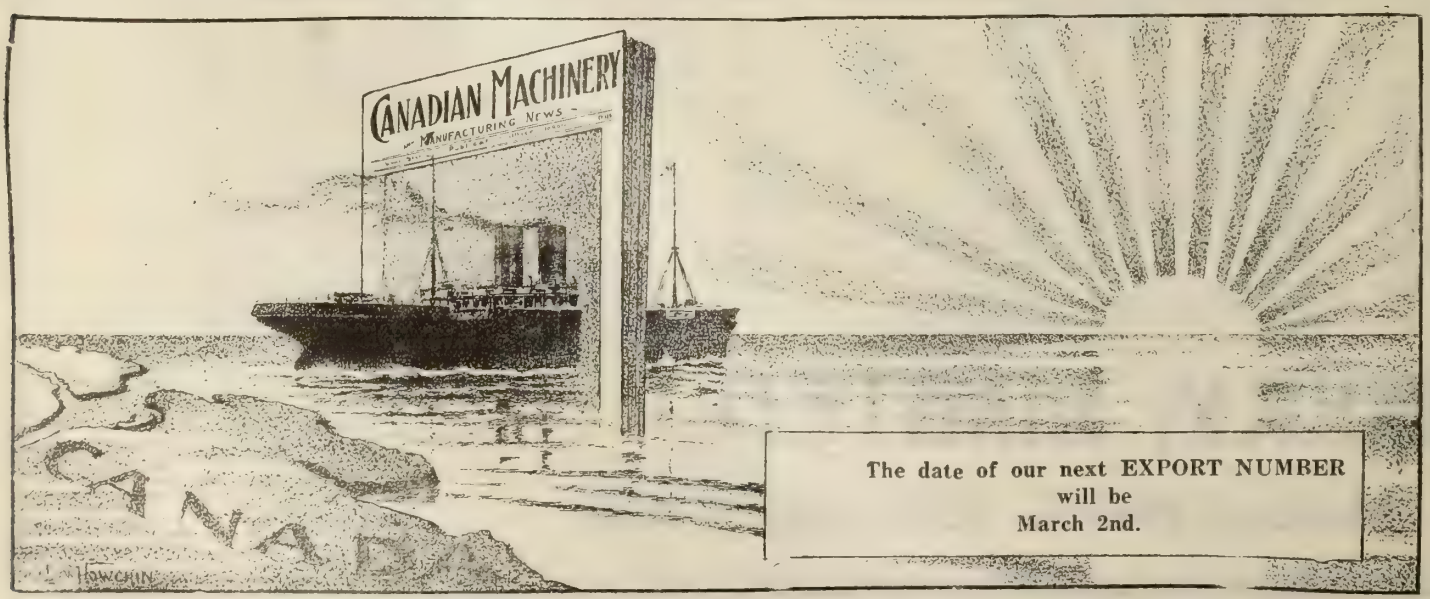
PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.



The date of our next EXPORT NUMBER will be March 2nd.

HINTS TO BUYERS

Torrington MACHINE SCREWS

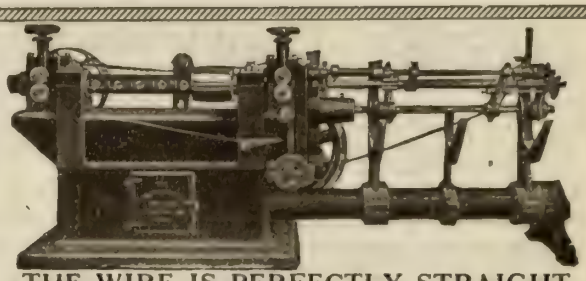
Side Knob and Lock Cap Screws



Let us quote you our prices on your next order. Our quality and service are sure to please you.



THE TORRINGTON COMPANY LIMITED
UPPER BEDFORD, QUEBEC



THE WIRE IS PERFECTLY STRAIGHT

and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?

The F. B. SHUSTER COMPANY, New Haven, Conn.
Formerly John Adt & Son. Established 1866
Also makers of Riveting Machines, Sprue Cutters, Cotter Pin Machines, etc.

Davis-Bournonville

Oxy-Acetylene mechanically- guided cutting torches:
The Oxygraph for cutting shapes from steel to drawing, pattern or templet.
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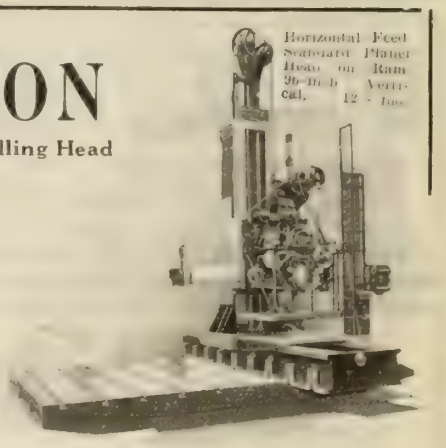
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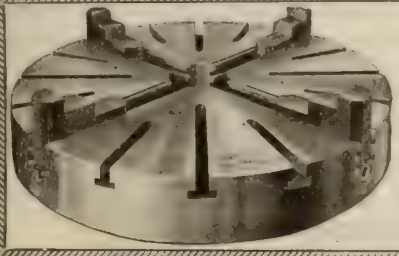
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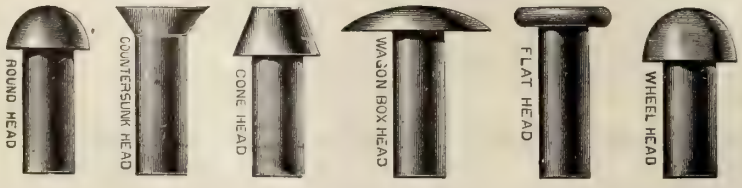
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Atkins & Co., Inc., E. C., Indianapolis, I.
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Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

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Beardmore & Co., Ltd., Wm., Montreal, Que.

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Canada Metal Co., Ltd., Toronto, Ont.
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Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

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Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que
British Empire Steel Corporation, Montreal, Que.
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Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

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Can. Fairbanks-Morse Co., Ltd., Montreal.
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Belt Hooks
Bristol Company, Waterbury, Conn.
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Bristol Company, Waterbury, Conn.
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Belt Lacing, Steel
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McLaren Belting Co., J. C., Montreal, Que.
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Fittings, Ltd., Oshawa, Ont.
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Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
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National Acme Co., Cleveland, Ohio.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Ltd., Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

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Ford-Smith Machine Co., Hamilton, Ont
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Pryibil Machine Co., New York, N.Y.
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Bertram & Son Co., Ltd., The John, Dundas, Ont.

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Rockwell Co., W. S., New York City.

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Canada Metal Co., Ltd., Toronto, Ont.
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Langley & Austin, Galt, Ont.

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Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
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Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
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McDougall Co., Ltd., R., Galt, Ont.
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Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
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Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

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Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
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Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

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Aikenhead Hardware Ltd., Toronto, Ont

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
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Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
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Wright Mfg. Co., Lisbon, Ohio.

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Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

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Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Prybill Machine Co., New York, N.Y.
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Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn

Chucks, Tapping
William I. Procunier, Chicago, Ill

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn

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Oakley Chemical Co., New York, N.Y.

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Gisholt Machine Co., Madison, Wis.

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Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

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Can. Link-Belt Co., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

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Can. Link-Belt Co., Toronto, Ont

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Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Oakley Chemical Co., New York, N.Y.

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Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

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Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont
Victoria Foundry Co., Ltd., Ottawa, Ont.

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Can. Mathews Gravity Carrier Co., Port Hope, Ont.
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia Pa

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont

Dealers, Machinery (See Searchligh Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co. Hamilton
Ford-Smith Machine Co. Hamilton Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd. Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont
Ford-Smith Machine Co. Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Brown, Boggs & Co., Ltd. Hamilton Ont
Canada Foundries & Forgings Co., Welland, Ont

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros Tool Co., Chicago, Ill

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros Tool Co., Chicago, Ill

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont
Garlock Machinery, Ltd., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drill Press Sleeves.
Preston & Schwartz, Galt, Ont

BUYERS' DIRECTORY

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Atkins & Co., Inc., E. C., Indianapolis, I.
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto Ont.
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Atkins & Co., Inc., E. C., Indianapolis
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
[illegible] Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Gardiner & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal, Q

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd. W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd. W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd. W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Ill.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Belt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Patterns, Wood and Metal
Crescent Machine Co. Ltd., Montreal, Q
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.

BUYERS' DIRECTORY

Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Metal
Atkins & Co., Inc., E. C., Indianapolis, I.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Atkins & Co., Inc., E. C., Indianapolis, I
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal. Q

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Leg
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F. & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.

BUYERS' DIRECTORY

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co. Waterbury, Conn.

Tanks and Pumps, O'
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Tape, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

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Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y

Tools, Small (See Machinists' Small Tools)
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Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis.
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Truing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Rice Lewis & Son, Ltd., Toronto, Ont

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

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Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

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Can. Fairbanks-Morse Ltd., Montreal, Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

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Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont

Valves
Can. Fairbanks-Morse Ltd. Montreal, Q
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

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Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

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Can. Link-Belt Co., Toronto, Ont.

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Torrington Company, Ltd., Upper Bedford, Que.

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Barnes Company, Wallace, Hamilton,

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L'Air Liquide Society, Toronto, Ont
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
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Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

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Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

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McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

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Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
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Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

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American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
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Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wiping Cloths
The Levi's, Toronto, Ont.

Wire
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton.

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Copper and Brass, Fine and Heavy
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Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

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L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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Bertram & Sons, Ltd., John, Dundas, Ont.

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Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

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Yeates Machinery Co., London, Ont.

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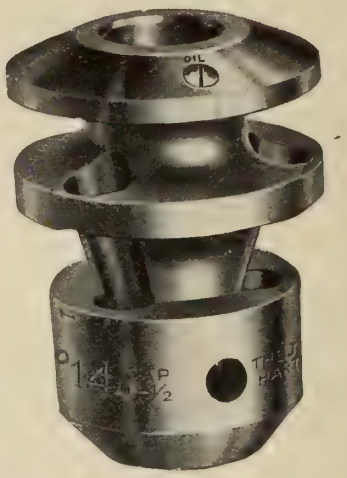
Jacobs Super Chuck



Patented 1909-1915. Other patents pending

A Look Inside

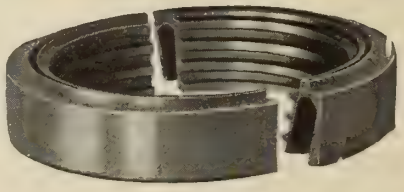
Here are the several parts—carefully designed, exactly fitted, perfectly made—that guarantee the Jacobs Super Chuck to hold a drill tight, to hold it right, and to keep on doing its work indefinitely.











FIRST THE BODY—scientifically casehardened; size limits within .0005″, arbor hole ground on a special fixture with six gauges to position it accurately in relation to the hole for the jaw.

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The Jacobs Manufacturing Company

Hartford, Connecticut, U.S.A.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVII. No. 8 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | Feb. 23, 1922 | $4.00 a Year Subscription Price

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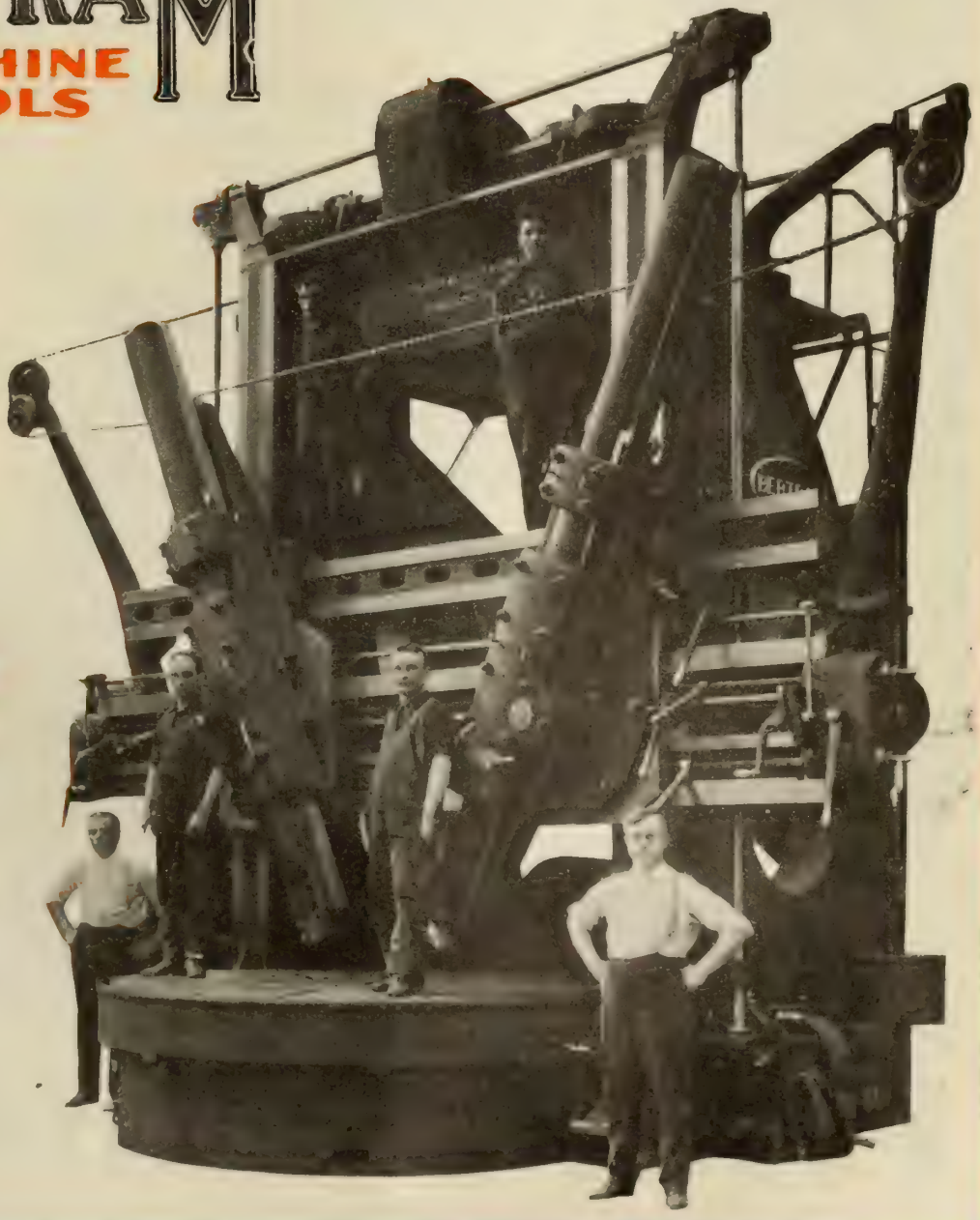
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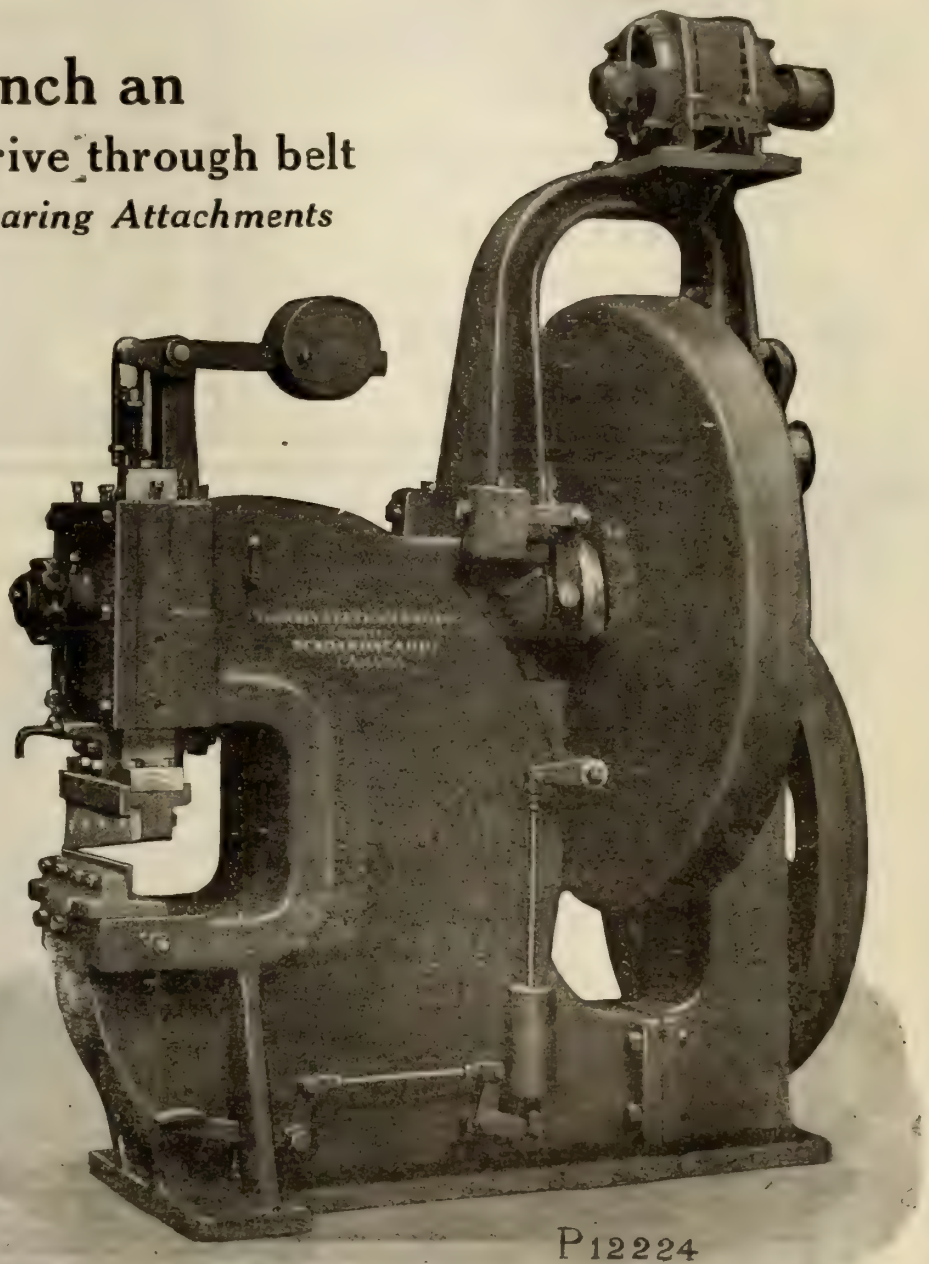


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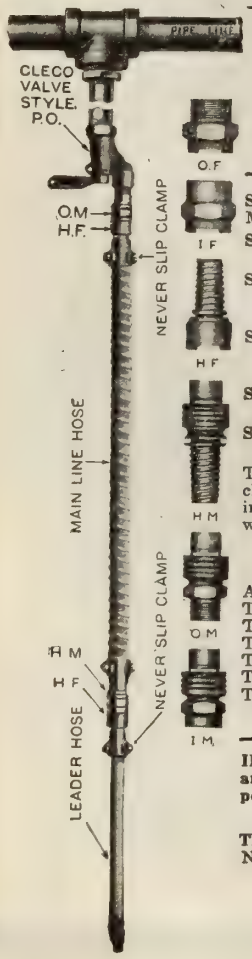
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They interchange in sizes most commonly used.
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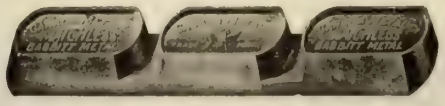


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The first cost may be more, but THE LONG RUN makes the value, and if combined with no trouble the profits are accumulative. Buy your Babbitt from Life-Long Babbitt Men.

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THE CANADA METAL CO., LIMITED

TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

PRESSES—DIES and SPECIAL MACHINERY

BLISS



Bliss Double Crank Press in production.

BLISS DOUBLE CRANK PRESSES

Bliss Double Crank Presses are built in sizes to meet every metal forming and stamping requirement. Weights 3,000 to 600,000 lbs. Designed to give the greatest possible strength for a machine of a given weight.

Adapted for the manufacture of sheet iron and steel goods, such as automobile parts, stoves, ranges, shingles, tractor parts, sidings for buildings, freight and passenger car parts, metal radiators, metal furniture, etc., etc.

Write us your requirements, there is a size that just suits your particular need.

"For Efficiency and Economy"
"Specify Bliss Presses"
"Standard the World over"

E. W. BLISS CO. MAIN OFFICE AND WORKS BROOKLYN, N.Y., U. S. A.

SALES OFFICES: DETROIT Dime Bank Bldg. CLEVELAND Union Bank Bldg. CHICAGO Peoples Gas Bldg. PITTSBURGH Keenan Bldg. ST. LOUIS Boatmen's Bank Bldg. BUFFALO Marine Bank Bldg. CINCINNATI Union Trust Bldg. NEW HAVEN Second Nat'l Bank Bldg.

American Factories: BROOKLYN, N.Y. HASTINGS, MICH. CLEVELAND, OHIO. SALEM, OHIO.

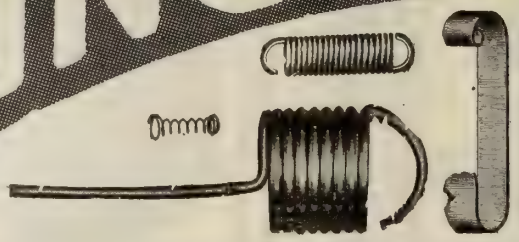
FOREIGN SALES OFFICES AND FACTORIES:

ENGLAND, Pocock St., Blackfriars Rd., S. E., London. Norwich Union Chambers, Birmingham. FRANCE, 100 Blvd. Victor-Hugo, St. Ouen, Paris.

No 190

THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO, CANADA

SPRINGS



ALL STYLES and SIZES

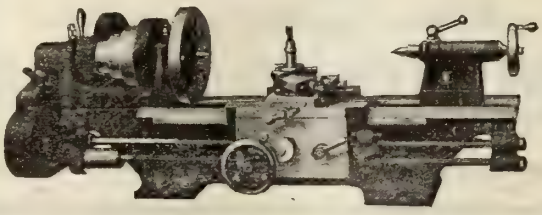
Spiral Springs, Hook Springs, Common, Coil Springs, Flat Springs—in fact we can supply any design you may desire. Get our prices before placing your next order. Expert advice gladly submitted on request.



THE WALLACE BARNES CO., LIMITED, Main St. W., Hamilton

"DALTON SIX"

Type B-6



"The Small Lathe for the Big Job"

Actual Swing - - -	8¼ inches
Between Centers - -	18½ inches
Collet Capacity - - -	¾ inch

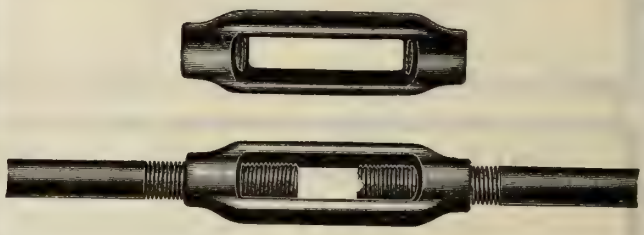
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Also Manufacturers of Type B-4 Lathes

Dalton Manufacturing Corporation
Sound Beach · Connecticut · U·S·A·
Cable Address " Aledal · Stamford "

CANADA FOUNDRIES & FORGINGS LIMITED

Drop Forged Steel



SOLID—NOT WELDED

16 Sizes with / without } Stubs

Canada Foundries & Forgings
Welland, Ont.

WHAT IS YOUR ADVERTISING DOLLAR BUYING?

High prices of materials and increased overhead have made necessary a stricter economy along mercantile lines.

Advertising should be considered as well as the commodities in which merchants deal. By choosing only those publications whose circulation is accurately measured, you not only practise economy in your advertising, but are assured that your money is buying a definite quantity of circulation.

Canadian Machinery's circulation is measured by the Audit Bureau of Circulation. Advertising placed in its columns is an economical investment.



HENRY BERRY & Company Limited.

LEEDS, England

Codes: A.I., A.B.C.(5th Edition), Engineering, Everybody's Pocket Code, Marconi International.

CANADIAN AGENTS:

Messrs. Fairbanks-Morse Company, Limited.

***Head Office*—Montreal**

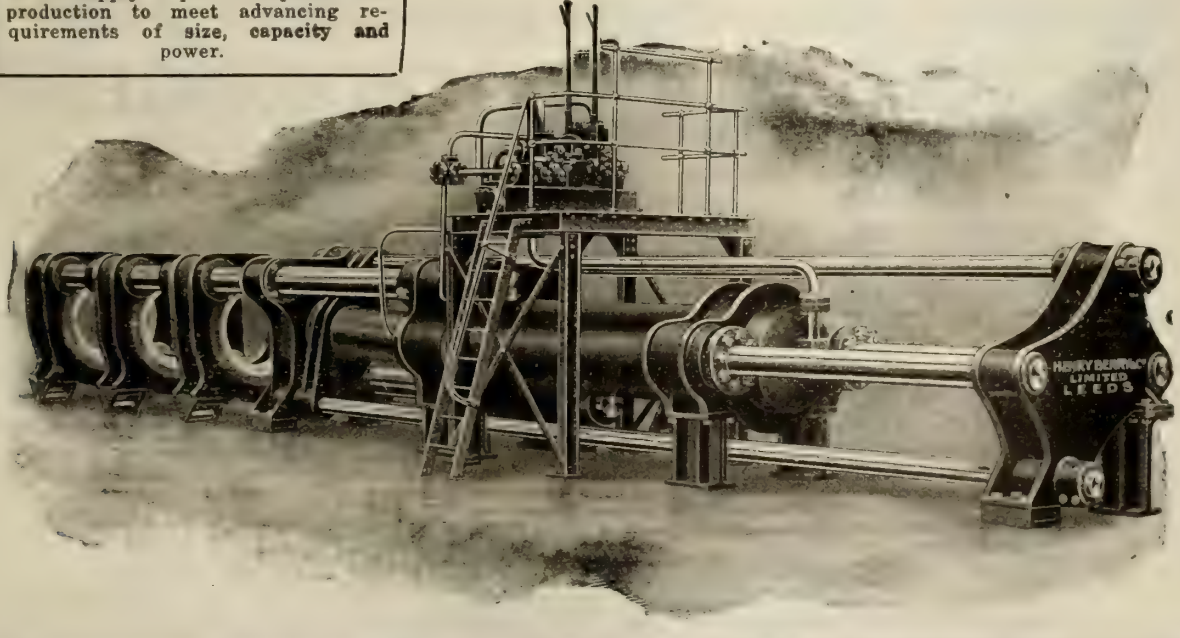
A Cradle Of Imperial Industry

Concerned for many years with the design and the manufacture of some of the largest types of machinery for the British Government, the Colonies and the Indian Empire, the firm of Henry Berry & Co. possesses some of the most extensive resources in the country for the production of the biggest, most powerful and most practical types of hydraulic machinery for Shipyards and Industrial Enterprises. These include all kinds of Shipyard Tools, Plate and Armour Bending Rolls, Rivetters, and Punching and Shearing Machines, Presses and Cranes.

Designs and estimates will be submitted to all requirements without charge. Prompt deliveries with full guarantee of Quality and Power.

750 TON PUNCHING & DRAWING PRESS

Pioneer manufacturers of hydraulic shell forging presses for the largest shells in use during the Great War, we are likewise always to the fore in the supply of plant for peace time production to meet advancing requirements of size, capacity and power.







BETTER TOOLS MAKE BETTER WORKMEN!

And there are no better tools of their kind than WILLIAMS' Superior Drop-Forged Hammers. All kinds, all sizes.

J. H. WILLIAMS & CO., Limited
"The Drop-Forging People"

45 Thorold Road **St. Catharines, Ontario**

OXYGEN AND HYDROGEN
(ELECTROLYTIC)

National Electro Products Limited is the largest manufacturer of Electrolytic (pure) Oxygen and Hydrogen in Canada.

WE PRODUCE GASES EXCLUSIVELY BY ELECTROLYTIC DECOMPOSITION OF WATER. We are, therefore, in a position to furnish Oxygen and Hydrogen far superior to like gases made by any other process.

After Exhaustive Tests We Have Decided to Handle The Well-Known

The Torch for Welders PUROX (OXYGEN / HYDROGEN) Who Want the Best!

WELDING AND CUTTING TORCHES

Our entire organization—technical and sales—is always at your service.

NATIONAL ELECTRO PRODUCTS

LIMITED

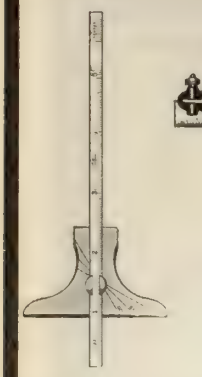
HEAD OFFICE: 80 ADELAIDE STREET EAST, TORONTO

TORONTO SALES OFFICE
80 Adelaide Steet East
Main 3167

MONTREAL SALES OFFICE AND FACTORY
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Facilities for Service that are unassailable
When you order "Liquid Air" Oxygen or Dissolved Acetylene it is delivered to you at the very time you want it delivered, with no exorbitant costs added for freight or long distance haulage. This is only made possible by "Liquid Air" chain of factories situated at convenient centres all over Canada, operating in conjunction with service stations situated at a point in your own immediate neighborhood.
Wherever your plant or workshop is situated you have a constant supply of Oxygen and Acetylene immediately available and Liquid Air service demonstrators are at your disposal at all times to help and advise you on all matters pertaining to the Oxy-Acetylene Process.
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Three Rivers
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LIQUID AIR Co
CANADA





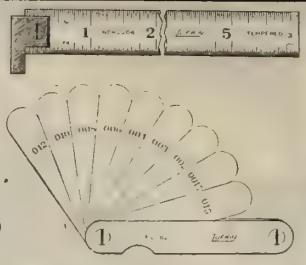
LUFKIN
RELIABLE
MECHANICS' TOOLS

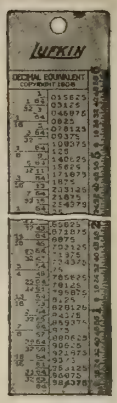
APPEAL TO EVERY PROGRESSIVE MECHANIC

Accurate, and having all the other essential qualities of precision tools; also many improvements which mean better work, easier done.

Their nicety of design and finish appeal to the eye. Their performance day in and day out will hold your approval.

Ask your dealer to show you a LUFKIN Send for Catalogue of Mechanics' Tools.





THE JOHNSON FRICTION CLUTCH

Friction Clutches From Stock

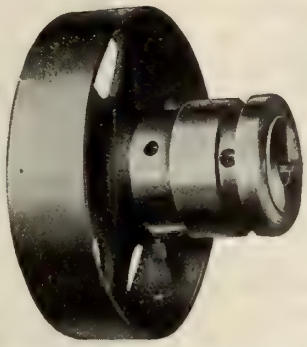
Johnson Clutches, both single and double, can now be obtained from stock in our standard slow speed type to fit all common shaft diameters and all standard pulley bores, within the range of light and medium horse powers that we cover.

State definitely —

Just what the clutch must drive.
Actual maximum horse power.
Speed of clutch shaft.
Diameter of shaft.
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We Will Select the Proper Clutch and Make Immediate Shipment on All Ordinary Requirements.

Friction Control Means Better Machinery



And the Johnson Clutch is supreme among friction clutches. Adopt it as your standard — always dependable and always promptly obtained.

Complete engineering service to consult on your problems and to handle special installations of any kind.

Write for our stock list and Yellow Catalog

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN

GISHOLT
LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
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REAMERS, "SOLID ADJUSTABLE"
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BORING BARS
With Adjustable Cutters
PERIODOGRAPH
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Separate Catalogs on each Product
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After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

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TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

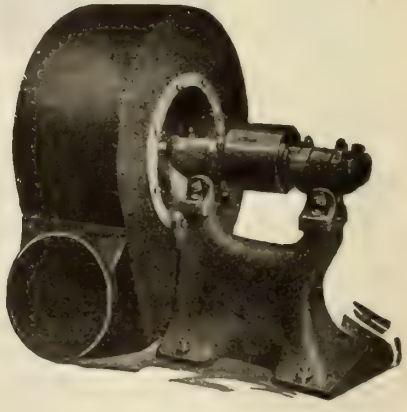
Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

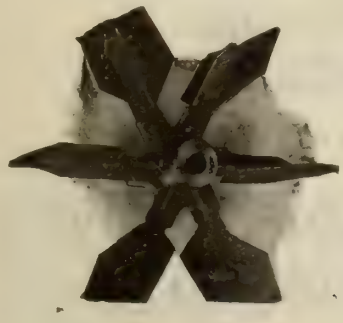
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"CANADIAN" MILL EXHAUSTERS

Handle Any Material



The Canadian Standard Mill Exhauster will handle any kind of material efficiently—sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc.



They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

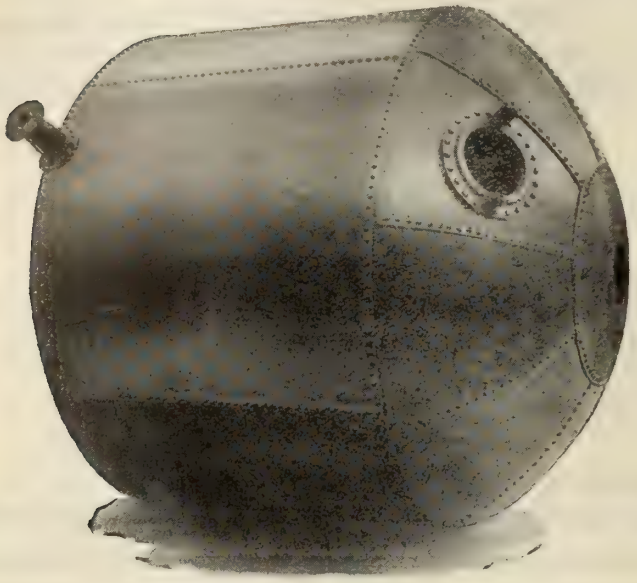
Catalog 410-77—gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co., Ltd.

KITCHENER, ONT.

STEEL TANKS

LIGHT and HEAVY



STEEL PLATE CONSTRUCTION

If it's a tank or any piece of steel plate construction we can make it.

Here are a few of our lines:

STORAGE TANKS for—
Oil Refineries
Oil Distributing Stations
Sugar Refineries
Distilleries
Packing Houses
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Chemical Works
Asphalt Plants
Cyanide Installations
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Filter Tanks
Air Receivers
Hydro-Pneumatic Tanks
Hot Water Tanks
Blow-off Tanks
Steam Jacketed Tanks

BINS AND HOPPERS for—
Coal and Ash Handling Systems
Grain Elevators
Mines and Quarries

SMOKE STACKS
BOILER BREECHINGS
RIVETED STEEL PIPE
PENSTOCKS
CAISSONS
TANK WAGONS

Consult us about your requirements or for Acetylene or Electric Welding

THE
TORONTO IRON WORKS
LIMITED
HEAD OFFICE: ROYAL BANK BLDG. TORONTO WORKS: CHERRY STREET

It is just as unreasonable to attempt a filing job with a file that has begun to get dull as it would be to run a machine without oil.

Full service from a file is possible only when the teeth cut keenly.

Discard a file as soon as it ceases to do this, and buy a new one.

To get long-lasting efficiency, specify one of these brands:

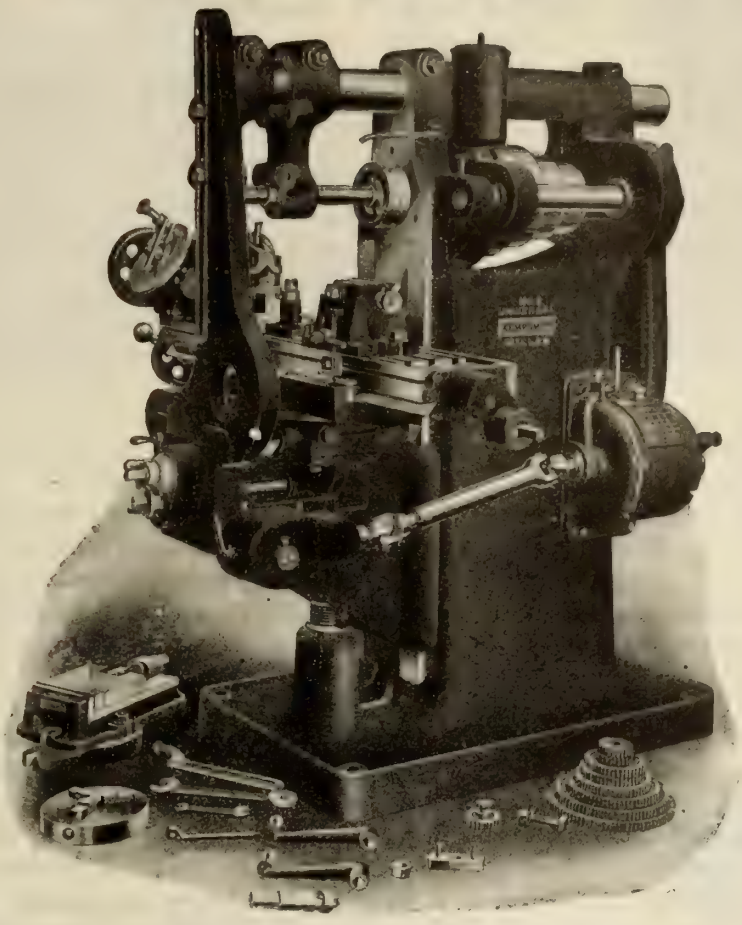
Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario

KEMPSMITH



No. 2 UNIVERSAL

Thirty-two years ago the Kempsmith Company began its career in a small one-storey frame building. To-day there are four main buildings, aggregating 106,000 square feet of floor area, besides various storage sheds, etc. Every building of the plant is a model of its kind.

It has always been, and will continue to be, the purpose of the Kempsmith Company to produce machines of the highest quality only, suited to the most advanced practice.

Every machine, whatever size or type, is put to test under cuts and conditions purposely more severe than it will encounter in even the most progressive shops, and when it leaves our factory it has our positive and definite guarantee back of it.

Literature will be gladly sent upon request.

THE KEMPSMITH MANUFACTURING CO.

MILWAUKEE, WIS., U.S.A.

Barandiaran & Co., 3 Alameda, San Sebastian, Spain; Bevan & Edwards Pty., Ltd., 117 King street, Melbourne, Australia; Blair, Reed & Company Nathan's Bldg., Wellington, N.Z.; Bloxham, Edgar, 12 Rue Du Delta, Paris, France; 245 W. 12th St., New York City; L. S. Devos, Grand Central Palace, New York City; Herbert, Alfred, 54 Dey Street, New York City; Neilsen & Winther, Blegdamsvej, 60, Copenhagen, Denmark; 24 Stone Street, New York City; Park & Lacy Co., 60 Clarence Street, Sydney, N.S.W., Aust.; Selson Engr. Company, 85 Queen Victoria Street, London, E. C., England; Corso Vittorio Emmanuele, 11, No. 9, Turin 5 Piazzo Castella, Milan, Italy; 24 Stone Street, New York City; Pascual Teja., La Capuchinas, No. 65, Mexico, D.F.; Spliethoff, Beeuwkes & Co., Leuvehaven, W.Z. 159, Rotterdam, Holland; Turner, Hoare & Co., Ltd., Lansdowne Road, Post Box No. 195, Bombay, India; Charter & Gardiner, 55 Calle Echaque Santa Cruz P. O. Box 1201, Manila, Philippine Is.; Societe Anonyme Belge, Alfred Herbert, Rue de Laeken, 35a & 35b, Brussels, Belgium.

CANADIAN DEALERS:—The Geo. F. Foss Machinery & Supply Co., Ltd., 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

Empty Shelves— and a Prediction

WITH inventories completed, retail hardware merchants find their stocks smaller now than at any time in recent years. Merchants have held back on spring bookings and freely admit that present stocks are totally inadequate for "Spring and Summer" trade.

Reports from retailers in all parts of Canada are such that we predict a pronounced buying movement within the next six weeks. We are entering a period of improved but cautious buying activity. Purchases will be considered more carefully, comparisons will be made more freely than heretofore. Merchants are adopting a "convince me" attitude. Unknown houses and unknown products are going by the boards these days. Merchants are not taking chances on buying any lines where there is an element of doubt as to the standing or reliability of the manufacturer or the product.

Merchants are the "choosers" to-day. The question is not one of where can I secure goods? It is a question of "whose line will I stock?" At the moment of decision, the line consistently advertised in Hardware and Metal—all other things being equal—is the one that stands the best chance of acceptance by the merchant. The 34th Annual Spring Buying and Directory Issue of Hardware and Metal, reaching the trade on March 18th will be studied closely by over 95% of the most important wholesale and retail hardware buyers across Canada from coast to coast. Thousands of feet of empty shelving will be filled up with lines advertised in the 34th Annual Spring Buying and Directory Number. Reservation should be made immediately.

HARDWARE & METAL

Office of Publication

143-153 University Avenue : Toronto, Canada

BRANCHES:

CANADA—Montreal, Southam Bldg., 128 Bleury St., Phone Main 1004. Toronto, 143-153 University Avenue, Telephone Adelaide 5740. Winnipeg, 901 Confederation Life Bldg., Telephone Main 3449.

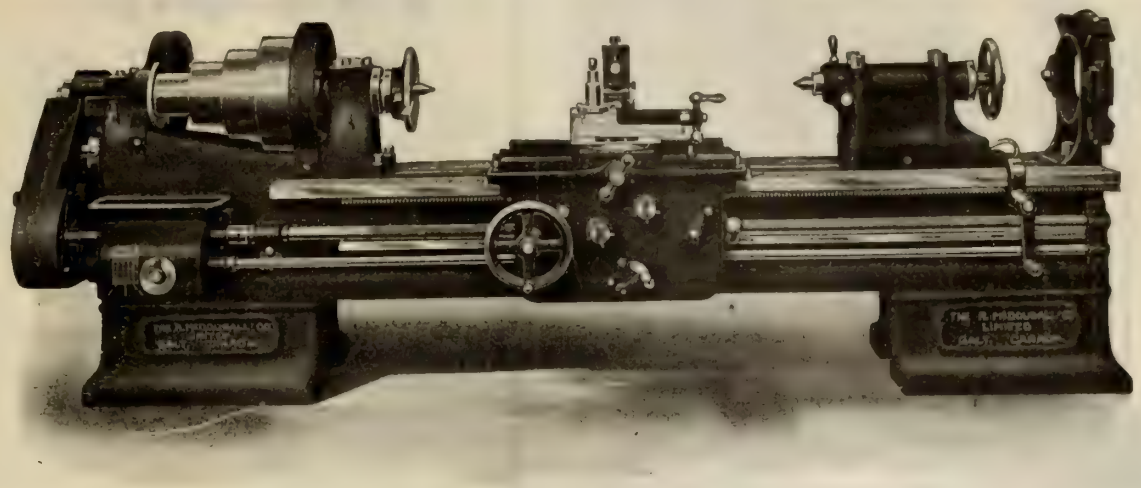
GREAT BRITAIN—London, The MacLean Company of Great Britain, Limited, 88 Fleet Street, E.C., E. J. Dodd, Director, Telephone Central 12960. Cable Address: Atabek, London, Eng.

UNITED STATES—New York, Room 1606, St. James Bldg., 1133 Broadway (corner 26th Street); Boston, Room 734, Old South Bldg., Telephone Main 1024; Chicago, 405-6 Transportation Bldg., 608 South Dearborn Street, Phone Wabash 9430.

EXPERT Workmanship

IS MUCH IN EVIDENCE IN THE CONSTRUCTION OF

McDOUGALL Engine Lathes



No pains are spared in the construction of this machine to make its accuracy and finish consistent with its perfect design.

McDougall Engine Lathes possess all the features which ensure economical production, dependable accuracy, and ease of operation.

Shall we send you our literature describing this lathe in detail?

THE R. McDOUGALL COMPANY, LIMITED, GALT, ONTARIO

The Canadian Fairbanks-Morse Co., Limited, Sales Agents

Long Service



The Real Test of

POWER PRESS

Economy

Whether the initial price is high or low depends on the kind of service given. What looks like a low price may prove exorbitant. Make certain about this. Choose a Hepburn Press and get real economy. Cranks are made from solid forgings. Long strokes. Long service guaranteed.

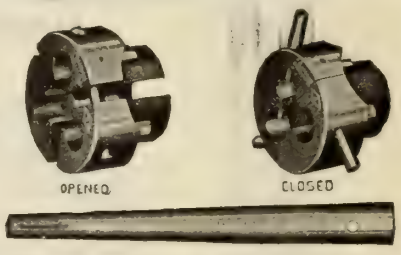
Write us if you need Cranes, Special Machinery, Planer Work, Pumps, Forgings, or Grey Iron Castings.

JOHN T. HEPBURN Limited

Engineers and Iron Founders

18-60 VAN HORNE STREET, TORONTO, ONTARIO.

REGISTERED J TRADE MARK



Any Tube--Thick or Thin

Instantly Expanded with

"JARDINE"

Patent Extension Self-Feeding Tube Expanders

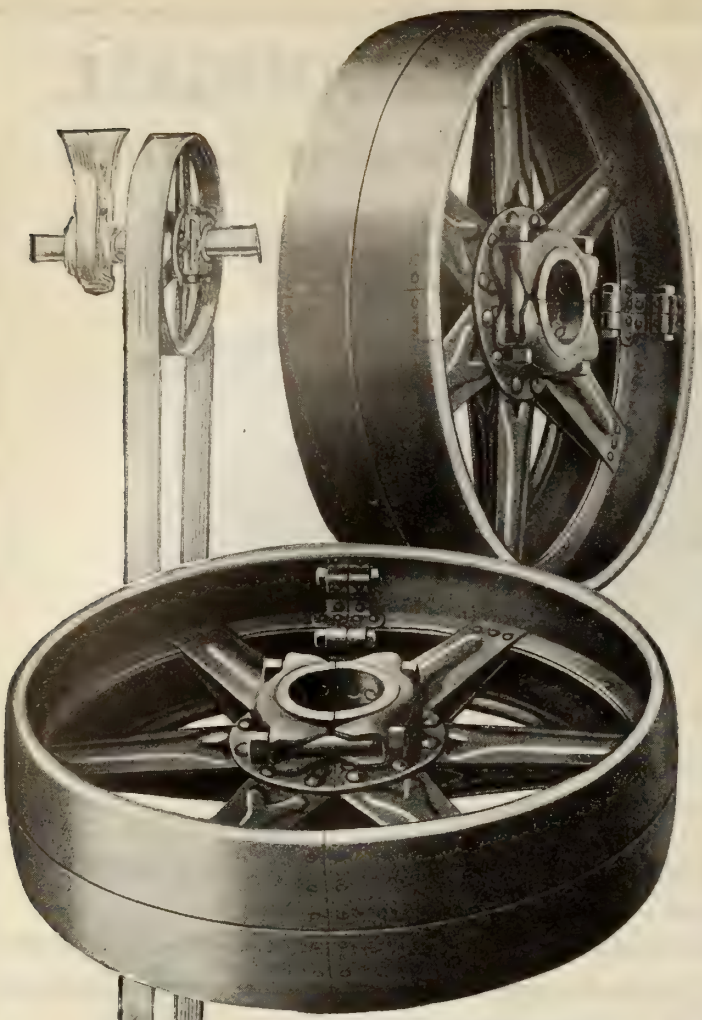
No time is lost. These tools are self-feeding and self-releasing. No difficulty with extra thick, extra thin or irregular size tubes. Perfect work on all. Reverses with two turns—no hammer needed. In sizes from 1¾ inches to 5 inches with case-hardened bodies that give twice the usual life.

Dudgeon style tube expanders, 1 inch to 6 inches.

Ask for catalogue No. 18.

A. B. JARDINE & CO., Limited

HESPELER, ONTARIO

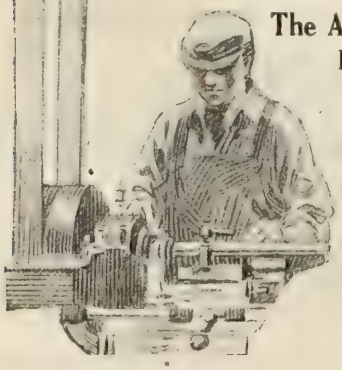


MORE POWER!
—LESS WASTE

Why "American" Pulleys deliver the possible maximum of power is explained in detail in a book entitled "Getting Maximum Pulley Efficiency"—it's yours for the asking.

Here are two of the principal reasons: "American" Pulleys reduce bearing friction and belt slip—they are light in weight yet strong enough for the heaviest duty.

The American Pulley Co.
Philadelphia, Pa.



AMERICAN
STEEL SPLIT
PULLEYS

Tycos
temperature
instruments


INDICATING


RECORDING


CONTROLLING

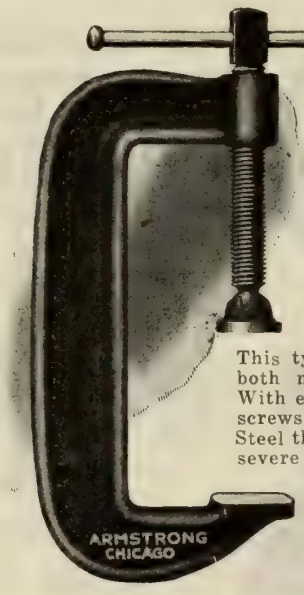
Once installed, *Tycos* Temperature Instruments become permanent assets by satisfactorily and economically meeting every temperature problem you have.

Taylor Instrument Companies
110-112 CHURCH ST., TORONTO, ONT.

There's a *Tycos* or *Taylor* Temperature Instrument for Every Purpose

832

ARMSTRONG



Drop Forged "C" Clamps

This type is made in all sizes for both medium and heavy service. With extra long hubs and oversize screws made of Chrome Nickel Steel they stand up under the most severe service.

C Clamps, Machinists' Clamps, Strap Clamps—large or small. Refuse imitations. Write for Clamp and Lathe Dog catalogue.

ARMSTRONG BROS. TOOL CO.
"THE TOOL HOLDER PEOPLE"
306 N. FRANCISCO AVE. CHICAGO, U.S.A.
STRONG STRONG

These Belts Never Seem to Wear Out

Gutta Percha & Rubber, Limited, made a decidedly helpful invention when they designed the rubberized fabric Belting which has made the engineering world recognize the

"P. M. S" Belting

as the most enduring, most efficient Belting that is made to-day. "P.M.S" Belting stands heat, cold, dampness and dryness; has minimum shrinkage and stretch, and will outwear any other kind.

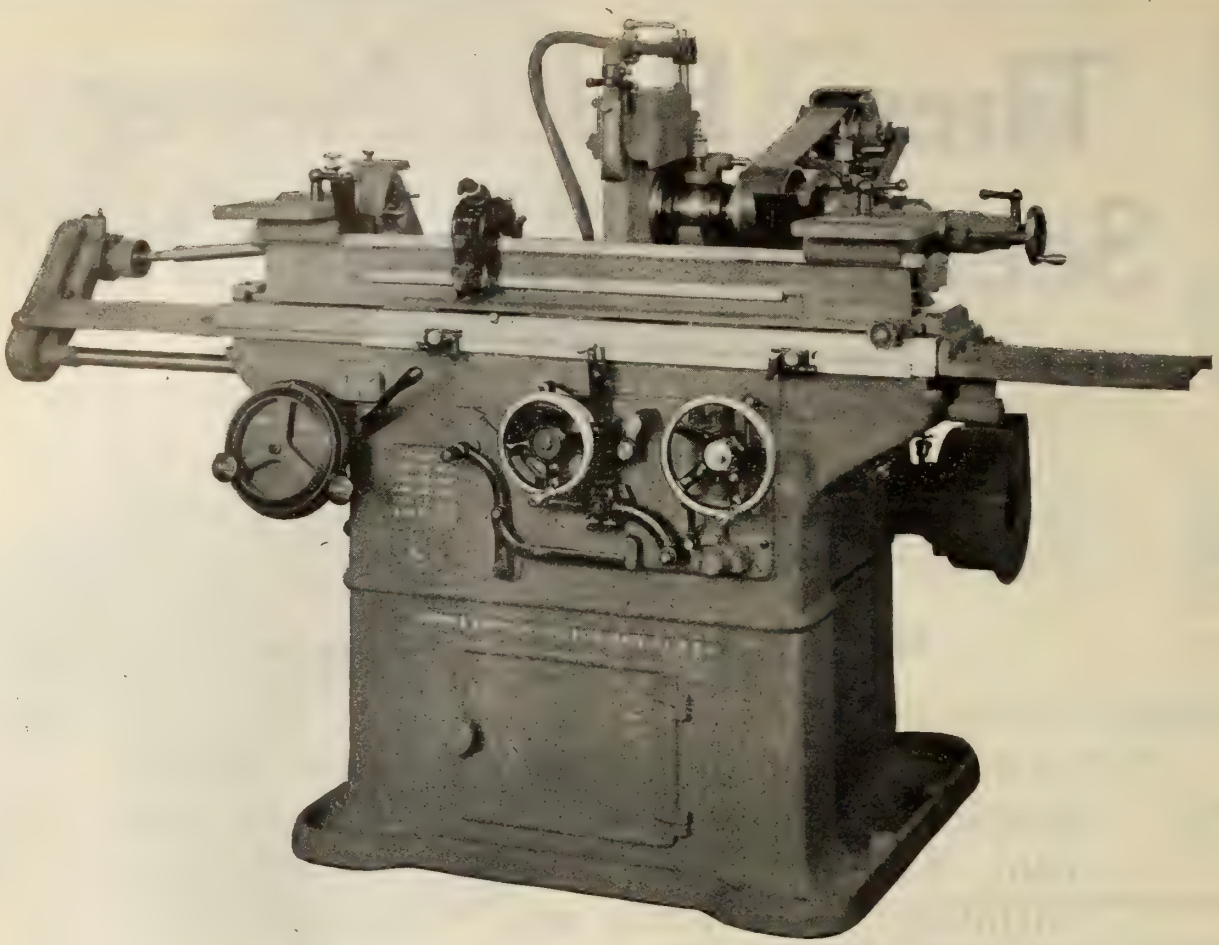


Manufactured Exclusively By

Gutta Percha & Rubber, Ltd.

Head Offices and Factory,
TORONTO

Branches in all Leading Canadian Cities



BROWN & SHARPE

PLAIN GRINDING MACHINES

A New Angle on the Economy of Grinding

Quantities of jobs demanding high accuracy and smooth finish, now being completed on automatics and turret lathes, can be finished with greater economy by grinding. Let's see how this is so. By giving pieces an allowance for grinding, you increase production on your automatics and turret lathes, no longer holding them to the slower speeds and feeds necessary for high accuracy or smooth finish.

The grinding machine keeps pace with this increased production and turns out smoother, more accurate work than could be secured by other methods. Thus quantity is increased and quality improved by the use of grinding machines.

Perhaps these points have thrown more light on the economy of grinding. The Brown & Sharpe No. 11 Plain Grinding Machine shown above is a popular size for production work.

Send for our Catalog No. 137 describing our complete line of Grinding Machines

Brown & Sharpe Mfg. Co.

Providence, R.I., U.S.A.

Canadian Representative : Canadian Fairbanks-Morse Co., Ltd.

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII. No. 8 FEBRUARY 23, 1922

Reducing Expense by Careful Oil Supervision

Economy of Closed Tank—Machinery Depreciates When Poor Oil is Used—Lubricant For Varied Uses—Proper Facilities Required for Oil Storage—Saving Fuel and Power

By WADE HAMPTON, Jr.

THERE is no more vitally important item in connection with the operation of machinery than lubrication, and by lubrication I mean, not the squirting on indiscriminately of oil, but of applying to each individual unit of a manufacturing plant, or each different unit of machinery, a correct and scientifically perfect oil for that particular unit.

As the human body must be properly fed, nourished and cleansed, so must machinery be properly nourished, fed and kept in an absolutely clean condition. It is just as sensible to suppose that you can feed a horse saw-dust instead of corn or oats and expect him to do as much work as a properly nourished horse would do, as it is to expect improper lubrication to produce 100 per cent. efficient lubrication. More money is wasted every year by operators of machinery on account of the poor or improper grade of lubricating oil they use, than on any other article that is necessary for the operation of manufacturing and power plants.

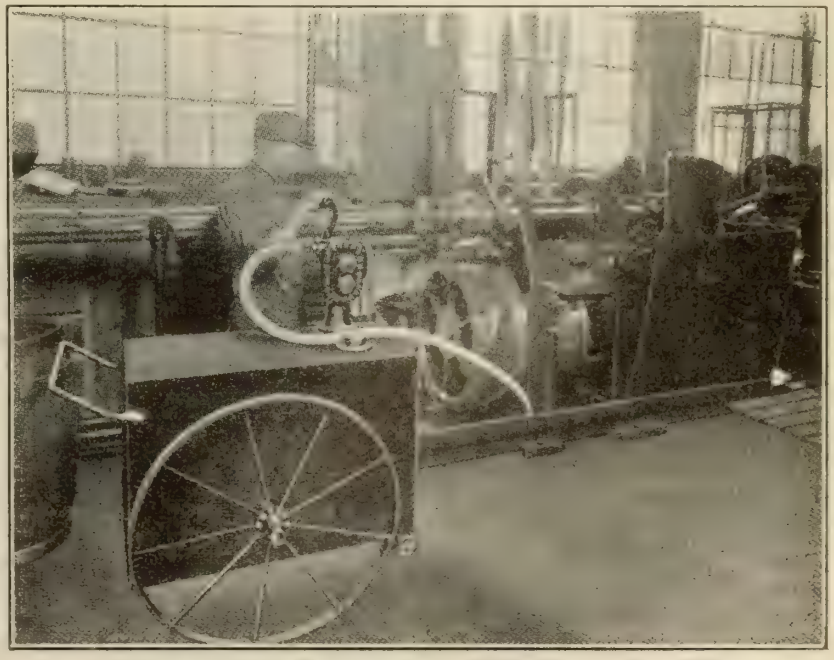
In a considerable number of years of visiting manufacturing plants, power generating stations, etc., the writer has had occasion to observe a great many conditions in connection with the lubrication of such plants which indicate that very little thought is given to the subject of correct lubrication, and that in 98 per cent. of the manufacturing industries to-day, particularly in the United States and Canada, there has been very little attention paid to the tremendous losses which are incurred through improper use of lubricating oil.

Where the Trouble Starts

The trouble usually starts in the purchasing agent's office. In plants throughout the country the average number of barrels of lubricating oil consumed per factory is approximately 10, and to the purchasing agent, who is buying fairly large quantities of other materials, this seems to be an unimportant item. He is approached from time to time by salesmen representing different firms who sell lubricants, and as the salesman is often not a technically trained man, he has only at his command such knowledge as he has been able to acquire from years of experience, or has been given him by the firm he represents. No company or individual selling lubricants, who realizes the importance of correct lubrication, ever fails to train representatives and salesmen to offer high quality products. They also carefully train them to know the lubricant, which fits any specific case.

A salesman who has called several times on a purchasing agent without success, is very prone, in order that he may make a sale, to quote on low priced products, even if he is not sure they are the proper lubricants for the purpose for which they are purchased. This has been going on for so many years that purchasing agents, as a general rule, do their buying of lubricants principally on a price basis, and it is just as reasonable to suppose that people can buy a high class, high grade oil, at a low price as it is to think they can purchase a car of Cadillac quality for the price of a Ford. Quality carries with it a high price, and it takes no exhaustive or extensive arguments to prove this. All manufacturers have to do is to apply the principle to their own business.

To get back to the purchasing agent again, the oil salesman, and the number of years they have been going without careful attention being paid to the use of oil for lubricating purposes. About 90 per cent. of all purchasers of oil consider one thing, and that is the price. Now the mechanical superintendent, or superintendent of production, or whatever his title may be in the factory, is probably so busy trying to get produc-



Withdrawing oil from pan of automatic screw machine

The matter contained in this article must not be used for any other purpose, as it has been written especially for Canadian Machinery. The author is sales manager and lubricating engineer for McColl Bros., Toronto, Ont.

tion up, or the cost down, that he has been an unconscious accomplice to the inefficient oil salesman and the purchasing agent. In other words he has been putting obstacles in the way of greater production, and lower costs, by taking and using the lubricants that the purchasing agent buys without making any exhaustive tests to see if they are the best for the purpose.

In 90 per cent. of the manufacturing industries and power houses in this country the methods of handling lubricating oils after they are received are very wasteful. They are usually kept in an exposed place where any one in the plant desiring oil can get it, and the oil is usually stored in either the original package with a common faucet screwed into the barrel, or in one of the old-fashioned tin tanks. The former method of storing, so common in this country, is very wasteful:

1st—On account of there being no way to salvage the drippings, or any oil that may be wasted on account of filling the container that is used to drain the oil from the barrel.

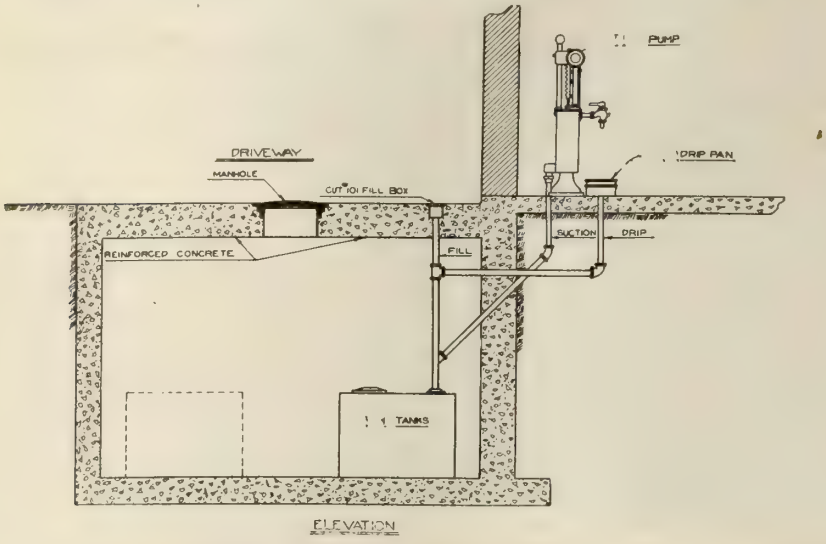
2nd—On account of the barrels becoming more or less dryed out and leaking.

3rd—There is great danger of some careless employee knocking up against the faucet and turning it on, and it is a common occurrence for complete barrels of oil to run away and be wasted because some person carelessly neglected to turn the faucet off, when he was through.

The latter method of storing oil in the old fashioned sheet iron tank, probably did away with the danger of loss by carelessness, as previously mentioned, but as these tanks are very loosely covered, the dust which is always in the air and which settles in most manufacturing plants, gets into the oil and causes it to become dirty. The bottom of the tank gets foul, and a great deal of oil from time to time is wasted, because it has to be thrown out, being unfit for use on account of the dirt that is in it. These tanks are not weather proof and as a great many oils draw dampness very rapidly from the atmosphere, they become impregnated with moisture, this materially affecting their efficiency as lubricants.

The First Step is to Prevent Waste

One of the first considerations of an economically operated plant, is the erection of an oil storage room in which there should be proper facilities for storing lubricants, and which should be kept under lock and key, the material being issued only on the superintendent's orders to the stockkeeper, so that the superintendent himself will have a record from the stockkeeper's report of which part of the factory, machine, machinery or department is using the most oil, or using an excessive amount.



Showing sectional view of oil storage

These storage facilities need not go into expensive equipment. The writer has in mind a very simple device which can be screwed into the top of a steel oil barrel, when the oil can be pumped out of the barrel as it is needed. These pumps do away entirely with leaking barrels or dust collecting oil tanks. Further, if there is anything wrong with the oil, the company supplying it will not be able to give the old hackneyed excuse that the oil was probably emptied into a dirty container or oil tank. By using this simple method of getting oil from barrels, it will never be exposed to the atmosphere until it is ready to be used. The steel barrel is merely rolled into the oil storage room, placed in position, and the pump screwed into the head bung of barrel.

There are many other more expensive oil handling devices, which of course, are more efficient and give a better check on the oil used, than the one heretofore mentioned, but in case a change in the class of oil should be decided upon by the management of the works, it becomes necessary to clean these tanks out. Also, if dirty oil should be put into them through mistake, and there is any of it left in them, it will not only spoil the oil you have on hand, but is allowing a loophole for the supplier to say that the oil was in good shape when it left his hands, and that he is sure the trouble was caused by the oil being put into a dirty tank.

The illustrations give an idea of different oil tanks commonly used in industrial plants, and we are indebted to the Canadian Tank and Pump Co., Toronto, for their use. Let us decide to come to the point where we are going to keep the oil as carefully guarded and issued as the most expensive material we use in manufacturing. Suppose we are going to be sure that all the oil we buy is issued for use on the machinery of our plant, and that we are going to hold the storekeeper accountable for it. If we do this, we have taken the first step in oil economy. We are, at the same time, going to give the operating superintendent of the plant an idea of how to intelligently figure out which machines in his plant consume the most oil, and which department is the most expensive to run from a lubricating standpoint.

The Selection of Lubricants

Careful estimates made by the most efficient engineers on the American continent, claim that practically 37 per cent. of the total horse power generated is overcome by frictional resistance. In other words, it takes 37 per cent. more horse power to do the work than is actually called for on account of friction. Friction reducing lubricants are essential to efficiently operated plants. Now, most any oil will lubricate, but the quantity which it takes to do the work indicates the amount of lubricating qualities in the oil. Lubrication is a study in itself, and a considerable mechanical knowledge is necessary, as well as a knowledge of lubricants and the conditions under which they work most efficiently.

The first step that should be taken by any prospective consumer of oil, should be to call into consultation a lubricating expert and get his recommendations as to which lubricants should be used on the different units in the plant, and how they should be applied.

The next step is to verify this specialist's recommendations. To do this, it is necessary to gather considerable detailed information. After the recommendations have been received, a quantity of the material, sufficient to make at least 30 days' run, should be purchased, very carefully stored as mentioned heretofore, and should be issued only on the presentation of an order signed by the proper authority.

The third step is to thoroughly cleanse all the lubricators in the plant, then clean the bearings. Next decide to use no oils or greases other than those recommended.

A very careful record should be kept of the amount of production that is turned out by the plant, the total number of hours the plant has run, and

(Continued on page 25.)

Anti-Slip Devices Save Time and Money

Prevention of Slip Vital to Safety—Positive Stops Prevent Sliding—Reducing Labor of Operator When Clamping Parts—Serration on Tool Face Adds to Efficiency

By FRED HORNER

AMONGST the numerous interesting featrues of machine tool operation that of slip prevention takes an important place. This essential is sought in certain portions of the machines, and in the tool-holding and work-holding appliances. The object in some cases is to prevent waste of time by having to re-set and re-tighten details of the mechanism, in other instances absolute prevention of slip is vital to safety. The results of untoward movement may mean a smash-up, or the work may be tooled to incorrect dimensions. These two points are more important in semi-automatic and automatic machines than in those where the operator is in constant attendance, or in machines doing general work, where the tools, etc., do not remain in fixed positions for long periods. Hence, an extra provision must be considered in many details of machine construction and tool-clamping devices, whereby a positive stop prevents the sliding of the part, this positive resistance acting in conjunction with the frictional mode of clamping usually adopted. Frequently the dead check to movement may be made to serve another useful function—that of fine adjustment—but occasionally the latter comes after the firm fixing and affords a small degree of correction for position. The precise method or arrangement depends on the type of machine under construction, and the facilities available for the introduction of the details. Some of the multiple tool-holders, for example, need different treatment to those of single-tool type, the construction of the stop plates or screws having to be made more compactly. The presence of other tools or sets of tools which range close together at certain intervals, likewise exercises a modifying influence on the check devices.

Conserving Energy of Operator

Another reason for applying anti-slip devices is to reduce the labor of the operator in clamping parts which are frequently tightened and loosened. By taking off the strain from a bolt or bolts by means of a positive stop, the wrench can be used with less exertion, and the bolts are not stressed severely in withstanding the pressure. Heavy cuts may be taken with perfect confidence, and no fear of sudden wrecking. One of the chief specimens of this class is the rack and pawl check for lathe tail stocks (Fig. 1), which is a valuable idea, since, otherwise, there is nothing to prevent the head from sliding endwise excepting the frictional hold of the bolts and plates.

Among auxiliary appliances the machine-vice is one of the most severely stressed, and frequently altered; consequently a favored device is that of notching out the face to engage a stop-strip which provides a positive thrust check to the moving jaw; or the base of the latter is made with a tongue (Fig. 2).

Another detail where end thrust is very great is the tool-bar employed in slotting machines, and in vertical planers. The method followed is either to bolt a positive stop-block on the ram to touch the tool end, Fig. 3, or to machine serrations across the back of tool-burr, and provide corresponding serrations on the face of the tool-slide, the bar being adjusted to the desired vertical relative setting and then clamped. The serration of tool-bars in this fashion is a different thing from dealing with the tools themselves, which are fashioned from plain steel, and do not as a rule pay to cut notchings on. Therefore if anti-slip has to be arranged for, it must either proceed from some feature incorporated in the structure of the holder, or an auxiliary screw needs to be located to come in the path of the tool, and block it.

Thrust On Slotter Tool Bar Preventing Slippage of Disc Tools

Disc or circular tools, such as for threading or forming, are not so easy to deal with as the rectangular tools, and the practice in regard to them is either to enhance the frictional grip enormously, or to cut face serrations, or make a hub with flats, so that a special washer or a rocking arm can be utilised to gain a positive grip. A mode of supplementing the frictional grip, while still allowing the heading disc to be turned into fresh positions after repeated sharpenings, is illustrated in the lathe tool in Fig. 4. The disc is not pulled against a plain flat face, but is built with a coned hub, to fit a corresponding taper in the bar; this supplies a frictional clutch of immense holding capacity, and extra to this there is a taper bush fitting inside the bore, the setting up of the screw bringing these two grips into action. Another principle, which is applicable to any of the circular forming tools employed in the automatic, is represented in the Brown & Sharpe holder seen in Fig. 5, where a hook-bolt, A, drawn against the tool flank gives what is in effect a large washer pressure over the side.

Serrations on the tool face add to work of manufacture but give a powerful hold positive against slip. The method of locking is preferably with a toothed washer forged with an extension arm, the end of which is raised or lowered by nuts on a screw. A similar idea serves for adjusting the holders for rectangular-blade tools, which latter are clamped in the rocking holder after the style of Fig. 6. By milling a hexagon or octagon upon the hub of a tool an alternative source of non-slip hold is afforded, a swinging arm being placed

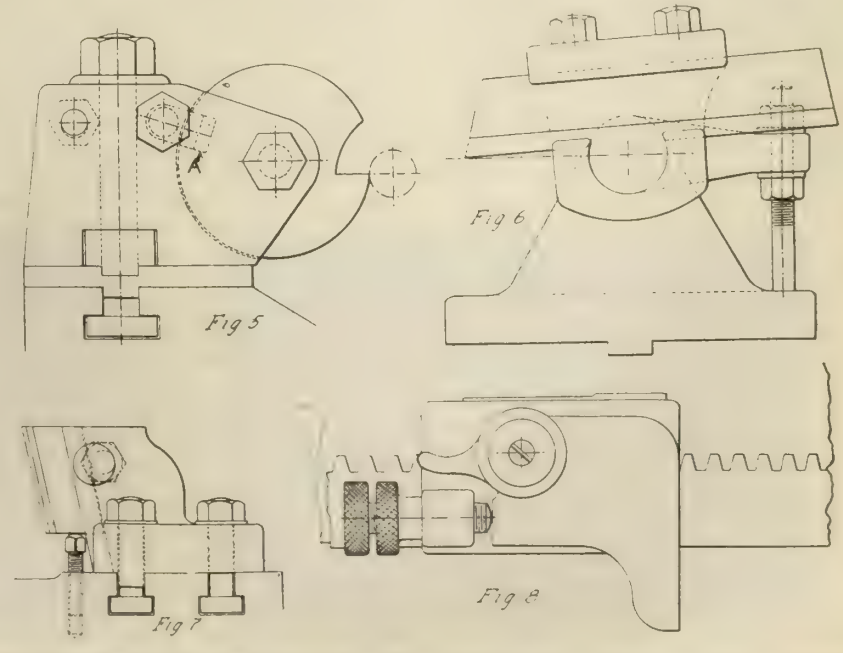


Fig. 5.—Locking cutter with hook bolt. Fig. 6.—Rocking type of locking device. Fig. 7.—Taking care of vertical thrust. Fig. 8.—Spring latch locking device.

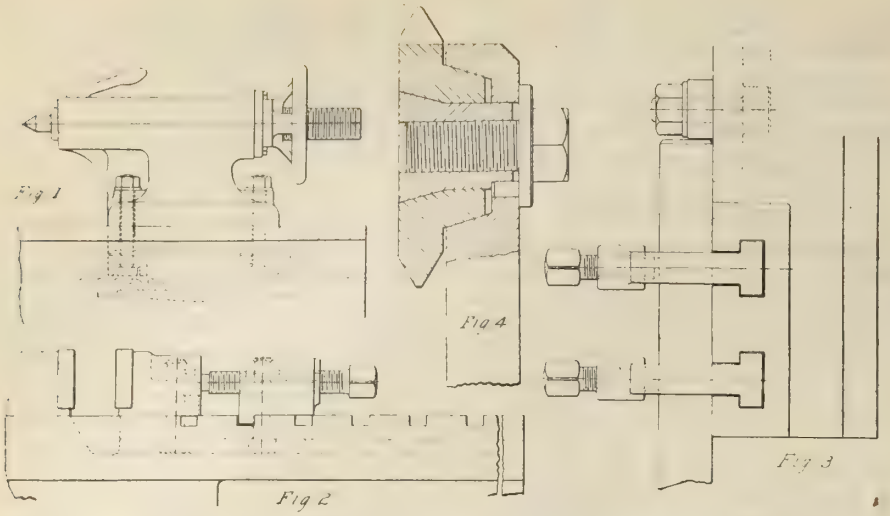


Fig. 1.—Rack and pawl locking device. Fig. 2.—Tongue and groove non-slip. Fig. 3.—Lock fitted with serrations. Fig. 4.—Double cone friction lock.

over the hub to control it by the slewing of the outer end of the arm.

The majority of the straight tools which are held in boxes and set to cut certain sizes are either secured with ample set-screws, often aided by serrated seatings or clamp-plates, or they are set up and afterwards sustained by back screws. The latter are the more positive way, and besides in some instances may serve as stops for convenience in replacing the cutters after touching up their edges. This applies also to many kinds of boring bars and heads fitted with backing screws for the cutters.

Anti-Slip Thrust Screw

Flat forming tools, whether presented in the ordinary or in the inverted position, are best sustained by a thrust-screw (see Fig. 7 for example), so that no amount of pressure from the work can cause displacement. A similar tool, the thread chaser of form type, happens to be checked in a different fashion; the adjustment here is effected by a small screw at one corner, partly fitting the chaser and partly the holder, hence end slip is impossible so long as the screw is in place.

Another feature which affects the operation of some machines is automatic tightening when an element tends to slip. The degree of tightness consequently varies with the amount of cutting pressure. The tightening is brought about by wedge cam, or eccentric action, or by screw and cone, etc. Many of the modern drill chucks operate on such a principle, so also do some of the heavy face-plate driving dogs utilised for wheel turning, and shaft dogs for grinding.

Reversing and feed dogs for grinding machines afford a further example of anti-slip fitting. To prevent sliding of dogs upon the bar, and possibly causing the fracture of an expensive grinding wheel as well as other damage, the best device is that of a rack on the bar. Fig. 8, spring latches locking the dogs thereto. The final adjustment is performed by the screw and lock nut. This practice makes for convenience in operation, since a dog can be raised to let the table run past the reversing locations, and the rack teeth ensure accurate replacement of the dog subsequently.

Side Slippage of Tools

Anti-slip devices considered in regard to the holding of pieces for machining, chiefly assume the form of dead stops. These, which are extensively utilised on such work as planing, to resist the tool thrust, are represented in another manner in innumerable jigs and fixtures, where solid faces, or ledges, and locating screws prevent any chance of movement. The risk of slip in planing is to be feared so often that the stop pegs, or bolted brackets on the table are in frequent request; what is more troublesome, however, is the chance of side skidding, which causes the piece to slew round and probably induce serious disatser to work or tools. The end stops alone do not always prevent this, particularly when cuts occur at extreme edges, and side stops have to be included. It is better to consider these seriously at first, and spend a little extra time in setting up than to incur skidding soon after the tooling has commenced.

Another condition where slip has to be guarded against is in cutting gears, including ba ches clamped together. Friction of the binding washers, or of the face-plate when such is used may or may not be a sufficient surety against slip after cutting has begun. But it is safer under slogging cuts to gain a drive with a pin against an arm or opening, or use a clamp which will always keep the blanks in the original position. When cutting spirals, especially, the torsional stress is very great (particularly in planing with multiple-toothed shaper tools) and the blanks should be keyed on to the arbor, or held very tightly, while the latter is keyed into the spindle.

Why Men Succeed

"SUPPOSE a young man is working in an office or a shop on small pay, and wishes to gain an increase so that he can marry, what would you advise him to do?" was the question put to Henry Ford.

"The fact that a young man has been on the pay roll for a long time, or wishes to marry, is not enough to justify an increase. He must get results of some kind. Many young fellows, especially those employed in offices, fall into a routine way of doing their work that eventually makes it become like a treadmill. They do not get a broad view of the entire business. Sometimes that is the fault of the employer, but that does not excuse the young man."

"Those who command attention are the ones who are actually pushing the boss. To be specific, get books and read up on the industry in which you are employed. If you are working in a bank, study banking. If you are selling clothes or dry goods, study the business from every angle. Get ready for a promotion before there is any actual vacancy. Be prepared for your opportunity when it comes. It pays to be ahead of your immediate job, and to do more than that for which you are paid. A mere clock-watcher never gets anywhere. Forget the clock and become absorbed in your job. Learn to love it. If you follow these suggestions you will not have to ask for an increase in most instances."

"Should a man talk over his business affairs with his wife?"

"Certainly. Isn't she his partner? And besides, she may have more sense about some matters than her husband. Two heads are always better than one."

"Do you think there has been an increase in pleasure-seeking among the young people? In other words, are they going pleasure-crazy?"

"Oh, no," he replied, shaking his head. "That is merely a passing fever. Did you ever stop to think why young people are so eager to have a good time?" he interjected abruptly. "It is because they crave experience and self-expression. Life is new and strange and they are stirred by the spirit of adventure. After that has been satisfied to some degree, they settle down and lead healthy, normal lives."

WATCH FOR THIS

It is one thing to own precision instruments, and another to know how to use them with maximum efficiency. Whether you actually own such instruments or not, it will pay you to read next week's Canadian Machinery, in which you will find a detailed article on the subject of the "Proper method of using precision instruments."

Methods of Handling and Heat-Treating Springs

Principles Governing Uniform Heating And Cooling—Cost Element Dependent on Many Things—Type and Arrangement of Equipment—Stationary and Continuous Furnaces—Utilizing Heat In Waste Gases

IN THE heat-treatment of springs, probably more variation occurs in methods of heating and handling than in the heat-treatment of any other standard fabricated steel product. This variation is due to the necessity of producing springs of different physical characteristics and in irregular quantities to meet a diversified demand.

The variety in size and shape of vehicular springs, with the still greater variety in the nature of springs for special purposes, and the divergent manufacturing conditions, make no two cases exactly alike. This calls for different methods of heating and handling in the practical application of the fundamental principles of heating and cooling upon which the heat-treatment of good springs is based.

Vehicular springs are now required in thousands where comparatively few were previously needed. Then, too, the springs on modern motor vehicles are subjected to much harder service than were those on the horse-drawn vehicles of the past. But even to-day the methods of heat-treating springs are occasionally below the relative standard of quality set by the old-time blacksmith, who with his skill overcame the disadvantages of inferior material and equipment and produced a limited number of comparatively good springs with a coal fire. It is fortunate, however, that high-grade steel and improved forming and heating equipment are now available, so that with correct methods of heating and handling, better springs may be obtained at less cost.

Making Special Springs

In the manufacture of special springs, particularly in the jobbing shop, the variety in the shape, quantity and methods of heat-treatment are such that it is difficult to approach even the limited degree of standardization in method of heat-treatment that is possible with vehicular springs. In either case the principles governing uniform heating and cooling cannot be disregarded without a sacrifice in quality, although there is great latitude in the design of equipment which will provide an efficient method of handling the springs.

In the up-to-date spring shop great care is taken in the process of manufacture to insure high quality product. The element of cost is dependent not upon quantity production alone, but is also greatly influenced by methods of heating and handling, design and arrangement of equipment, and efficiency of the operatives. The proper co-ordination of all these essential factors generally results in improved quality, decreased cost and increased business.

To heat correctly is the first consideration in the manufacture of quality product. The process of heat-treatment, method of heat application and influence of the "human element" predominate.

To heat economically it is necessary to consider the influence of the type, size, number and arrangement of heating, cooling and handling units upon the items of output, labor, fuel, floor space, investment, and such other items as may properly be included in the actual cost of production.

The fundamental factors governing the uniformity of heating and cooling, which are based upon the elements of temperature and time, and the mass and surface of the individual piece exposed to the heating or cooling medium, cannot be ignored without a sacrifice in quality and ultimately in cost of the finished product.

The relation of type and arrangement of furnace equipment to the cost of product is not sufficiently appreciated. This is primarily due to disregard of the fact that the cost of production is very largely influenced by the nature of equipment and method of heating and handling, not by the price of fuel alone.

Furnaces are too generally selected merely with regard to the nature of fuel or heating energy for generating the heat, or with reference to the method of handling the material, and with disregard of the method of applying heat to the individual spring. Although efficient methods of handling are necessary from the standpoint of production, it is just as important to provide for proper application of the heat to insure good quality. Poor heating conditions, resulting in uneven coloring of the springs or dark spots in the heating zone, are generally disclosed in service.

Uniformity of Heat

Proper consideration is not usually given to the difference between indication of uniform temperature at some point in the furnace chamber and the uniformity with which the heat is applied to the individual piece. Indication of temperature control may be accepted as evidence but certainly not as proof, of control of heated product; for, unless there is proper method of heat application and loading, and regular input and output of material, keeping the chamber substantially and continually filled to capacity, it is not likely that a uniformly heated product will be produced even though there is a uniform delivery of heat to the chamber.

The great variety of plant conditions and production requirements make it difficult to develop any one process of

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Fig. 1.—Twin and 6-chamber furnaces adopted for work on autombile leaf springs.
Fig. 2.—Six-chamber furnaces, equipped with separate chambers for fitting, hardening and drawing operations, and for work of two crews.

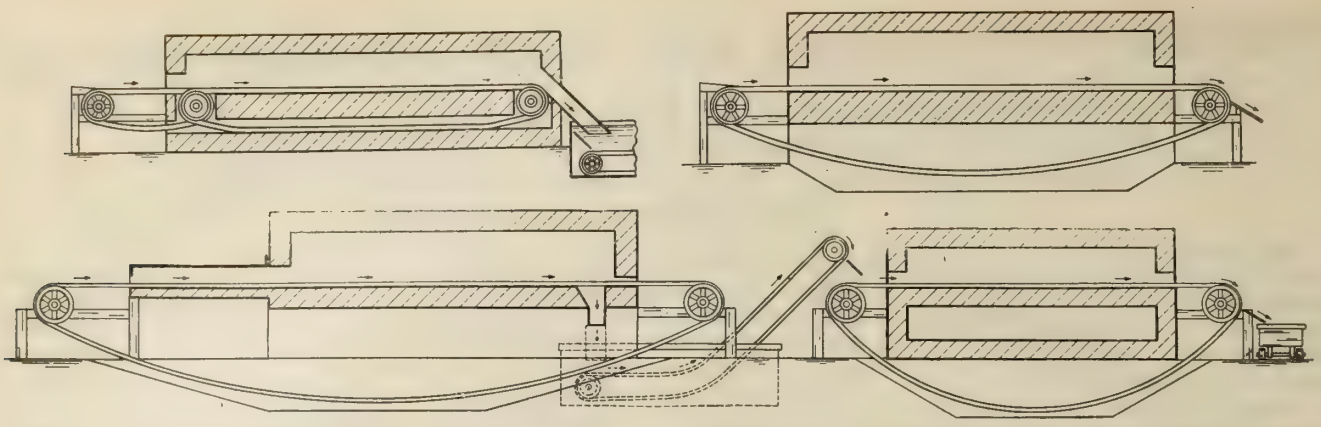


Fig. 6.—Continuous conveyor type for hardening special springs. Fig. 7.—Similar type for drawing temper and annealing. Fig. 8. Continuous type of furnace arranged for instantaneous transfer of springs in hardening and drawing.

heat-treatment, method of production, type of machine or furnace that may be considered a standard for the production of high-grade springs at low cost. Even with an established process and type of machine, the variety of plant conditions, such as nature, quantity and flow of material, cycle of operation, floor space, available fuels, etc., affecting the type, size, number and layout of furnaces, invariably make it necessary to adapt the furnace equipment to the plant conditions.

Formerly, one small chamber heated enough stock to keep one fitter busy. The fitting, hardening and drawing operations were frequently performed in the same furnace and at practically the same temperature, the judgment of the fitter being depended upon to determine both the temperature and the period of time required.

The demand for better quality and decreased cost indicated the inherent weakness of such methods. The advent of machines to meet the pressing demand for quantity production has led to the development of different types of furnaces to meet the equally pressing demand for better methods of heating, cooling and handling.

There is marked contrast between the hand-fitting operation, Fig. 1, the simple types of fitting and shaping machines, Figs. 3 and 4, and the more elaborate forming and quenching devices, Figs. 5 and 10, for shaping the spring. This contrast, however, is no greater than that between the old-fashioned single-chamber furnace with its one-heat method of operation, dependent almost entirely upon the skill of the operator, and the improved types of stationary multi-chamber furnaces, Fig. 2, and different types of modern automatic furnaces. Such modern furnaces not only contribute to an improvement in quality through better methods of heat application, but also materially reduce the cost of production through the economies effected in labor, fuel, floor space, equipment, and number of operatives per unit of production.

Three-Heat Method

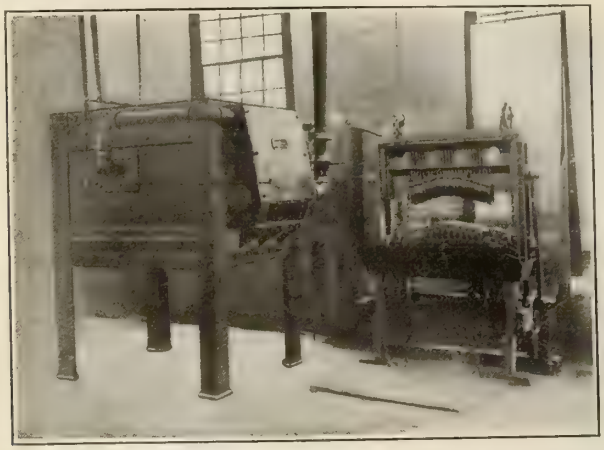
In the hand-forming of vehicular springs the three-heat method is preferred. The leaves are heated for shaping, again for hardening and finally for drawing. In such hand-fitting, and wtih some machine-forming operations, stationary furnaces in single or multi-chamber form may be employed. Double-chamber furnaces, Fig. 1, with separate chambers for hardening and drawing, and a separate furnace for fitting, may be made necessary by the shop conditions.

Three or six-chamber furnaces, Fig. 2, arranged for one or two screws, as preferred, with separate chambers for fitting, hardening and drawing represent the modern practice for hand-forming with stationary furnaces and are generally preferred for the advantages they afford in concentration of operation, saving in floor space, efficient methods of handling, etc. The size, number and arrangement of chambers in such stationary furnaces are dependent entirely upon the shop conditions and manufacturing requirements.

Continuous furnaces of automatic or semi-automatic type for machine forming are used in a variety of design, with different methods of generating and applying heat and methods of handling the springs. When the plant conditions permit, the use of such furnaces generally leads to improved quality of product resulting from uniform time of exposure and rate of heating, also a lower production cost through more efficient methods of handling the product and utilizing the heat.

The continuous furnace has its limitations. It performs to best advantage when the size, shape and composition of the stock are fairly uniform; and when the supply is regular and sufficient to permit of substantially continuous operation at full capacity. Its field of usefulness is narrowed when the supply of stock is irregular and the operation intermittent; when there is a distinct variation in the size, shape or quantity of the stock to be heated, or by other conditions that do not make the operation as a whole strictly continuous.

The continuous conveyor type, Figs.



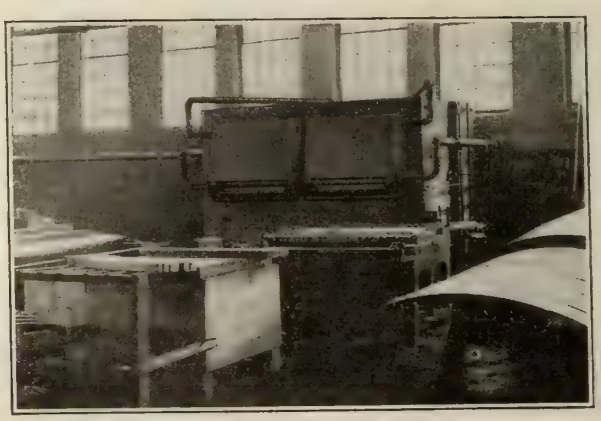


Fig. 3.—Single-chamber type of furnace conveniently located for serving vertical forming machine. Fig. 14.—Double-chamber type fitted with pre- and re-heating chambers.



Fig. 5.—Showing forming machines and quenching tanks at discharge end of multi-chamber furnaces.

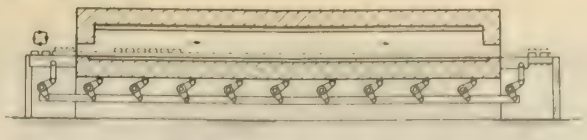


Fig. 9.—Section of intermittent conveyor type furnace.

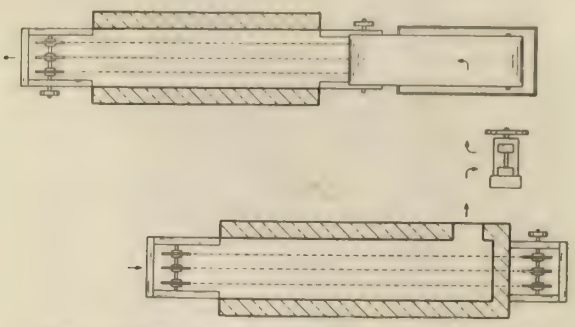


Fig. 11.—Floor plan of hardening and tempering furnace shown in Fig. 10.

6 and 7, in which the material rests upon and is continually carried by an endless conveyor, may be employed in a variety of forms for conducting the various heating operations separately or in sequence. Fig. 8 illustrates furnaces for special springs, with provision to decrease time of exposure in cooling by discharging from within the chamber and automatically conveying the springs to the drawing furnace.

The intermittent conveyor type, Fig. 9, intermittently conveys the stock through the chamber floor bars, between which the conveying mechanism operates, in a series of steps or stages.

The rotary table type is provided with a metallic hearth entirely within the heating chamber, Fig. 12, or with a refractory hearth, Fig. 13, of which only the carrying surface is exposed to the heat. Modifications of either type, with regard to method of charging and discharging material, are made to suit individual requirements. This furnace is, by reason of the shape of the hearth, limited to conditions where the length and shape of the spring do not seriously affect the carrying capacity of the hearth.

The pusher type, Fig. 14, is another form of semi-automatic furnace which is frequently made necessary by provision to carry the springs on trays, or when the size and shape of the springs and the process of heat-treatment warrant its use.

Drawing Coloring or Drying

The car type furnace, Fig. 15, may be considered for drawing, coloring, or drying comparatively large batches of springs. It is built in the single-chamber type, as shown, or double- chamber type, in which the car is alternately charged and withdrawn. It is also built in either of these forms with openings at both ends, so that one carload may be drawn into the chamber as another is discharged.

Endless combinations of such furnaces as illustrated by Figs. 8 and 11 may be effected to suit individual requirements without eliminating the continuous feature of heating and handling. A continuous furnace may be arranged singly or in series to serve one machine. One furnace may be arranged to serve two machines, with provision to automatically remove the springs from the quenching bath, after hardening, to the drawing furnace.

Frequently it is necessary to arrange combinations of continuous and stationary furnaces by reason of some manufacturing requirement which prohibits the strictly automatic method of production but nevertheless permits of practically continuous heating and handling in the fitting, hardening and drawing operations.

The design of furnace and detail arrangement of conveyors, working openings, etc., are affected by the nature of the heat-treating process, the size, shape and quantity of the stock, methods of charging and discharging, and the floor space. These factors determine the design, number and layout of furnaces in the shop.

Special forms of springs in large quantities are heated to advantage in the furnace illustrated by Fig. 16, the conveyor being adapted to the physical characteristics of the individual piece.

Large quantities of rods for the manufacture of agricultural springs are continuously heated for forming, hardening or drawing in the continuous furnace illustrated by Fig. 17.

Drawing operations may be performed in oil baths when the temperatures are comparatively low; or when the temperatures are higher, in baths of salts or metals with low melting point. Stationary types of such furnaces are provided with a single pot, Fig. 18, or with double pot, Fig. 19.

Combinations of bath methods of heating with continuous methods of handling are illustrated by Figs. 20

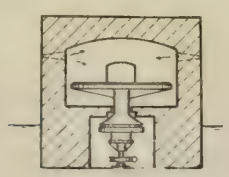


Fig. 12.—Section of rotary table furnace.

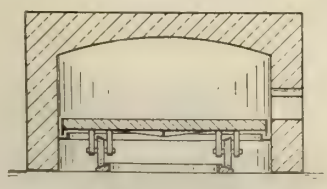


Fig. 13.—Section of refractory hearth type rotary table furnace.

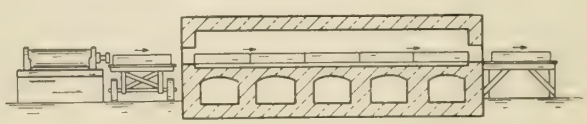
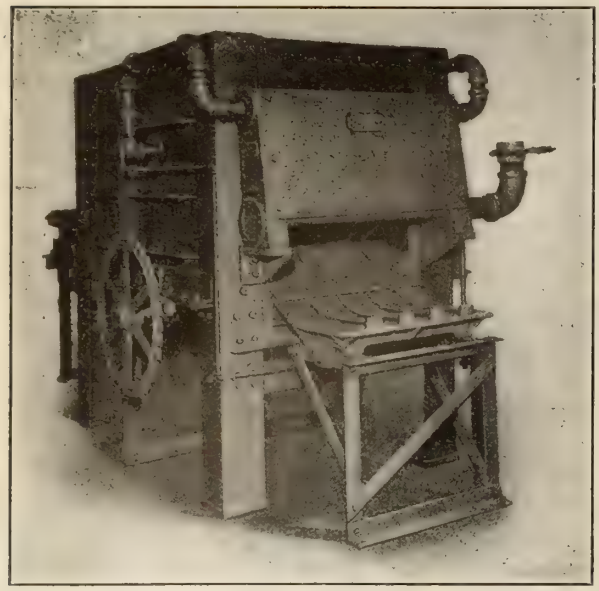
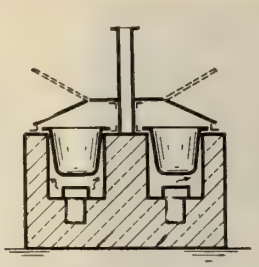


Fig. 14.—Furnace fitted with mechanical pusher.



Fig. 10.—General view of furnace room with forming machine and quenching tank in foreground.





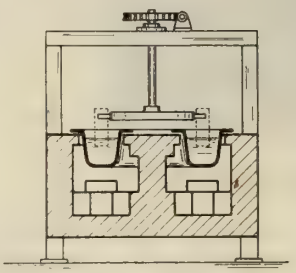


Fig. 17.—Continuous heat treating furnace for rod stock. Fig. 19.—Twin pot tempering furnace. Fig. 20.—Continuous type of bath tempering furnace.

and 21. There are a great variety of furnace designs embodying these methods of heating and handling, the selection depending upon the nature of the product and the manufacturing requirements. With such furnaces the advantages of the bath method of heating and a continuous method of handling make possible a result, in quality and quantity of product, that cannot be produced with the ordinary type of pot furnace.

With an equally efficient method of applying the heating or cooling medium to the entire surface of each piece, satisfactory results in drawing are secured, without the use of a bath, in furnaces having a uniform heating chamber atmosphere.

For tapering, nibbing or miscellaneous end-heating operations, the type of furnace illustrated by Fig. 22 has proven very satisfactory in practice. A novel feature of this furnace is a special type of economizer shield, Fig. 23, placed over the working opening to protect the fitter from the heat and utilize the heat in the waste gases, which are deflected upward to preheat the air and fuel for combustion. This construction reduces the fuel consumption, promotes combustion and permits location of the furnace close to the machine, Fig. 22, thus enabling the fitter to work more efficiently and in greater comfort.

Arrangement and Operation

The economies which may be brought about by intelligent selection, arrangement and operation of equipment properly adapted to individual plant conditions, exert no small influence on the items of labor, fuel, output, floor space, investment and other items included in the actual cost of production.

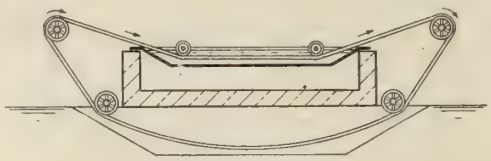


Fig. 20.—Continuous type of bath tempering furnace.

Fuel or electricity may be used for generating heat in such heat-treating operations. The form of fuel or electricity to use depends upon the nature of the heating operation, manufacturing requirements, plant conditions, prices of available forms of fuel or electricity, and the type of furnace most suited to all of these factors.

The form of the heating energy must be considered with the form of the furnace, not only with reference to the manner in which the heat is released or controlled, but to the manner in which the heat is applied to the individual piece, and the method of loading and handling the material to be heated.

A given form of fuel or electricity and method of heating and handling may make possible a design of furnace which will accomplish a result, in quality and cost of product, not apparent from consideration of the form or price of the fuel or electricity alone.

The physical difference between anthracite and bituminous coal, in solid or powdered form, coke, fuel oil and hot or clean gases, must be considered along with the difference in composition of the gases resulting from the combustion of such fuels, and the possibility of overcoming an apparent disadvantage in the physical or chemical form of low-priced fuels with suitable furnaces.

Likewise, electricity must be considered with reference to the difference between the arc, induction and resistance methods of generating heat; the composition of different forms of resistors or these forms of electricity, and the heat-electrodes, which may affect the composition of the heating atmosphere; the position of the heating elements in relation to the material to be heated; the heating and handling requirements of the different types of furnaces adapted to individual plant.

Frequently the apparent disadvantages in physical form of low-prices bituminous coal are offset by a proper method of heating and handling material in suitable furnaces. The apparent advantages of the arc, induction or resistance forms of electricity are frequently offset by improper furnace design, just as apparent disadvantages in

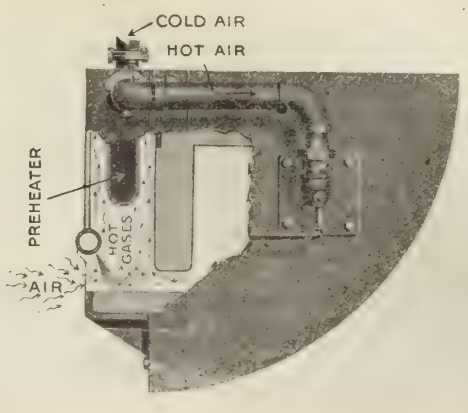


Fig. 23.—Showing deflection of hot gases and preheating of air for combustion.

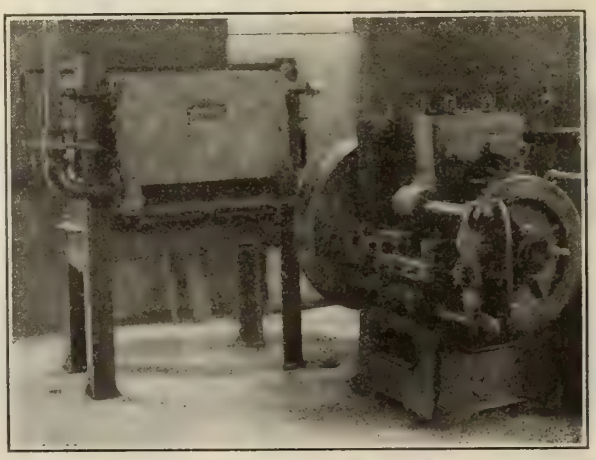


Fig. 22.—Furnace for heating ends of stock, with forging machine adjoining.

prices are frequently overcome by suitable designs of furnaces which decrease the amount of energy required and accomplish a result, in quality and cost of product, that would not be otherwise possible. An apparent failure with a given form of energy in one instance and an apparent success with it in another, must be considered with the variable element in the design of furnaces that accounts for the difference in result.

No one form of fuel or electricity or furnace is suitable for all conditions. The selection of either is largely a matter of compromise in reconciling requirements of quality with others related to methods, plant conditions and cost of production.

The quality of the heated product reflects the uniformity with which the heat is applied to the surface of the individual piece and the heating atmosphere in which it is exposed. The nature and price of a given form of fuel or electricity, and the method of controlling the quantity supplied to a furnace, must be considered with other equally essential factors that control the uniformity and cost of the product itself.

The cost of production is governed by many factors affecting the items of labor, fuel or electricity, output, floor space, investment, and other items entering into the actual manufacturing cost. It is also largely influenced by the intangible values in quality of product resulting from proper methods of applying heat to the product.

The price of fuel or electricity must be considered with the amount consumed and the nature and cost of the ultimate result made possible by the intelligent use of the right form of energy in the right form of furnace. The problem is one of selecting that combination of furnace and fuel or electricity which, wtih proper methods of applying and utilizing the heat and handling the material, will produce the best quality product at the lowest cost, all things considered.

REDUCING EXPENSE BY CAREFUL OIL SUPERVISION

(Continued from page 18)

all information that will give to the superintendent the actual amount of work completed, so that he can compare it with the amount of oil used. Against this production and the amount of oil consumed, should be figured the energy consumed in driving the plant, that is the amount of fuel burnt, or the current used, etc., etc.

The same procedure should be followed at least thirty days previous to the time that you started to use the recommended lubricants, that is before the time you start in to take advantage of your lubricating engineer's recommendation.

By comparing the first 30 days—that is the time you were running on the old lubricants and the time you were running on the new lubricants—you would be able to determine the amount of power used, the cost of same, the amount of material produced, and the amount of oil per unit consumed. By comparing these figures, you will easily determine the value of the new lubricants you are using and you will be surprised that, although in many cases, the oil or lubricant has cost you 100 per cent. more, the amount of fuel or power you have saved, plus the saving on oil, plus the increased production will be tremendous. The oil saving may not be due to the fact that it took less oil alone, but will probably be principally due to the careful way it was issued and the care that was taken in applying it. The saving may not be due entirely to the oil, the increased production may not be due entirely to the oil, but it may be due to the application of it.

Mistakes Commonly Made

From time to time engineers have attempted to offer manufacturers and consumers of lubricants, tables of specifications, which some purchasing agents and mechanical superintendents have attempted to follow. This is perhaps the greatest mistake that has ever been made. There are so many local conditions, such as atmospheric temperature, rev. per minute, methods of application, length of run, method of storing, system of using oil, and these specifications are not always applicable to the individual case in question.

A common mistake that we frequently come in contact with is the effort of the manufacturer or general manager to keep their processes, systems, etc., a secret. Unless you can take the lubricating engineer or lubricating salesman into your confidence and tell him what you are doing, the conditions the factory is being operated under, etc., you cannot expect him to be able to make very intelligent recommendations. It is just as foolish to suppose that he can go to the purchasing agent, have him ask for a price on engine oil, stop there, and expect the salesman to quote on the correct oil to be used. A physician could not intelligently prescribe medicine for a sick person, if he were not allowed to get the person's temperature and generally examine his condition. There is no question too minute, or nothing that is of no importance in connection with lubrication.

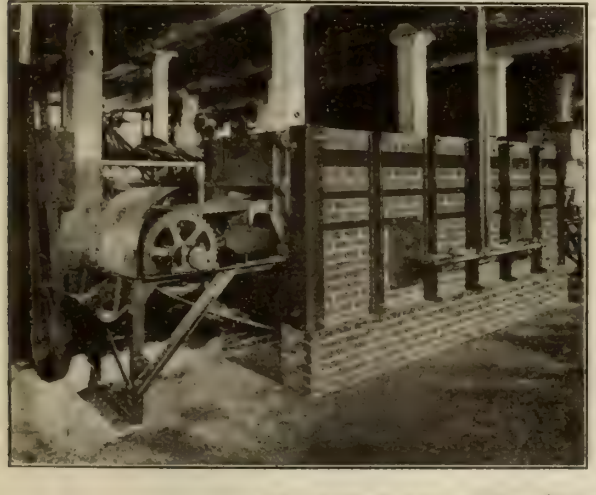
Another mistake we commonly come in contact with is the purchasing agent, mechanical superintendent, or salesman, who has a half knowledge of his subject and thinks that he knows all there is to know about it. We cannot all be specialists. The purchasing agent is not expected to know the technique of lubrication, neither is the mechanical superintendent, and it is hardly fair to expect that an oil salesman will know it all.

What Should be Done

At least once every two years, purchasers of lubricants should keep a very careful record for at least thirty days on the number of pounds or gallons of lubricants consumed; the amount of fuel used to generate power; the amount of hours running, etc.; the time lost for repairs, hot boxes, etc.

Purchasers should also figure the lubricating cost per unit of production, the fuel or power consumed per unit of production, and the number of hours shut down for repairs, etc. They should then call in a lubricating expert, give him all the data they have on hand and free access to the factory for as long as he wishes. After he makes his recommendations, they should be carried out carefully, and the same data as above mentioned kept and a comparison made between the two sets of figures.

First class lubricating companies are always willing to furnish to the oil consuming trade, the best advice that can be had, and most first class companies maintain an efficient corps of lubricating engineers who work in conjunction with their regular salesmen on cases where this is necessary. There is usually no charge for this man's services to the consumer and in 99 times out of 100 the benefit the consumer receives from such advice, is very far reaching.



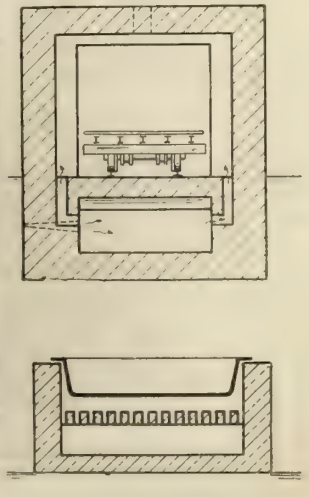


Fig. 15.—Section of car type furnace.
Fig. 16.—Discharging end of automatic spring tempering furnaces. Fig. 18.—Pot furnace for tempering in a bath.

Designing Machine Screws and Bolts

Fundamental Principles—Various Thread Shapes and Their Respective Uses—Screw Thread as a Power Medium—Thrust Factor Depends on Shape—Safety of Bolts—Pipe Threads

By L. T. RUTLEDGE

SINCE we have considered the designing of a triple riveted butt joint in the Feb. 9 issue, we will next take up the threaded, or screw type of fastening.

A screw fastening, intended for holding two or more parts together, is a cylindrical shaped piece fitted with a thread. The fastening may be either permanent or temporary but, as a general rule, the fundamental feature of bolts and screws is, that parts connected with them may be easily disconnected when required. In this latter particular it is quite different from a riveted fastening.

The study of threaded fastenings will be introduced in this discussion by considering the type of threads in general use, and the form of screw fastening as a complete fixture.

Type or Form of Thread

The various forms of thread in common use are the United States standard or Seller's thread, the V-thread, Whitworth, square, trapezoidal, Acme, and the standard Brigg's pipe thread. Fig. 29 shows the various forms of threads.

Though the more general function of threaded fixtures is to serve as fastenings, nevertheless they are used for the purpose of transmitting power. A lead screw on a lathe moves the carriage along the bed. A screw-jack is used to raise heavy loads and sustain them. It will be apparent that the efficiency of the screw has to be given some attention, when transmission of power is effected. In this discussion, the latter application of threaded fixtures will be considered along with the more general application.

The two common forms of thread in use in Canada and the States are the "V" and United States standard. Both forms are strong, may be produced quite easily, and, due to their low efficiency, they are well adapted as a screw fastening. A low efficiency indicates a high friction and it is apparent that the higher the friction between the screw and the metal it is threaded into, the more serviceable the fastening. The two forms of thread resemble one another, the angle between the sides being, as shown, 60 degrees. The U. S. thread differs from the older V-form in the respect that the sharp point is absent. A flat equal to the pitch divided by eight, or $\frac{P}{8}$, is left on the top, and also at the root as shown in 29(a).

The depth of the V thread equals P x 0.86603, whereas the depth of the U. S. thread is p x 0.64952. The V and U. S. screws have the same number of threads for each standard size except in one instance, namely, for the ½ inch size. A ½-inch U. S. cap screw has 13 threads per inch, whereas a ½-inch V-thread cap screw has 12 threads per inch.

Whitworth Thread

The Whitworth thread is the principal one of the English standard threads, used on bolts, screws, and machine parts. It differs from the Seller's thread in so far as the angle is 55 degrees instead of 60 degrees, and in addition has the crest of the thread, and the space at the root, rounded by a circular curve instead of being flat. The radius of the rounded part is p x 0.1373. The depth of the thread is p x 0.64033. The number of threads per inch for the various standard sizes of bolts and screws corresponds exactly with those of the V-thread standard.

The greater percentage of the ammunition furnished by Canada under English specifications during the period of the late war was fitted with Whitworth threads. For some considerable time our mechanics experienced some little difficulty in cutting accurate Whitworth threads. The main difficulty seemed to be due to maintaining a uniform pitch throughout the thread length. The variations in the profile affected the pitch line. However, as soon as accurate thread gauges were available the trouble disappeared.

Square Thread

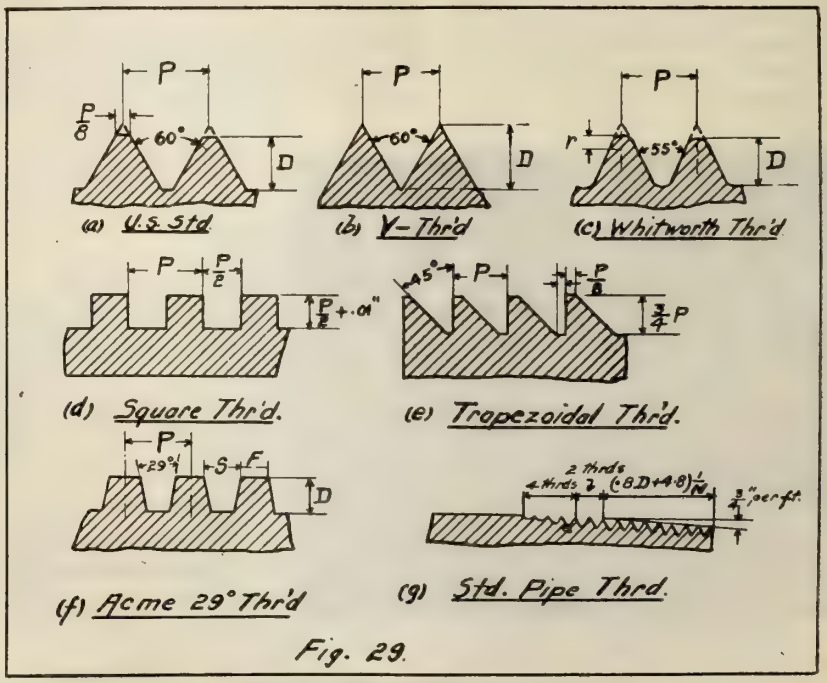
The square thread, as well as the trapezoidal and Acme, is adapted for the transmission of power. The square thread has great strength and also high efficiency. This latter property is essential on account of the use to which it is put. A very important advantage is that the thrust is very nearly parallel to the axis of the screw and therefore has no bursting strain on the nut.

It has a couple of serious disadvantages, viz, it is difficult to take up any wear which may occur, and the cost of manufacture is much greater. The proportions of square threads have never been standardized as in the case of the preceding types. However, the proportion given in Fig. 29 (d) is a common one.

Trapezoidal Thread

The trapezoidal or buttress thread, shown in Fig. 29 (e), is occasionally used for the transmission of power in one direction only. In cases where there is little work to be done during a reversed motion, as in some presses, and when used on the breech blocks of large guns, the effect of the oblique thrust is negligible and this is often the best form of thread for the purpose.

Thus this type of thread to a certain extent combines the important feature of the square thread already explained, with the strength of the V-thread.



Showing Various Forms of Screw Threads.

The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, write us, and we will see that Mr. Rutledge supplies you with the desired information.

The acme thread, as illustrated in Fig. 29 (f) is an adaptation of the most commonly used style of worm thread, and is intended to take the place of the square thread. It is a little shallower than the worm thread but generally the same depth as the square thread and much stronger than the latter. The wear can readily be compensated for by an adjustment of a split nut used in conjunction with it, as is done in the case of the lead screw of a lathe. Acme threads can be manufactured in quantities at a low cost.

The values of the dimensions as given in the illustration in terms of the pitch are as follows:—

$$P = \text{linear pitch} = \frac{1}{\text{No. of threads per inch}}$$

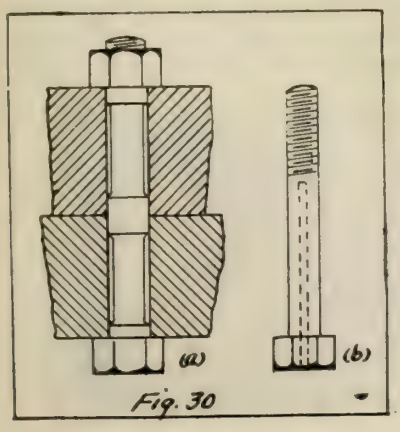
$D = 0.5P + .01$ in.
$F = 0.3707P$
$W = 0.3707P - .0052$
$S = 0.0293P$
$B = 0.6293P + .0052$

Many of the above values are determined from a trigonometric function of 29 deg.

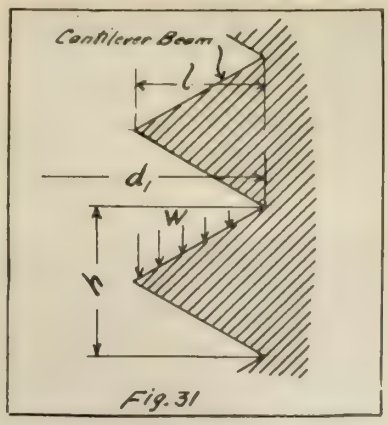
In Fig. 29 (g) is shown a section of a standard gas pipe thread. This type must be considered only as a special type of fastening and not for the same class of service as those discussed previously. The illustration shows the total length of thread divided into three parts. The first part at the end of the pipe, shows a perfect thread, top and bottom, over a tapered length of $(0.8D + 4.8)\frac{1}{n}$—in which D is the outside diameter, and n the pitch.

The middle part has two threads which are full at the root, but imperfect at the top, and not on the taper. The third division has four imperfect threads, flat on the top and bottom. The taper of the first section is ¾ inch per foot.

It should be borne in mind that commercial sizes of iron pipe are given by the size of the bore. Thus, a ½ inch iron pipe has a hole through it approximately ½ inch in diameter, which is the nominal inside diameter. The actual inside diameter as given in Briggs' table is 0.623 in. The actual outside diameter is 0.840 in., the number of threads per inch 14, diameter at end of pipe due to the taper 0.815 in., root diameter of thread at middle section 0.701 in., depth of thread .057 in., length of perfect threads 0.39 in., number of perfect threads 5.46.



Reducing Area of Bolt Body



V Thread Diagram

Forms of Screw Fastenings

The following important commercial forms of screw fastenings are met with:—(a) bolts cap screws, (c) machine screws, (b) set screws, (e) studs (f) lag screws, (g) stay bolts. We will discuss these briefly and in the order given.

Bolts:—A bolt is similar to a rivet in the particular that it is a round bar with one end upset to form a head but it differs to the extent that the other end is fitted with a thread on which a nut is threaded for holding purposes. Bolts are well adjusted for holding two parts together rigidly and at the same time permit of the parts being dis-assembled by simply removing the nut. The holding is accomplished by the friction of the thread on the nut with the thread on the shank of the bolt and the friction of the nut on the bearing surface of the machine part. The under side of the head of the bolt takes bearing as well as the nut. Bolts are divided into the following common classes, namely, machine, carriage, coupling, automobile, and stove bolts.

Screws:—Screws, unlike bolts, do not require a nut but are threaded directly into the pieces to be fastened. Where two members are to be held together, one of them is fitted with a clearance hole for the screw, and the other is fitted with a tapped hole to receive the screw. Cap screws, and machine screws hold by the pressure exerted by the head of the screw, whereas set screws hold by the pressure of the point.

Studs:—A stud is a bolt in which the head is replaced by a thread so that the stud has a thread on each end, there being a section at the middle with no thread. The stud passes through one of the parts to be connected such as a cylinder head cap and is screwed into the cylinder end. A nut, screwed on the outer end, serves to hold the cap on. Thus the stud remains in position when the parts are disconnected.

Lag screws, also called coach or wood screws, are in a class by themselves. Ordinary lag screws have threads made by the die or rolling process, which gives a good enough thread for the purpose to which the screw is put, namely, rough wood work. There are two types, the cone point, and the gimlet point.

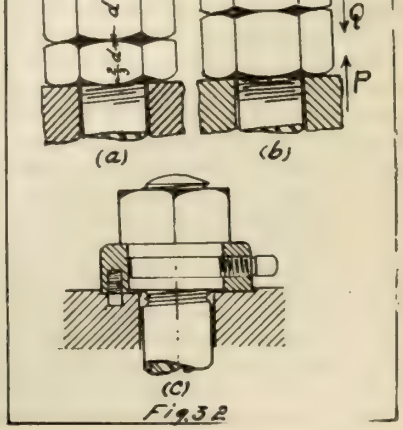
Ordinary wood screws or screw nails, as they are commonly called, are made in sizes from No. 0 to No. 30 and in lengths from ¼ inch to 6 inches. The increase in length is by eighths of an inch up to 1 inch, then by quarters of an inch up to 3 inches and by half-inches up to 5 inches. As a rule the threaded portion is about seven-tenths of the total length. The included angle of the flat head is 82 degrees.

Stay bolts:—Stay bolts are fastenings used chiefly in boiler construction. A stay bolt is quite similar to a stud since it is a rod with a thread on each end. Stay bolts are quite long, and when such a bolt is threaded into place in the boiler, each end is riveted over to give a permanent and leak-proof fastening. According to the code of practical rules covering the construction and maintenance of stationary boilers, and adopted by the American Society of Mechanical Engineers, "each end of a stay bolt must be drilled with a 3/16-inch hole to a depth extending ½ inch beyond the inside of the plates, except on small vertical or locomotive types of boilers where the drilling of the stay bolts shall be optional." The object of the holes apparently is to give some indication of a rupture by the leakage of the fluid within the boiler.

Stresses in Screw Fastenings

(a) Stresses due to Screwing up:—The stresses induced in bolts, screws or studs due to screwing up tightly into place, whether it be screwing a nut on or screwing a cap screw into place, are a tensile stress resulting from the elongation of the bolt and a torsional stress due to the frictional resistance on the thread

(To Be Continued)



Locking Devices

Reclaiming Broken Parts Reduces Overhead

Making Salvage Pay a Profit—Locomotive Cylinders Repaired at Small Cost—Broken Castings Should Not Be Scrapped Without Investigation—Salvaging Cast Iron Rolls

By FRED E. ROGERS

TO BECOME an expert welder requires more than the mere knowledge of handling the torch. It is essential that a thorough understanding of chemical characteristics of the various metals be acquired before final success can be achieved. The article herewith explains in some detail the more important features in connection with the methods that have proved themselves efficient in oxy-acetylene welding of different metals.

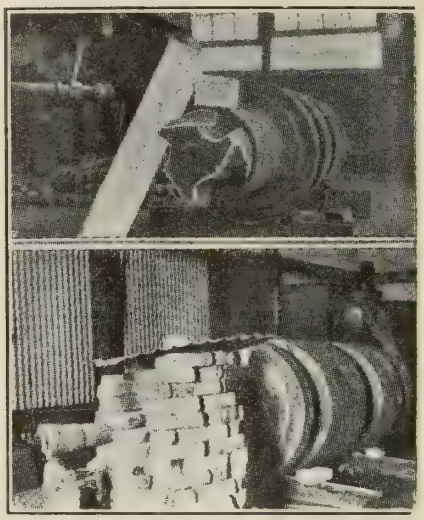
Fusing Cast Iron Into Weld

Welding a thick broken casting requires melting of a considerable quantity of cast iron welding stick. When welding a preheated casting that has been bevelled to form a groove of comparatively large dimensions it is common practice to hasten the filling process by breaking up cast iron welding sticks into short pieces and throwing them into the groove where they are melted. Puddling the weld works out the oxide from the fused adding material produced from the broken sticks. Obviously, a welder can speed up welding in this manner very much. It is not uncommon in heavy cast iron welding to deposit five or six pounds of metal per hour.

Welding Locomotive Cylinder

Broken locomotive cylinders often can be repaired with the torch at less cost than by any other method. But it is useless to undertake the work unless the welder is prepared to strip and preheat the cylinder sufficiently to permit free cylinder welding and to eliminate expansion and contraction stresses. This means in many cases that the actual welding is but a small part of the labor required for the repair. It pays, however, to spare no pains to insure the success of such a welding job. The salvage in locomotive cylinder welding is more than the cost alone of a new cylinder, which is a large sum; it includes the earning capacity of the locomotive for every day saved in making the repair.

The usual cause of a cylinder break is the fracture of a piston rod which under steam pressure of perhaps 30,000 pounds or more is hurled through the front end of the cylinder, breaking the head and tearing away parts of the cylinder barrel. Sometimes the fragments are too small to bother with while in other cases they are large and can be used. When the pieces are lost it will be necessary to make a pattern for a casting to replace the lost section. This piece may be welded in place, the procedure being the same as though the original pieces were available.



Above.—Worn roll wabbler.
Below—Roll end in pre-heating furnace.

The edges of the breaks should be beveled as well as the edges of the replacement pieces. The beveling should be done for the most part on the inside of the cylinder to insure a solid internal weld free from holes and defects.

The weld on the outside should be built up or reinforced. This can usually be done without interference with the external appearance of the cylinder as the wood or asbestos covering applied to the cylinder is from 1 to 1¼ inches thick. A reinforcement can be made ½ to ¾ inch thick without interference with the application of the sheet steel cylinder jacket.

Having the parts fitted ready to weld they should be clamped in place and the cylinder preheated by means of a charcoal fire in an extemporized brick or sheet iron furnace. When the metal has been raised to a low red, welding should be started, working, if possible, with two torches, one inside the cylinder and the other on the outside. The welders should in all cases start at the beginning of the breaks and proceed towards the edge, working on the theory that welds made in this manner tend to eliminate their own internal stresses. A practice employed successfully in reinforcing the exterior of cylinder welds requires the use of wrought iron semi-circular pieces with ears similar to the half of a pipe clamp. These should be about 1 inch wide and ¼ inch thick, having a radius of 1½ inch. They are applied successively over the break, especially on uphill welding, and fused into the cast metal helping to hold it in place and acting as a dam as the work proceeds.

When the cylinder weld has been finished it is advisable to reconstruct the furnace, put in a fresh charge of charcoal and reheat to a low red temperature to relieve the stresses and to anneal the metal. The cylinder should cool down slowly for several hours. It is, of course, necessary to put in a portable boring bar and rebore the cylinder and face the end to fit the cast iron head. It is essential, therefore, that the metal be soft and easily machined.

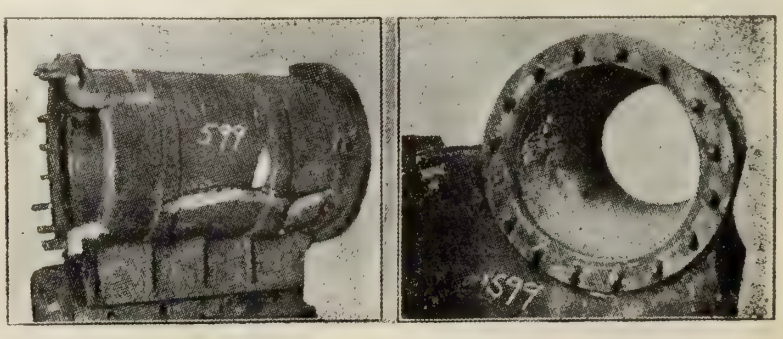
Old Furnace Castings

It is believed by many that furnace castings cannot be welded broken, especially if they have been long in use. Broken castings such as grate bars can be welded, however, often with no difficulty at all. An expert can weld a broken grate bar that has been in service a long time. Sometimes he will use a small amount of copper with the welding rod. This is not absolutely necessary, however. A common mistake in welding burned cast iron is in using too hot a flame. Temper the heat and watch the metal. When little spots of fluid metal are discernible, add the welding rod and get the metal flowing.

If it refuses to run clear, but persists in a "grainy" formation, shift the torch to another spot and try again. When the metal is once started welding is easy.

Salvaging Cast Iron

Cast iron rolls, used in steel mills for rolling sheets and bars, often wear out



Repairing Locomotive Cylinder.

From a book by the author entitled, Welding and Cutting.

at the wabbler and before the roll itself has given out. The wabbler, so-called, is the rolling mill form of universal joint which permits the rolls to spread apart while the metal is passing through. The oxy-acetylene process is used successfully for repairing cast iron wabbler joints, the metal being built up and the shape restored as when new.

The approved practice is to preheat the wabbler and the roll, and to deposit the cast iron progressively until the original shape has been restored. A sheet metal template should be cut to the original form which can be slipped over the end of the roll and used thus to check the accuracy of the work. A template cut to the shape of one lug may be used also to advantage.

Welding Duriron

Acid-resisting cast iron such as "Duriron" may be successfully welded with the torch using filler rod of the same material. These irons are very hard and brittle, and under no circumstances should welding be undertaken without thorough preheating. The use of a good scaling powder will facilitate welding, making clean, smooth welds.

Brazing Cast Iron

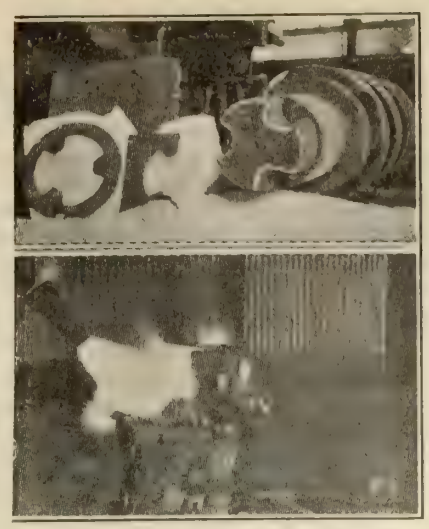
Brazing cast iron in a forge fire cannot be accomplished in the same manner as steel or wrought iron. The free carbon in cast iron prevents amalgamation of the spelter with the metal, and it is therefore necessary to treat cast iron first to reduce the free carbon content and to deposit metallic copper in the surface layers. When this has been done brazing cast iron can be accomplished with ease.

The same difficulty is experienced when undertaking to braze cast iron with the oxy-acetylene torch, but the high heat of the flame enables the operation to burn out the free carbon and to secure amalgamation of the spelter with the metal. The use of certain fluxes especially those containing chlorate of potash and cupric acid facilitate burning out of the carbon and preparing the joints for the deposition of the spelter.

When a special flux which deposits metallic copper in the surface layers of metal after having burned out the excess carbon is not available the job may be accomplished by heating the cast iron until it causes the brazing rod to melt when held in contact outside the flame. Rubbing the brazing rod on the hot cast iron "tins" it, and when trimming has been accomplished, the brazing is easy.

Malleable Iron

Malleable iron castings offer a problem in welding because of the peculiarity of the metal structure produced by heat treament. White cast iron, very brittle when cold, is used for making malleable castings, the malleability characteristics resulting from heat treatment or annealing. When malleable iron is fused with the torch and welded with cast iron welding sticks, the



Above—Wabbler restored by welding. Below—Oil burner used for pre-heating roll end.

weld structure is cast iron much weaker and more brittle than the malleable iron itself. The use of malleable iron sticks somewhat improves the joint, but as the malleable iron is changed to gray iron by melting, it is advisable to avoid welding malleable iron in general. If a malleable iron piece must be repaired brazing is recommended, using bronze rods and a reliable flux for the purpose.

Reclaiming Malleable Castings

The white cast iron used for making malleable castings is melted in reverberatory furnaces, cast and annealed or malleabilized by packing in iron boxes with hematite ore or mill scale. The castings are heated and cooled in the furnace for six to eight days. White cast iron is changed by the process to the so-called malleable product by the prolonged heating and annealing process.

A simple and effective process for reclaiming malleable castings is to braze the defective part with bronze. This is objectionable, however, to some customers.

The most satisfactory method to the customer is to inspect the white iron castings for defects and to reclaim them before putting through the malleabilizing process. On account of hardness and brittleness of castings in this state they must be carefully preheated and cooled after welding. When white castings are repaired, white cast iron filling rod should be used. The subsequent process will then convert the new metal into malleable iron along with the body of the casting.

In some malleable iron foundries the parts are reclaimed after having been packed and annealed, using for the purpose malleable iron filling rod. No definite rule can be laid down for this procedure as the advisability of reclaiming will depend upon the nature of the defective part of the piece and position of the defect with relation to the parts subject to greatest stress. In general, of course, it is not considered good practice for the reason that malleable iron is deteriorated by the heat of the torch flame, and reconverted into an inferior grade of cast iron.

Hence, the situation with respect to reclaiming of malleable castings is substantially as follows:

Malleable foundries may reclaim castings in the white iron state by white iron filling rod, provided the castings are carefully preheated and cooled to equalize the stresses.

2. Malleable castings may be reclaimed by brazing, using bronze rods. The bronze produces a strong and effective repair. It is objectionable to some customers because of the obvious repaired defect.

3. Castings may be repaired after the malleabilizing process, using malleable iron or steel filler rod, but only at the cost of reducing the strength of the casting.

American malleable iron of the "black heart" form is difficult to weld with the torch. The reason is the high carbon content of the interior and the comparatively low carbon content of the malleablized shell. The latter requires a much higher temperature to fuse than the centre, the consequence being that when undertaking to weld a black heart malleable casting the inside sloughs down and falls away before the exterior can be raised to the fusing point. The "white heart" or British malleable, however, does not offer as much resistance inasmuch as the fusing temperature of the heart is approximately the same as the rod; but the joint, of course, lacks the strength and malleability of the original shell. This kind of malleable can be successfully welded with cast iron welding malleable casting and welding, therefore, cannot be recommended where strength is a prime requirement.

INCREASING LIFE OF STEEL PARTS

Every possible means of extending the life of steel parts subjected to hard wear should be studied. The tires of railway and tramway wheels provide a case in point, and users of them will be interested to learn of the success of a new process of heat treatment. Increased life to such tires can be obtained by raising the tensile strength of the steel and also by improving its structure. It is mainly in this latter respect that the new process is said to appeal.

The tire is cooled at a certain rate through the critical range of temperature by subjecting it, as it slowly revolves, to a blast of moist air. This treatment does not simply produce a surface hardening, as it can be regulated to give particularly hard and uniform structure to any desired depth. The tests which have been made with tires treated in this way gave remarkably good results. This new process has been developed by a British company.

Practical Ideas for Executives

SETTING BALL BEARINGS IN BABBITT

By D. A. Hampson

A line of machines was to be built and the design included a number of high speed shafts in each, to be carried on ball bearings. To bore the housings and put on end plates for each bearing would make the machines entirely too costly. The method followed was to set the bearings in babbitt and make the box divided horizontally. Cast iron blanks were turned to the exact same size as the outer rings and these were properly spaced on a mandrel—the babbitt was poured around these blanks and the pockets thus quickly produced. The machines are now in their third year and so far there has been no trouble with the practice; the babbitt was poured at the lowest possible temperature and was thoroughly anchored in the cap and box. It seems that this opens a wider field for such bearings for, ordinarily, the seat and fastenings cost more than the bearing itself to the end that competitive design hedges away from their use.

PREVENTING END MOVEMENT OF SHAFT

By F. M.

Two efficient methods of preventing a shaft from moving endways, where it is not intended to take direct thrust loads, are shown by the accompanying illustration, Fig. 1. In both instances a wire pin is used and the shafts are of small diameter. The illustration at the left shows two views with a pin going through the boss portion of the bearing in which the shaft runs. The shaft "A" is recessed at "B" and through the boss "C" is a pin "D." This pin hole is drilled so that at least one-half of the pin will engage with the groove in the shaft. After driving the pin in position the ends are bent over slightly to prevent the pin from falling out. With this method the shaft is free to revolve wh.. .he pin prevents the same from moving endways.

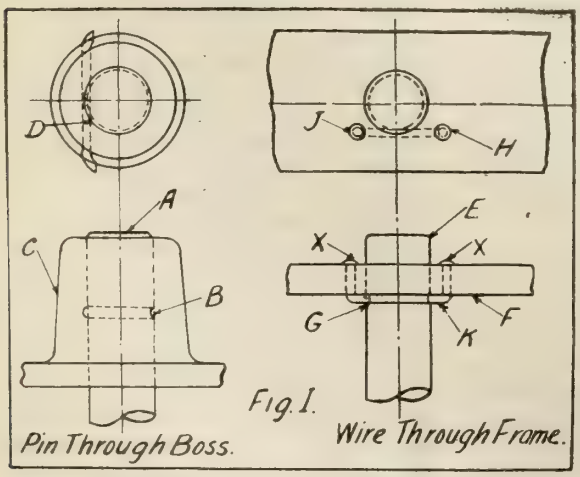
In the views at the right of the illustration, the shaft "E" runs in a flat plate "F" set edgeway, and a groove "G" is cut in the shaft. Through the plate "F" are drilled two holes "H" and "J" and the "U" shaped pin "K" is driven into these holes while the pin is sprung into the groove in the shaft. After putting this "U" shaped pin in position the ends are headed over at "X" and pin is securely held in position. The shaft is free to rotate although prevented from moving endways. One advantage this method has is that the shaft may be pulled out of position without removing the "U" shaped pin "G", as it is only necessary to spring it out of the groove to enable the shaft to be pulled endways.

HOLDER FOR SURFACE FILING

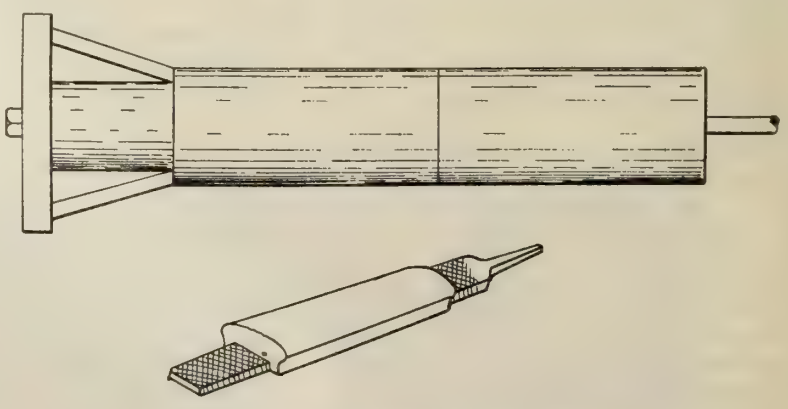
Entirely different from the general run of file holders was the one the writer saw extensively used in a printing press plant down in Connecticut. Press beds and other surfaces having areas from 15 to 30 square feet were being filed, either to obtain what they termed a smooth "frictionless" surface or to meet the cigarette-paper-and-straightedge test. And how those machinists did remove the metal! They used wooden blocks channelled to fit tightly over the files. The blocks were about a foot long, three inches wide and one and a half inches high—such a size is just about right for a good and comfortable grip and it is high enough to keep the fingers away from the work. This shape has an advantage not possessed by the other holders, in that it brings the hand down close to the work, grasping a piece practically the same as the file and thus enabling the workman to do all that he would with the bearing hard upon any certain portion of the work. Eighteen inch double-cut equaling or flat files of coarse cut are used for this work. The finish required is of a high standard. A little kink is practised that is worthy of imitation. Before the files are checked out in the shop for this work, the tool room man goes over them for high teeth and in every case he grinds the two cut ends slightly for a quarter of an inch back, doing this on a disc wheel or fine stone. This removes the high tooth that is almost certain to exist at the ends of the cut and is sure to scratch the work if left on.

BUILT-UP COLUMN PATTERN

A foundry in a remote village was asked to make a number of cast iron columns ten feet long, such as are used in the construction of commercial buildings. The columns were to be 8 in. in diameter with a 6 in. cored hole clear through and the usual rectangular base at one end. A pattern and a core box had to be made by the foundry itself, whose sole equipment toward that end consisted of a drill press and a short 12 in. engine lathe, aside from carpenters' hand tools. The pattern was made as shown herewith. Part of an old telegraph pole was secured and this was cut up into sections about 16 in. long which were faced square on the ends and turned to the required outside diameter, taking pains to make all the pieces the same. Then a hole was drilled through these wood cylinders and, after the carpenter had built the base, a ½ in. tie rod was run through the whole. When shellacked, this made an excellent pattern and at a most reasonable cost.



Preventing end movement in shaft.



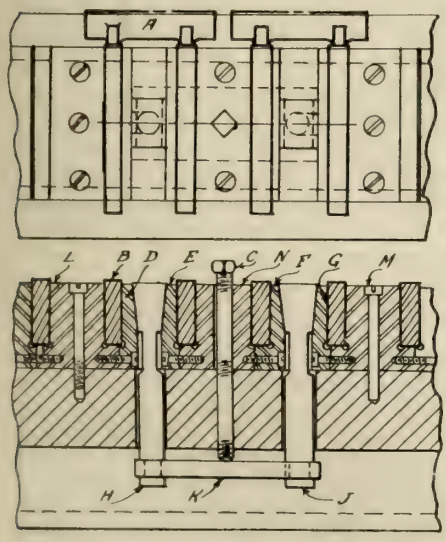
Above.—Method of building up column pattern.
Below.—Holder for surface filing.

METHODS OF CLAMPING FOUR PLACES AT ONCE

By H. M.

A rather novel arrangement having as its object the clamping of four places by simply tightening one set screw, is shown by the accompanying illustration, Fig. 1. This drawing shows a section of a gang milling fixture useful for milling the edges of the work A shown in position, a gang of cutters being used to mill a number of these pieces at once on the top edges B, while the opposite edge is likewise milled in the same fixture by reversing the work.

The particular purpose of this illustration is to show how by tightening screw C the jaws D, E, F, and G are caused to grip the work at the respective places indicated by the letters. This is accomplished through the medium of two wedge blocks H and J which are connected by a strap K. The jaws D, E, F, and G are held in the position shown by screws, these being notched and spring tempered so that the action of pushing down the pieces H and J will, through the medium of the bevel at their upper ends, cause these to be sprung so they will clamp the work which has been previously finished on the sides.



Showing arrangements for clamping four places at once

In operation the tightening of screw C forces down strap K which carries with it wedge blocks H and J. H forces outward D and E while J forces outward F and G, thereby clamping the work against the respective blocks L, N, and M. Loosening the screw C releases the work by allowing wedge blocks H and J to move upward which permits the work clamped to be removed as the jaws spring away from the work when the pressure is removed. This is a very effective means of clamping work which has been finished on the sides with reasonable close limits and a number of these units are employed in one fixture.

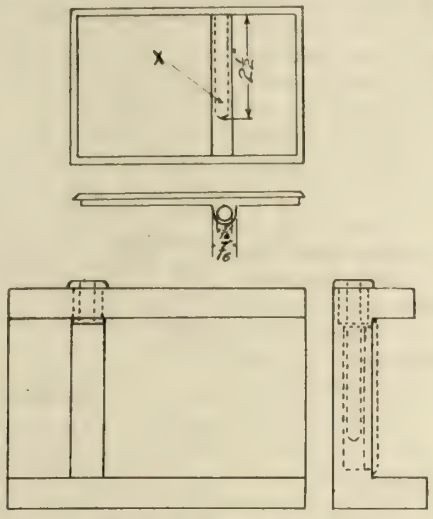
Fixtures of this type are suitable for multiple drilling, milling or grinding operations.

Have You Ever Had A Problem Like This?

A DRILLING PROBLEM

By H. T. Osborn

"Sometimes what appears to be a simple task," writes a reader, "turns out to be a puzzle when the job comes to be done. Here is an example of such a problem. We contemplated the manufacture of a certain article, and accordingly made up a set of patterns and jigs. On marking up the first few of the article we ran up against "it." This puzzle may prove easy to some of the readers of Canadian Machinery, and H. T. O. looks forward to such a solution.



Sketch of Jig and Piece

"The sketch will give an idea of the part, which was of bronze. When drilling the 5/16 inch hole, the drill would run out always in the same direction and bulge the side or break through at "X." The jig was quite square and packing was even tried to throw it "off square" in the opposition direction. This helped a little but not enough. The drill press table and spindle came in for attention but the trouble didn't appear to lie there.

"The bushing in the jig was square with the rest of the jig. Drilling a 3/16 inch hole first, was tried. This went right, but always on putting the 5/16 inch drill down it would run to the side. We ground the drill to various angles, without effect. The drawing shows a wall 1/16 inch thick on the outer sides of the hole. This of course was reduced as the drill ran to the side and caused a bulge, but the drill always started to run out before any distortion of the metal showed up. For some reason or other the job was dropped, and we never got a chance to experiment further. Can anybody offer an explanation of the cause of this?"

We all have problems at some time or other, some of which we cannot solve. This department is being created to act as a clearing house for ideas, and co-operation of every reader is requested. The maximum benefit can only be derived through an interchange of opinions.

Have you a problem which is yet unsolved? Or have you solved some difficult proposition, which you believe others would like to hear about?

If you can answer "Yes" to either of these queries, then by all means send your story in to the Editors of Canadian Machinery. They will not only thank you for the interest shown, but will pay for all accepted ideas. Every plant has its problems. We expect a regular deluge of replies. See that we are not disappointed.

ELECTRIC SAFETY LAMP

Electric safety lamps are coming into very general use in British mines where there is any risk of explosion. One element in their safety is the fact that they cannot be unlocked by the miner himself. A strong magnetic force has to be exerted in order to unlock the lamp, so that the battery may be taken out for re-charging. In the usual form of unlocking machine the current for the magnetic mechanism is usually applied until a certain batch of lamps is unlocked, when perhaps the current is still left on. This leads to waste of current and occasionally to damage to the lamps. In the new appliance there is a tubular magnet so arranged that when the lamp is placed on the unlocker any portion of the magnet will operate the lock. The placing of the lamp on the unlocker depresses the switch and applies the current; and when the lamp is taken away this switch automatically returns and cuts off the current. The action of this switch is automatic

FLEXIBLE COUPLING

One of the most common problems before the mechanical engineer is to provide an efficient and reliable flexible coupling between two shafts. There is no limit to the number of devices which for several generations have been designed to meet this demand, but a recent invention put on the market by a British firm proves that the field was not quite exhausted. The new coupling is extremely simple. The usual flange at the end of each shaft is cut in the form of a sprocket wheel, and a double chain is wrapped round the two sprockets. For this coupling it is claimed that it can transmit a much greater horse power at a lower cost than any other coupling of similar dimensions. It does not require lubrication; the balance is perfect; and as the stresses are equally distributed a high degree of safety is attained. For cases where heavy duty and long life are particularly desirable a certain amount of lubrication is recommended.

Recent Developments in Mechanical World

Care And Lubrication of Pneumatic Tools

PNEUMATIC hammers should be cleaned by pouring gasoline into the inlet and blowing it through by means of compressed air. An alternative method is to leave the tool overnight in a kerosene bath and next morning blow out the kerosene and lubricate well. For lubricating, a good light oil should be used. Heavy oils of poor grade are apt to cause trouble, says a writer in the Practical Engineer, and a similar light oil should be used for the pistons and valves of piston air drills. In some cases an automatic lubricator is fitted over the air inlet of the drill.

The crank chamber of the drill should be filled with a high grade grease occasionally, the filling being done by means of a syringe. Dirt sometimes causes a piston to stick. Grinding must not be attempted in such circumstances, but the cause must be removed with a piece of fine emery. The air hose should always be blown before attachment to the tool, and a hammer must never be run with the cylinder loose in the handle.

Getting Service Out of Belts

HUMAN NATURE plays an important part in getting service and longer life out of a belt. It is human nature to do things in what seems the easiest way, not always realizing it is often the most expensive and usually the most laborious, because it necessitates doing the work over and over again. This applies particularly in the case of cutting belting and joining it. Cutting the ends of a belt to put it into service seems such a simple thing that often the belt man does not give it the consideration necessary to insure the best results, and much of the difficulty with otherwise good belts is due to their not being cut and joined accurately. When you know how, it is as easy to make a belt joint which will run the same as endless as it is to do it by careless rule-of-thumb methods.

"When a belt runs wabbly or races back and forth across the pulleys," continues F. K. Douglas in a recent issue of Belts, "you are paying about twice as much as you should for it, because its life is being shortened and you are paying for power that is lost and production that you don't get. You are also repeatedly paying for unnecessary time and labor in fixing things up.

"Provided that its ends are cut square and it is joined with care, a belt can be made to run as straight as an arrow if the pulleys are lined up true. It is much easier to do it right than to do it over. This applies to making the completed joint as well as to cutting the belt. Therefore, it is best when joining a belt to do so in a way which is permanent and which ensures the belt's most satisfactory service. A prominent belting engineer has said that the following twelve points are essential for a 100 per cent. belt joint.

"It must maintain maximum strength of belt, avoid destruction or weakening of the lengthwise power-carrying belt fibres, prevent breaking the belt back of the joint, not hammer on the pulleys, not to be subject to wear or to crystallization, insure continuous, uninterrupted operation without supervision, hug the pulleys tightly and insure full transmission of power, run silently, be easily taken apart for removing or shortening, be safe against accidents or breakdowns, be easily and quickly made without special equipment, and must last for the life of the belt."

Statistics of Oil Resources

Some recently compiled statistics from various independent sources show that the probable oil resources of the world are not so limitless as was once surmised, although there is no disposition to view the future with that pessimism felt by some technologists. Oilfields, states Mr. A. Beeby Thompson, in a paper read before the Petroleum Technologists, do not cover vast areas like coal, but are represented by comparatively small and isolated pools where concentration has been induced by a combination of geological events. Existing as a liquid more or less volatile and usually accompanied by much gas, petroleum is frequently expelled with violence when its source is tapped by a bore-hole. The contained gas constitutes the agent of expulsion. It is this circumstance that enables gas and oil strata to be so quickly deprived of their flush contents instead of having to adopt laborious, lengthy, and costly mining operations as in the case of solid fuels.

Making Gas Cylinders Safe

FOR A LARGE number of engineering and mechanical processes it is necessary to store oxygen in both its liquid and gaseous forms in cylinders. Especially for mine rescue work there is a great demand for reliable cylinders of much lighter types than are usually available. Accordingly the British department of Scientific and Industrial Research appointed a committee to go into this question. This committee has issued its first report dealing with the storage of air, oxygen, nitrogen and other permanent gases. The report includes a number of recommendations both as to the composition and form of the cylinders and as to the rigorous tests which should be carried out before a cylinder is put into service. Recommendations are also made for periodical tests of the cylinders under hydraulic pressure power.

Standards For Testing Welds

The American Welding Society, 33 W. 39th St., New York City, have in print a bulletin entitled "Standards for Testing Welds." This book consists of a report of the Committee on Standard Tests for Welds of the American Bureau of Welding, which is a joint advisory board of the American Welding Society and the Engineering Division of the National Research Council. Differences in the procedure of testing welds in the past have caused widely divergent results, and comparisons are frequently impossible, with the result that the usefulness of much of the research work on record becomes limited, and in many cases the results are actually misleading. The committee feels that the need for some immediate standards is great, and the universal use of the specifications contained in the bulletin is urged upon everyone who will have to do with the testing of welds.

A new use for the oxy-acetylene blowpipe has been found in the manufacture of heat exchangers for refining petrol. Equipment of this type has hitherto been constructed with screwed connections, says Welding Engineer, which has not only been very expensive to manufacture and assemble, but the screwed connections do not approach in tightness of joint and permanence, the welded construction that is now superseding threaded pipes. These exchanges consist of twelve sections and each is made up of 112 tubes welded into tube sheets at either end, making 2,688 welds per unit. So important has welding become that the plant doing this work has its own acetylene welding shop in which three welding and two cutting blowpipes are continuously employed.

New Things in Shop Equipment

BRASS AIR GUN

A brass air gun, designed for service in foundries, machine shops, and other places where dust or chips are to be removed, has been developed and placed on the market. The construction practically eliminates air leakage. The valve is equipped with a renewal disc, providing accurate contact of the seat and takes up wear of frequent use. The gun is made by Jenkins Bros., of New York.

SHAFT COUPLING

A free-floating shaft coupling which compensates for both parallel and angular misalignment of connected shafts, as well as providing for axial movement, such as the floating of an armuture shaft. Power is transmitted from the driving to the driven hub through a floating link. A casing surrounds the parts, retaining rings preventing the hubs from slipping out. The coupling is made in sizes to fit shafts from ⅞ to 6½ inches in diameter. These are manufactured by The Kay Mfg. Co., South Norwalk, Conn.

BENCH FILING MACHINE

A bench filing machine having a reciprocating movement for using ordinary files in the regular manner, or a rotary motion for round files or special milling cutters. The table may be tilted to any desired angle for the purpose of giving draft to dies or similar pieces. The machine is driven through a three-step cone pulley. Special files having inverted teeth can be supplied so that the pressure on the work will always be downward. These machines are being placed on the market by the Boston Tool & Mfg. Co., Boston, Mass.

GENERAL TOOL-HOLDER

A tool-holder intended for general use in a lathe, boring mill, or shaper. A square hole is broached through the front end of the shank to suit the holding of square-section tool bits. Round, square, or hexagonal bars can be held to the shank transversely, and small bars can be secured in place by means of a V-block. It is thus possible to hold boring tools, drills, taps, etc., up to ¾ inch in diameter. A special clamping device is provided for holding a parting or cutting-off tool. Manufactured by the Rapid Universal Tool-Holder Corp., New York City.

SPECIAL DRILLING FIXTURE

A machine for the drilling of unusual shaped pieces has recently been developed and offered to the trade. This device is used on drilling machines to take the place of the many parallel strips and pieces of blocking required when more or less drilling of irregular shaped pieces is required to be done, and where a quantity of any one kind does not warrant making a special jig, the fixture consists primarily of a base block and two adjustable angle plates that may be placed in any position relative to each other and securely fastened. The Hartman Mfg. Co. of Hartford, Conn., are the makers.

INSIDE MICROMETER CALIPER

An improved type of inside caliper has recently been developed, which is claimed to have a wider range of possibilities than previous designs. One of the new features is that of the detachable handle, which makes the tool instantly convertible from right to left, making possible the easy reading of the graduations from either position. The spindle has a greater adjustment. Interchangeable rods are provided. The standard set, packed in a pasteboard box, consists of the inside micrometer, and adjusting wrench and five rods, giving a range from three to eight inches by thousandths. Additional rods can be furnished for measuring greater lengths, also a handle to make possible the gauging to greater depths in cylinders. These micrometers are made by the Reed Small Tool Works of Worcester, Mass.

MILLING MACHINE FOR HIGH SPINDLE SPEEDS

To take care of light milling operations on heavy parts of machinery a machine has been developed to obtain higher speed of spindle on the heavy tools required to accommodate the work. The reason of the design is that light milling operations must often be performed on heavy pieces, that are of such a size as to require a large machine to accommodate them. With this idea in view the company fitted up their No. 5C vertical milling machine so that when so ordered it can be equipped with a special three speed countershaft which permits of spindle speeds up to 1,400 r. p.m. and the use of cutters as small as 7/32 inches in diameter. This arrangement does not in any way interfere with the obtaining and using of the ordinary spindle speeds which range from 13 to 500 r.p.m. There are two shifters on the counter shaft, one for high speeds and one for low speeds. The machine has been developed by the Becker Milling Machine Co., Worcester, Mass.

SPOT-FACER AND COUNTERBORE

A very useful tool, in the form of an interchangeable spot-facer and counterbore has been recently placed on the market. The complete tool consists of the following component parts; a nickel steel holder, an externally and internally threaded nut, a high-speed steel spot-facer with milled flutes, and a machine steel pilot. The cutter is aligned correctly with the holder, by means of a ground boss that fits snugly into a hole machined in the holder. The external threads of the nut are used to thread it into the holder. The nut has two functions, one to permit the quick removal of the pilot in case of breakage; and secondly, there are several nuts, all having similar outside threads but with varying sizes of internal threads, which permit of using various sizes of pilots and tools. The end of the pilot has two flat sides and screw driver slot which permits it to be both put in place and removed from the fixture by either a screwdriver, pliers or wrench. The spot-facing tool can be used in standard Eclipse holders and pilots, through the medium of an adapter. The spot-facer and counterbore tool is made in sizes from ½ to 3 inches in diameter. The standard shank of the holder is made in No. 2. No. 3 and No. 4 Morse tapers. Spot-facers can also be supplied without the pilots. These tools are the product of the Eclipse Interchangeable Counterbore Co., of Detroit, Mich.

OVERHEAD TRAMRAIL SYSTEM

A new and somewhat novel overhead carrier has recently been introduced to the trade. It has been designed with the idea in view of reducing the time required to move work from machine to machine in the shop. The carrier may be operated by hand or electric power. The rail of the carrier may be bent to a 4-foot radius. The rails are made of a special analysis, high carbon steel which is of light section and can be bent cold on the job. The fittings employed in connection with the erection of the rail have been standardized to meet practically all requirements in connection with the installing of the carrier system in wooden, structural steel or concrete buildings. These fittings are of such design that the tramrail can easily be erected by workmen of the plant in which an installation is to be made. A system of sliding switches is provided, which makes it impossible for a carrier to run off the rail at an open switch, because of the provision of a safety stop which drops on the rail. The switches can be locked in position to prevent a carrier and its load from forcing the switch out of position. A further safety provision is made which prevents an electrically operated carrier to run at full speed against a safety stop. This is accomplished by use of a trolley insulator which provides a dead section to receive a carrier. The electrically operated carriers have ample power to carry a full load up a 12½ per cent. grade. This tramrail carrier is manufactured by the Cleveland Crane and Engineering Co., of Wickliffe, Ohio.

SELF FEED RIP SAW

A machine tool recently introduced to the trade is a new model of rip saw which embraces several new safety devices as well as a very efficient dust chute. The design of the saw enables either rough or finished stock to be sawn. The saw arbor is mounted on a frame having a vertically adjustable table. It is provided with an in-feed roller of either the corrugated or smooth design. This feed roller is used to convey the stock, not only through the saw but across the table. The arbor is so designed that saws can be mounted on it in gangs. Six saws separated by collars one-inch in width can be operated at one time. The feed provides for three different rates namely, 80, 110 and 140 feet per minute. The outstanding features of the machine are very marked, the principal ones being the quick adjustment facilities of the feed rollers, the quick adjustment and locking of the ripping fence, and the quick adjustment of the vertical table. The absorption of shocks on the feed rollers by a mechanism that also overcomes any tendency toward jerking in starting the stock through the machine, is also an important feature. The dust chute and cover form a very adequate guard for the lower portion of the machine, while the upper portion is protected by another guard. Guards even cover the feed rollers. Saws up to 18 inches in diameter can be used. Lumber up to 5 inches in thickness can be cut, and pieces 24 inches in width can be ripped. The machine may be driven with either motor or countershaft and is known as No. 65 model. The Oliver Machinery Co., of Grand Rapids, are the manufacturers.

MULTIPLE SPINDLE DRILLING MACHINE

A new multiple spindle drilling machine of the rail type has recently been placed on the market. The spindle heads on this machine, not only have a rail motion but are mounted on extending arms which permit of an in-and-out motion at right angles to the motion on the rail. The advantage of this design is that it permits irregularly located holes to be drilled and also holes with close centre distances to be taken care of. The machine is usually built with four spindles but other numbers of spindles can be provided. The design of the machine is sufficiently rugged to take care of drills 2 inches in diameter when operated at normal speeds and feeds. The in-and-out movement of each spindle can be operated independently but provision has been made to operate all the spindles together, from one end, in as far as the in-and-out motion is concerned. A counter-weight and clutch is provided for each spindle enabling it to be operated independently of the others.

Simultaneous feeding of all spindles can be controlled from one end of the machine, while independent feeding can be taken care of at the individual spindle. Quick hand-controlled vertical movement of the spindles is obtained through the medium of a hand wheel at one end of the machine. Each spindle has its own automatic stop that disengages the feed at any predetermined point. Cone pulley drive through back gears is provided, as also is motor drive through either constant or variable speed motors. A cutting lubricant pump with a distributing pipe manifold is part of the regular equipment. Cast iron floor plates, structural steel table frames, or portable tables that roll on flanged wheels on tracks led under the rail, are all optional standard equipment. The machine is adapted to take care of a very diversified class of work, as many combinations of speeds, feeds, equipment, etc., are available as well as a very varied application of the machine. The builders are the Edwin Harrington Son & Co., of Philadelphia, Pa.

HOB SHARPENING MACHINE

A motor driven universal full automatic machine for sharpening hobs, having right or left hand spiral flutes, has recently been placed on the market. The machine is also adaptable to the grinding of formed cutters, curvex cutters, or ordinary gear cutters either singly or in gangs. Two motors are used to drive the machine, a one-horse-power motor driving the spindle and a half-horse-power motor to actuate the table in its reciprocating motion, operate the indexing mechanism, drive the pump, etc. This arrangement, it is claimed, in conjunction with certain other features of design, absorbs completely all vibration. It is also stated that the consumption of current for power is reduced. Further, it is claimed that on account of the rigidity of the machine that more stock can be removed with less abrasion of the wheels, and also fast feeds can be used.

The maximum spiral at 8 inches diameter is 47 degrees right or left. The machine grinds on both strokes and indexes automatically, without stopping, at the end of each return stroke. A 9-inch grinding wheel is used, and a table speed of 28-feet per minute is used on regular work. At the end of a complete revolution of the hob, the machine automatically adjusts itself to take a new feed of a depth ranging from .0002-inches to .005 inches as may be desired. The work carrying head is so rigidly designed that except in the case of the heaviest hobs no tail support is required. The wheel spindle is carried in large bronze bearings, having oil-well type lubrication, dust proof, and provided with adjustments to take up thrust and wear. The machine is equipped for wet grinding, flooded conditions of work and wheel prevail at all times. The manufacturers state that owing to the fact that there is no idle or lost time in operation, and that the machine is substantial enough for the rapid table. The machine will sharpen hobs from four to ten times faster than the methods now ordinarily used, and accomplish this without "burning" the hob teeth. The machine is manufactured by the H. E. Harris Engineering Co., of Bridgeport, Conn.

ENGRAVING MACHINE

For some time past there has been an increasing demand for a heavy type of engraving machine for cutting dies, steel stamps, large size letters, gun work, lettering bottle moulds, and many such similar jobs in steel, brass, and cast iron. Recently a heavier design of engraving machine has been placed on the market to meet this demand. The pantograph is adjustable and has a range of 1:1 down to 6:1. The pivot bearings are ball bearing, both radial and thrust, all other pantograph bearings being formed by hardened ground and lapped cone point centres, male and female. The tracing style is held in a ½ in. collet. The adjustable scales are mounted on top of surfaces of bars, easily read, graduated, with engraved figures, giving settings for various reductions. These scales are graduated full length (20 graduations to the inch) so that any intermediate reduction can easily be obtained. For larger work, there can be furnished practically the same machine, but with a larger pantograph, the reductions being 2:1 down to 8:1.

The cutterhead is heavy and rigid and is an integral part of the heavier of the pantograph bars. The spindle 13/16 in. in diameter, is mounted on ball bearings and has a range of 1,800 to 800 r.p.m. enabling very small cutters to be used for fine work and finishing up corners, etc. Spindle speeds down to 600 r.p.m. may be obtained, by using special drive pulleys. Spindle nose has a straight hole ⅜ in. diameter with collet nut for holding cutters. When engraving work of curved or irregular contour, the forming attachment is used, having six different adjustments, in order to set it quickly and accurately in relation to the work to be engraved. The lower member of this attachment, which is directly over the centre of the spindle, carries the former block which is a hardened piece of steel of same shape as engraved surface, except in reverse. This controls vertical movement of spindle. The table is 10 in. wide, 30 in. long and 2 in. thick, at the thinnest part, and has three Tee slots ⅝ in. wide. An oil groove is planed at each edge of the table, so that oil or cutter lubricant can drain into pockets at the ends of table.

A copy holder is mounted on a bracket at the right side of the machine and is adjustable to compensate for change in reduction of pantograph. The table or longitudinal feed is 17½ in.; saddle or cross feed is 8¼ in., minimum distance end of spindle to top of table ½ in.; maximum distance end of spindle to top of table 16 in. The length of machine, front to rear, is 46 in.; width of working space overall, 68 in.; approximate net weight of belt driven machine, 1,800 lbs.; approximate net weight of motor and starter, 150 lbs. This machine is being manufactured and marketed by the George Gorton Machine Co., of Racine, Wis.

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Prevent Accidents At All Cost

THE REDUCTION in number of factory accidents during the last few years has been very encouraging, but much can yet be accomplished. Take the illustration shown on this page. The correct method of handling bars incurs no additional effort or time, but a careless workman can unwittingly cause a serious injury by lowering the front of the material carried.

Not only must employees enter into the spirit of accident prevention, but the manufacturer himself should set an example by occasionally walking through his plant, pointing out to the superintendent improvements which could be made in the cause of safety.

The plant owner should enter into and not resist the spirit of fire inspection. In walking through the factory he ought not to blind himself to faults but should view things with a critical eye. He should be continually on the lookout for dirty waste, sprung spanners, loose boards in the floor, fire pails not properly filled and so on, all these being conducive to accidents.

These suggestions merely scratch the surface, but bring out the point that the owner should walk through his plant, determined if possible to find something wrong, rather than to shut his eyes to needed changes that would entail expense. It is one thing to *say* your plant is safeguarded, and another thing to *know* definitely that accidents have little chance to occur. A large manufacturing plant spent many thousands of dollars about a year ago in safeguarding one floor alone. Some grumbled at the time, these including machine operators who felt all this safeguarding was mostly humbug, but results proved the wisdom of the move. From an average of one to two accidents a day, they brought the toll down to three a year, and with other improvements they intend incorporating, expect to eliminate accidents entirely. The manager in this case is a keen-sighted gentleman who makes it a point of walking through the plant frequently, actually looking for trouble. The fact that he is now finding it difficult to discover inefficient guards, is a point in his own favor and speaks well for his perseverance. This is true accident prevention, and manufacturers would do well to follow suit.



Showing how easy it is to prevent accidents

Avoid Oil Waste

EVERY MANUFACTURING plant uses lubricating oil of some nature. The grades differ considerably, likewise the care taken of the same. An article on lubricating oils appears on the first reading page of this issue, and many valuable hints for the executive are contained in this matter.

Oil should be used, not abused. The amount of oil wasted annually in manufacturing plants is astounding. The man oiling the lineshaft is careless, tips his can before he has placed the spout in the oil hole, and waste results. If someone could follow him, catch the overflow, then show him at the end of a month the oil lost, he wouldn't believe it possible. This is only one outlet for waste, but sufficient to pound home the fact that carelessness is responsible for a large percentage of loss.

When a machine operator applies at the tool room for a milling cutter, he leaves his check as proof that he has received the tool. It is an understood fact that the cutter is in first class shape, otherwise he would not accept it. Knowing that he must return it in good condition he takes care of it, but wave these restrictions aside, then watch the damage to cutters as they come back.

Oil is a valuable fluid, and an operator should be made to understand this fact. He should realize that he must use it cimcumspectly, and once he knows that he must give an account of the amount supplied him, he will be more careful.

The manufacturer must do his part by installing suitable equipment to conserve the oil, keeping it clean, thus making it of maximum efficiency. Quality is important. A poor oil, though cheap in first cost, is expensive in the end. As one man so aptly put it. "You can't get an article good, and cheap." By close co-operation between executive and employee, considerable saving yearly will result.

E. W. Beatty, president of the C. P. R., announces the granting of three scholarships to the Toronto University. These are given for the purpose of inducing graduates of Western colleges in Canada to pursue their post-graduate studies at Varsity. This is a splendid move and deserves the hearty support of all interested in education.

Business Improvement is Very Encouraging

Few Price Changes—Undertone Bright—Gradual Betterment—Sheets Brisker—Small Tools Show Good Movement—Aggressive Salesmanship Brings Orders—Keen Competition

MANY LINES SHOW A BETTER DEMAND

PERHAPS the most interesting development in the metal and machinery situation is that the basic raw material, pig iron, is now back to the lowest price since November, 1915, and in the primary U. S. markets more business is being done.

In several departments of machine and allied trades there never was a time in the experience of the oldest men when there were so few orders. Many of them have no orders in progress or in sight. Yet at no time was there a greater feeling of optimism and confidence in the future of Canadian business.

Taken as a whole, Canadian markets show a gradual improvement this week. There have been no further price changes of importance, but in Toronto the quotation on iron and steel bars is now generally down to $2.75 from $2.90. Band steel is now quoted at $3.25 in place of $3.40. Apart from these items, prices on the Canadian steel market remain the same.

Blue annealed sheets are in slightly better demand in the Toronto field, owing to the continued open weather which has allowed more outside work. Other lines are moving, but not very briskly.

Small tools and supplies are selling at a good rate. Prices are firm, and dealers say that the entire month of February will show up to good advantage on their books.

Pig iron is very dull in Canada and further shading in price is going on. Foundries are going through a period of record dulness.

Machine tools are showing a further improvement especially on the Toronto market. This is due more to aggressive salesmanship than perhaps to better conditions. Several good orders have been closed and other enquiries which look to be worth while are on tap. Keen competition exists on this market. Montreal reports poor trade in machine tools, but this seems to be a local trouble only.

Steel ingot production in the States increased considerably last week. Part of the recent increases in steel production is in railroad material, not fresh purchases, but contracts placed late in 1921, specifications of which have only lately reached the mills. The production rate is expected to go still higher within the next two months when the spring demand becomes accentuated.

Bars, shapes and plates are down 10c in the States to $1.40 from $1.50. The latter price is still in evidence on small orders. Sheet quotations remain steady, and coke shows a stiffer undertone than it has done for some time past.

TORONTO

February 22.

"WITHOUT question, conditions are decidedly better." This statement made by a prominent local dealer, covers the market situation exactly. Business is far from normal, but it is infinitely better than it was at the end of 1921. In fact every week shows additional improvement.

Steel Market.—While no one expects a rushing trade in steel during February, the amount of business being closed is well worth while, everything being considered. Black and blue annealed sheets show the best demand of all lines, and this is no doubt due to the open weather we have been experiencing. Manufacturers are erecting smoke stacks, builders are using sheets for varied purposes and of course there are many other channels for these two lines.

Iron and steel bars have tapered off in price, being now quoted at $2.75 in place of $2.90. Some dealers are buying to hold up the price to between $3.00 and $2.90, but very little business is being closed at these high figures. A small order might only get a $2.90 price, but where the business would run up to a good figure, the $2.75 mark is easily obtained. This of course, brings band steel down to $3.25 instead of $3.40 and here again, we find a few dealers aiming for the high figure, but with little success. Apart from these changes the market is much the same as last week. Following are the new quotations:

Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-1 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00

Pig Iron.—The demand for pig iron continues to be very light. Foundries are inactive and as long as the chief consuming source is quiet, we cannot look for any improvement in the production end. The market is still quoted at $27.15, and as this is low, considering production costs, there is not much chance of a drop.

Non-ferrous Metals.—Copper is a little easier at present, and the demand is actually less now than it was at the close of last year, or the opening of this. Business seems to have been over-stimulated during the October-November 1921 period, and consumers were induced to buy their first quarters requirements on the assumption that prices would be higher. However, now that this theory has proved itself to be wrong, buyers are fighting shy of second quarter commitments, with the result that there is an exaggerated idea of stagnation. One large dealer claims that there is no likelihood of a lower market for April, May or June copper, and he thinks that when buyers do have to come into the market, there is a possibility of a slight advance, probably forcing the price of Electrolytic to 14c.

At present the outside market is selling copper at 13½c. delivered Eastern ports for prompt or future over the next four months. The east seems to have purchased all it requires, and export trade is quiet.

The rise in sterling has caused a serious decline in the price of copper in England, and heavy losses have been sustained by speculators in Red Metal. The advance in sterling will also make the value of tin in New York higher, but unless sterling keeps on the upward march, no decided advance in price is expected.

Lead remains about the same as last week, but the demand is not great. Spelter is a little more active, but no decided advance is looked for in this metal. Following are present quotations for 100 lb.

Lake copper	17 50
Electric copper	17 25
Castings, copper	17 00
Tin	34 50
Spelter	*7 25
Lead	6 75
Antimony	8 00
Aluminum	27 00

Scrap Metals.—Prices have not changed since last week, and demand still remains very light. Until foundries become more active, we cannot expect much improvement in the iron lines, and as far as the other articles are concerned, they are low in both price and demand. Following are present quotations.

Copper, light	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 machine composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
	Gross
Boiler plate	9 00
Heavy melting steel	12 00
Axles (wrought iron)	20 00
Rails (scrap)	12 00
Malleable	12 00
No. 1 machine cast iron	19 00
Pipe, wrought	6 00
Car wheel	18 00
Steel axles	18 00
Mach. shop turnings	6 00
Stove plate	16 00
Cast boring	6 00

Machine Tools.—A decided improvement has taken place in this market. Several good orders have been closed during the week. The chief feature regarding this business, is that it has all been of the "Go-Get-It" variety. In other words, dealers had to go after it

good and hard, before they managed to close.

A peculiar point came up this week, and one worthy of careful consideration. A certain dealer had travelled quite a few hundred miles in order to try and secure a much desired order. Everything seemed O.K. The engineering department was satisfied, in fact everybody concerned seemed satisfied, except the purchasing agent. "We will give you this business if you'll meet such and such a figure," he remarked, naming a ridiculously low price, and the dealer's reply is worth recording.

"Do you know what you are unconsciously trying to do," he commenced. "You're trying to make honest men, dishonest."

"What I mean in this," continued the dealer. "I've travelled a considerable distance because I wanted this order in the worst possible way. I realized that competition would be very keen, and shaded my prices accordingly. I'm down to the lowest possible figure now, that is if I give you the proper quality of goods suitable for your work. I could give you a lower figure, supply you with seemingly similar material, pleasing you temporarily perhaps, but being dishonest nevertheless."

The dealer secured the order at his own figure and the point brought out is worth consideration, viz., that you may squeeze a purchase through at a very low figure, but are you getting quality at the same time? It may be a buyer's market, but the buyer should be sure he hasn't set a trap for himself by his keen bargaining. Get as low a price as you can by all means, but make sure the quality is there.

One dealer reports there is a tendency to buy for a longer period, rather than hand to mouth variety. In such cases a small margin of profit only is allowed, thus protecting both dealer and buyer. Second hand tools are still moving, these being even more brisk in some cases than the new tools.

Small Tools and Supplies. — A still further improvement is noted in this line. Every week shows business a little better and dealers feel that this steady upgrade movement will continue until the normal point has been reached. This will of course be a slow and gradual process. Nothing special is featured, the demand being general, and even the locality of orders is pretty well scattered.

Miscellaneous.—Oils and greases are still quiet, manufacturers purchasing only for immediate needs, and the same story holds good regarding waste and wipers for industrial purposes. Steel pipe is selling at a fair rate, but as soon as Spring opens up the demand in this line is expected to increase. Considered in its entirety, the local market shows a gradual improvement.

In the March 2 issue will appear an article on Precision Instruments. Watch for it.

Montreal

February 22.

THE GENERALLY quiet conditions that have prevailed since before the first of the year in business circles do not appear to have changed much in the last week. Trading in steel is very quiet.

The channels through which steel is usually marketed do not present any prospects that give promise of early business. In the case of merchant bars, the demand has fallen off to an alarmingly low point. One does not have to look far for the explanation. The largest consumers are manufacturing plants and these firms are operating at a small percentage of their capacity.

Iron and Steel.—These lines show one of the quietest periods in the last decade. The base price of steel is claimed to be below the point where a reasonable profit can be obtained. Mills are looking up orders very aggressively in an endeavour to keep their organization together. Even these aggressive sales efforts have not been productive of good results. At present the productive capacity is far in excess of the consumption even under normal conditions.

The prospects for an increasing demand in structural shapes are good. Locally there will be a great deal of building. The plans that are being seriously considered are good grounds for stating that the local building contractors will have a busier season in 1922 than they have had in many years.

Sheets are not moving as rapidly as they have been in the last few months. The present lull is not expected to last as the demand for this class of material comes from a wide and representative range of consumers. It is expected that seasonal demand will soon increase.

Plates are very quiet. A better situation in this department is looked for presently. Heavy sheets and the thinner plates are being consumed in a multitude of ways in the manufacture of containers, and as conditions improve outside the metal industries, the demand for this material will increase.

Pig Iron.—The market for pig iron is in the same condition as it was last week. There have been no price changes and the demand is not any better. The foundries have not picked up any business lately that would alter the quiet conditions prevailing. All the buying that is being done is of the hand-to-mouth variety. Prices are not attractive to the producer, and it is questionable if any of them would be willing to contract very far in advance.

Machine Tools and Supplies.—The machine tool business is also very quiet. Any sales that are being made are for single tools. The railways, generally large purchasers of machine tools, have not come into the market for some time. A large surplus of machine tools was accumulated during the war years, and this is only being slowly absorbed by the small amount of work being done in railway shops, owing to the falling off in traffic.

The small tool business is not as good locally as it has been for some months past. There is, of course, a small amount of business, but during the last week it has only been nominal. Prices are gradually falling and from time to time additional discounts are given. These represent part of the saving made in production, and the manufacturer in the face of poor business and keen competition is taking only a fair profit, and is passing most of his additional savings on to the consumer.

Non-ferrous Metals.—The quotations on non-ferrous metals are somewhat weaker this week. London markets show quite a falling off in price. In fact quotations are lower to-day than they have been at any time in the last ten years. A week ago they reached the low point of last August. The further drop has been made since. The business being closed is very poor, and the call for ingot copper and ingot lead is light. More or less scrap is being consumed, but this market is also very weak.

Pittsburg

February 22.

PITTSBURGH, (Special to Canadian Machinery)—Steel ingot production underwent a sharp increase last week, as it can be estimated on the basis of trustworthy reports that the rate was 28,000,000 gross tons a year. This is well above the highest rate attained last autumn and shows a sharper increase than occurred in the earlier weeks of last year. Our report a week ago pointed out that production increased during January at a greater rate than had been suggested in the statements made public by the mills as to the condition of the market.

Steel Production.—Part of the most recent increases in steel production is in railroad material, not against fresh purchases, but against orders or contracts placed late in the old year, specifications against which have only lately reached the mills. This includes some rail business, being filled at the Edgar Thomson works, in the Pittsburg district, and in the Chicago district, also car material, being produced in the Chicago district, against freight car orders placed in November. Apart from this railroad business, the production of ingots is for speedy rolling into finished products, against orders booked from day to day for prompt shipment, and thus on the whole the rate of steel ingot production reflects closely the state of buying.

A general survey is of interest, to show the swing. The slump in production last spring and summer, when stocks of steel and of manufactures of steel were being liquidated, brought the ingot production rate down to 11,000,000 tons a year, in July. Then production mounted, and the rate was 23,000,000 tons a year in October and November, measuring the size of the autumn consumption, as stocks were then fairly well liquidated. Early winter brought

a recession, and the rate the last week in December was under 18,000,000 tons. Now the rate is up to 28,000,000 tons, showing a very sharp increase in seven weeks, and a 20 per cent. gain over the rate of last autumn.

The full force of the spring demand is of course not felt as yet, and thus the prospect is that production will reach still higher rates in the next couple of months. Presumably there will be a tapering off towards summer, but there is no reason apparent for demand not showing a still higher tide next autumn, for fundamental conditions are improving continually and perhaps no more slowly than one should expect.

Requirements Widespread.—Demand for steel is widespread, almost universal. No consuming line is conspicuous for the size of its demand, and no line is conspicuous by its absence from the market, excepting alone the agricultural implement trade. No part of the country is buying much more heavily than other parts, but the agricultural sections, in general, show much less demand than industrial sections. The reason for this is well understood, the very low prices realized by farmers for what they sell, as compared with prices they are asked for things they normally buy.

The buying, except in the case of rail contracts and freight cars, in the case of the railroads, and a moderate sprinkling of large construction jobs, is all of hand-to-mouth character, and for very prompt shipment. It is not a case of buyers "holding off" because they are suspicious of steel prices. The buyers are buying as much steel as the state of their respective lines of business requires. They have no occasion to buy for forward delivery, since they feel assured that when in future they may need steel they will be able to get it. The large productive capacity now existing seems to insure that. Thus, when ingots are produced at the rate of 28,000,000 tons a year, the estimate made for last week, this is 10 per cent. more than the production in 1910, when the steel mills were fully engaged and all consumers of steel were busy, but it is only 53 per cent. of capacity. The natural presumption is that consumers will be as busy as they can be consuming steel before mills are entirely engaged in making steel.

Steel Prices Sagged.—Bars, shapes and plates are now quotable at 1.40c rather than at 1.50c. This does not mean that the market has declined by any such amount in a week, whereby much smaller orders than formerly can now be placed at 1.40c, a price which a couple months ago was done only on the largest and most desirable orders. The 1.50c price is still in evidence, but obtains chiefly on carloads and similar small lots. The range of the whole market has been quotable as 1.40c to 1.50c for some time past, but formerly 1.40c was a special price. Now it is rather the 1.50c that is the special price.

So far as can be ascertained, mills have not gone below 1.40c except in an occasional instance, perhaps, when a mill is at a freight disadvantage. Eastern mills have been doing 1.50c to 1.60c f.o.b. mill, making delivered prices that would require a price of less than 1.40c for a Pittsburg or valley mill to meet, usually these mills do not attempt to get orders in the east when the eastern mills make their special prices, just as long ago they had to leave the Chicago market largely to the Chicago mills. This represents quite a change from the old times when "Pittsburg plus" made the market for practically the entire country.

Sheet Prices Steady.—Sheets continue to be firmly held at 2.25c for blue annealed, except in the lighter gauges, 3.00c for black and 4.00c for galvanized. Nails continue in about the same position as formerly, with $2.50 maintained for the general run of the trade and $2.40 done with particularly large distributors. Standard steel pipe is being shaded 2½ to 5 per cent. by independents and as more often than not the independents give an extra 2½ per cent, there is no particular prospect of the leading interest changing its regular prices.

Pig Iron and Coke.—Furnaces feel that pig iron is lower than it should be, considering costs, while at the same time each furnace that is in operation wishes to sell every ton possible, the result being that sometimes pig iron looks strong and sometimes weak. Quite a test was made in the past few days in foundry iron, disclosing this condition, that all the furnaces but one refused to go below $19 valley, while one valley furnace did sell at $18.75, and some of the furnaces that held ordinary No. 2 rigidly at $19 were willing to sell No. 2X at precisely the same price. Then there are at least two furnaces, having a slightly lower freight to Pittsburg than the valley rate of $1.98 that hold to $19 at furnace, which would give the Pittsburg consumer iron at less than the equivalent of $19 valley, but not as low as $18.75 valley. With one valley furnace having sold at $18.75 the market seems quotable at $18.75 to $19 valley, against $19 formerly quoted.

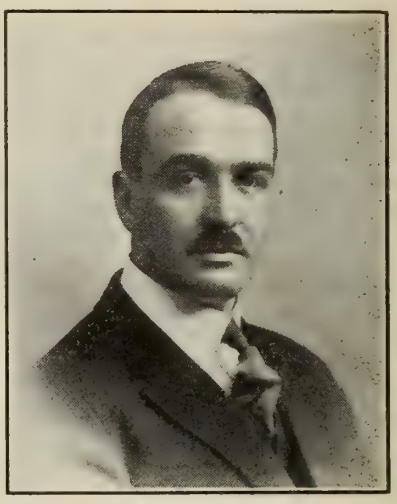
Connellsville coke, which showed a stiffer undertone a week ago, appears to have advanced sharply, for it is positively asserted that one lot of 75 carloads of prompt furnace coke went at $3.25 and a day or two afterwards 50 carloads went at $3.50. Whether such prices will hold if demand relapses to its former small proportions is a question. Dover furnace, Dover, O, which blew in a few days ago, contracted to July 1 at $3.25. Offerings of foundry coke at $3.75 seem now to have disappeared entirely, leaving the market at $4.00 to $4.25 for spot or prompt.

The Cincinnati Milling Machine Co., Cincinnati, has published a 32-page illustrated booklet in which the use of milling machines in locomotive repairing is described and illustrated. Data are given on machining operations on various locomotive parts. In addition specifications of the machines are given.

EXPECTS GOOD BUSINESS BY JULY

H. H. HINES is now district sales agent for the Consolidated Steel Corporation, with office in the Royal Bank Building, Toronto. Speaking to Canadian Machinery on the steel situation, Mr. Hines said, "that on the whole, the steel market had not shown as marked an improvement as many had hoped for with the turn of the year, but in spite of this fact, their tonnage for January was larger than any month in 1921."

"Opinion is still divided considerably," continued Mr. Hines, "regarding the prospect of a big buying movement in the spring. So far as our firm is concerned, we are looking for a considerable demand by the first of July.



H. H. Hines, district sales agent for The Consolidated Steel Corporation.

"Indications point toward spring business of some considerable volume and we particularly desire for special reasons, that standard commodities will go lower than the prices now ruling, but in spite of our desire, we believe such a condition is impossible, until further marked changes take place in the fundamental governing costs.

"We cannot see where these changes can occur in the near future for prices are undoubtedly dragging bottom at the present time, and we do not look for any lower figures to rule generally. In fact we are rather inclined to think a stiffening tendency will occur at the first real indication of improved demand."

For four years Mr. Hines was with the Imperial Munitions Board at Ottawa, as assistant purchasing agent. In 1919 he joined the sales staff of the National Acme Co., Montreal, and in December, 1921, resigned to accept a position with the company he now represents. He comes to Toronto with a varied experience, and a keen knowledge of existing market conditions and is a Canadian by birth.

The Dominion Motor Show will again be held at the Motordrome, on Sherbrooke St., Montreal, during the week of Feb. 25 to March 4. Three-fourths of the space has already been reserved.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	*$2 75
Steel bars, base, Toronto	*2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	*3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	*1 40
Tank plates, Pittsburgh mill price	*1 40
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05

F.O.B., Toronto Warehouse

Small shapes	3 00

F.O.B. Chicago Warehouse

Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	78
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 25	$17 50
Electric copper	17 00	17 25
Castings, copper	16 75	17 00
Tin	*35 00	34 50
Spelter	7 00	7 25
Lead	6 50	6 75
Antimony	6 50	8 00
Aluminum	24 50	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.92
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.65	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$ 8 00
Copper, crucible	10 00	10 50
Copper, heavy	10 00	10 50
Copper wire	10 00	10 50
No. 1 machine composition	8 00	8 50
New brass cuttings	6 00	6 00
Red brass turnings	7 00	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 25	3 50
Medium brass	4 50	4 50
Scrap zinc	4 00	4 00
Heavy lead	4 25	4 00
Tea lead	2 25	3 00
Aluminum	12 00	10 00

	Per Ton	Gross
Boiler plate	$10 00	$9 00
Heavy melting steel	9 00	12 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	8 00	12 00
Malleable scrap	12 00	12 00
No. 1 machine cast iron	22 00	19 00
Pipe, wrought	8 50	6 00
Car wheel	22 00	18 00
Steel axles	18 00	18 00
Mach. shop turnings	5 00	6 00
Stove plate	17 00	16 00
Cast boring	3 00	6 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine screws, fl. and rd. hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine screws, fl. and rd. hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head cap screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh.

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 90
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	*$0 24½
Solder, guaranteed	*0 26
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, *32%; cast bushings, 32%; unions, *47%; plugs, *30% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 50	....
Galvanized sheets, No. 28	5 55	
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis. 28 B.W.G.	6 75	
Gorbal's Best, No 28		
Colbornes Crown. No. 28.		
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sixes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	*60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	37 50
Black oil, per gal.	21 00
Cylinder oil, Capital	66 50
Petroleum fuel oil. bbls., net	10 40
Pure turp., single bbls. gal	1 35
Linseed oil, raw, single bbls.	1 00

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12	Popular	9
Standard	10½	Keen	7½
No. 1	13		

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored.18
Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

McColl Bros., 67 Bocelier St., Ottawa, will erect a warehouse and three storage tanks.

Mr. J. Vance of Coppin, Ont., is in the market for complete saw mill equipment. Estimated cost $25,000.

The Dover Oil Company, Bell River, Ont., are in the market for equipment, tanks, piping and drilling equipment.

The Sunshine Soap Co., Hagersville, Ont., with Walter Diffie as manager, will build a factory at that town to cost $60,000.

The Board of Commissioners, Edmonton, will spend $300,000 on improvements and additions to its waterworks plant.

The Greb Shoe Co., Kitchener, are in the market for $25,000 worth of special shoe making machinery and equipment.

The erection of a garage at a cost of $18,000 on Kent Street. Lindsay, Ont., is contemplated by Mr. Fee, Montreal, Quebec.

At a recent meeting of the Montreal Harbor Commissioners, J. F. Simmons was appointed to the position of Harbor Master of the Port of Montreal.

The actual outlay on business and engineering construction has increased since the end of the war 323 and 310 per cent. respectively.

The Board of Education, Fort William, Ont., have adopted a resolution for the erection of a school at a cost of not more than $90,000.

The City Council of Toronto passed by-laws for raising $2,500,000 by debentures for expenses and new buildings required by the board of education.

The factory owned by the Leggett & Platt Bed Spring Co., 900 MacDougall Street, Windsor, Ont., was recently damaged by fire with a loss of $12,000.

Fire losses in Canada during the week ending February 8 are estimated by the Monetary Times at $756,300 compared with $1,363,000 the previous week.

The Catholic School Commission, Montreal, have obtained the approval of the Quebec Legislature for the borrowing of $2,300,000 for the construction of schools.

Mr. Stern, of the Canadian Tank & Pump Co., says that business is exceptionally brisk in their line. Good sales are being closed, and from their experience, he feels things are decidedly on the up grade.

Montreal fire losses since the first of the year approximates upwards of $37,000 each day for every day this year. This is nearly 300 per cent. higher than that of the corresponding period of 1921.

There is a report current to the effect that the manufacturing plant of the Asphalt Block Company of Walkerville, Ont., will shortly re-open. The plant has been closed for several years.

General contracts for the erection of of shed costing $15,000 for Canadian Ramapoo Iron Works, Stamford, Ont., has been awarded to the Robertson Construction Co., Niagara Falls.

The president and managing director of the Calgary Gas Co., has stated that the company has planned to spend some $50,000 in building new wells next summer for procuring a new supply of gas.

Yarrows Limited, Vancouver, B. C., has been awarded the contract for repairs to the Government steamer Givenchy which struck and was submerged for six weeks near Bella Bella, three months ago. The work will cost about $10,000.

The Wallace Shipyard, Vancouver, B. C., was awarded the contract for the remodelling of the steamer Admiral Farragut, the company being the lowest bidder at a price of $63,250. The work will last 60 days.

The Abitibi Power and Paper Co., plant at Iroquois Falls established another record output during the first week of February with an average daily production of 455.38 tons against 459.13 tons the week previous.

Commenting on the possibility of a strike among the coal miners of the United States, H. A. Harrington of the Coal Exchange of Canada stated that a lengthy duration of suspended operations, would result in considerable inconvenience to users of American coal in Ontario. Canadian authorities will likely take steps to minimize coal shortage.

The Magnolia Metal Co., of Canada, located at Montreal have completed their new factory and offices on Shannon Street and are now fully equipped for smelting and refining white metal alloys. The equipment includes new reverberatory furnaces and facilities for chemical research, etc.

What are Canadian banks doing to make possible the financing of Canadian exports to continental Europe? Poland is buying millions of dollars' worth of machinery, motors and machine tools in the United States.

It is announced unofficially that the British Empire Exhibition, advertised for 1923, will likely be postponed until 1924. A British mission is now in South Africa working up interest in the exhibition, and is due to arrive in Canada for the same purpose on August 12th next.

The Department of Public Works, Ottawa, plan extensive harbor improvement, including the deepening of the harbor at Goderich and improving and making additions to the docks. The cost of the work is estimated at $50,000.

The Standard Steel Construction of Welland has secured contracts for the construction of three swing bridges, one for the Trent Canal in Ontario and the other two for locks 1 and 2 on the Welland Canal at Port Dalhousie.

Application will be made by the city of Toronto to the Provincial Legislature for authority to pass a By-law to raise $1,012,579 for the laying or renewal of such pavement in connection with construction, repair and renewal of the street railway tracks of the Toronto Transportation Commission.

The London and Port Stanley Railway, Phillips Street, London, is in the market for a derrick clam shell bucket and unloading and operating equipment for coal unloading depot at Pt. Stanley. Estimated cost $25.000.

The erection of a convention hall on the Victoria Park property at the corner of 17th Avenue and Second street, East, Calgary, to cost approximately $143,000, has been recommended by manager E. L. Richardson and the executive of the Calgary Exhibition Board. The project has been approved by Mayor Addison and many other citizens.

A reduction of approximately 40 per cent. on all farm machinery has been announced by the United Grain Growers Limited. It is further stated that they have based the spring prices on the implement price prevailing in 1915. Generally speaking the prices of farm products are down to the 1915 level.

In accordance with the judgment and order of the Board of Railway Commissioner of industries. **The Ford com**rate of exchange in connection with shipments of freight between points in Canada and the United States, from February 15 to February 28, inclusive, will be 4 7-16 per cent., and the surcharge on the said traffic will be three per cent. The rate of surcharge on International passenger business will be based on four per cent. exchange.

During the last year Hamilton secured 24 new industries according to the report of Mr. T. W. Kirkpatrick, Commissoiner of industries. The Ford company has established its headquarters in Hamilton, but has not yet commenced manufacturing. This showing is regarded as highly creditable in view of the industrial condition prevailing during 1921.

Plans connected with a demand for Hydro-Electric power in the Calumet channel of the Ottawa river at Bryson, Quebec, have been deposited by the Ot-

tawa Steam and Electric Power Mfg. Co., with the Minister of Public works at Ottawa and the Land Registry office at Bryson disclosing the fact that the company is considering future expansion.

It has been announced that the sum of $400,000 has been provided for the remodelling of the old Board of Trade building at Toronto, to house the offices of the Toronto Transportation Commission and the Toronto Hydro Commission instead of going ahead with the construction of a new office building.

The big marine boiler order received by the Engineering and Machine Works St Catharines, Ont., will keep the boiler department of the plant going night and day for the next three months. The manager stated his plant was fully manned at present. Signs of improving business are also being shown in other industrial plants in the city and district.

The civic council of Peterborough, Ontario, will make an effort to secure from the Dominion Government an additional $41,000 towards the cost of constructing the Hunter Street over-head bridge. On the original cost of $300,000 for the bridge the Government would need to contribute one-sixth, or $50,000. Up to the present time the cost of constructing the bridge has been $550,000.

The Department of Trade and Commerce has recently decided to concentrate its efforts to induce industrial executives of the United Kingdom to consider the Canadian field as a theme of operation. With that aim in view a booklet has been prepared by the Department of Trade and Commerce presenting information about Canada's resources, transportation system, labor conditions and industrial activity.

Mr. H. B. Bousette, director of the Commercial Intelligence Branch of the Department of Trade and Commerce, speaking at the Rotary club in Peterboro recently, urged the Rotarians to take an interest in export trade and direct their influences to advancement of Canadian products in other lands. The speaker stated that twenty-two agents are busy in foreign countries opening up connections for Canadian firms. The cost of this work last year was $230,000.

Arrangements have practically been made by the Quebec Harbor Commission for the erection and operation of an oil fuel plant in Quebec similar to the plants now in operation in Halifax and St. John. The idea is that the city of Quebec will be the main fuel station on the St. Lawrence for all oil burning vessels. The commission plans to erect a 225,000 gallon tank on the property of the commission and this will be completed by May 15th next.

Harbor Officials are of the opinion that navigation will be later than usual in starting this year. One stated that instead of there being about 17 miles of open water between Montreal and Quebec, as is usual at this time of the year, there is only about 13 miles, while from Montreal the ice carriers extend to Pont Neuf, which is a much greater distance than usual. April the 15th is the day set to see the real opening of navigation.

In order to be able to meet the United States competition the charges for the use of Canadian dry docks on the Pacific Coast have been reduced about one third or back to their pre-war level, for the next six months, at the end of which period the question of dry docks charges will have been considered and definitely settled by the Government. The docks at Esquimalt and the floating dry dock at Prince Rupert are affected by this reduction.

Engineering and Machine Works of Canada, St. Catharines, Ont., have announced the receipt of a fair sized order. J. E. Waterhouse, the managing director, stated to Canadian Machinery, that they had closed contracts for ten Scotch type marine boilers, 14 ft. 7 in. in dia. x 10 ft. 8 in. long, and for a working pressure of 180 lbs. Eight of these are for Three Rivers and two for Collingwood. As delivery is required this spring it has been necessary to put on a night shift.

Facts and figures about Canada have been prepared in such form as to attract the attention of the British manufacturers to the field that the Dominion presents to their energetic enterprise. The establishment of about 700 branch plants by American companies while highly desirable, is a sharp contrast to the comparatively small interest shown by British manufacturers. However, there is evidence that many British manufacturers are considering the matter of beginning business in Canada.

As a result of a conference between the Premier of Ontario and the members of his cabinet, the mayor and city council of Fort William and representatives of the Great Lakes Pulp and Paper Company, an agreement may be arrived at which will result in the construction of a pulp mill and paper mill at Ft. William. Both Ft. William and Pt. Arthur are vastly interested economically in the establishment of the industry and the distribution of Nipigon Power at low rates.

Speaking on the advancement of trucks, at the present time it has been found that the motor propelled vehicle travelled 25% longer distance, made 183% more round trips, 48% more corn, and 50% more wheat and that from 45 to 50% of the ton cost per mile of wagon hauled grain. One farmer has found that the cost to deliver 28 cans of milk by truck was $2.52 comared with $7.56 delivered with horses. This certainly speaks well of the progress of the automotive industry and it may be a good sign for cylinder re-grinding.

China with its 375,000,000 people, is coming to desire and therefore need, many of the accessories of the West. Canadian firms who go to seek business in China are getting it. That country imported about $1,000,000,000 worth of goods in 1920 and will import a great deal more as time goes on. China is evidently sending more to Western nations than to Japan, as trade figures indicate. Steel and machinery of all kinds are in demand in China and electrical goods in considerable quantities.

The business of the Collins Manufacturing Co., of Toronto, and Never-Fail Products Limited of Hamilton have been combined. The new organization will be known as the Collins Never-Fail Products Limited. They will carry on their production and largest operations in Hamilton in their modern factory at 1322 Burlington Street, East. The new company will develop to a much greater degree in the line of metal supplies and products before made by the Collins Manufacturing Co. The line of sprayers will be continued as well as other novelties made by them. C. W. Collins will be president and general manager.

When the estimates to provide for continuance of the Canadian Government Merchant Marine come into the House of Parliament this year they will not, it is understood, come from the Minister of Marine and Fisheries, as has been the case in former sessions, but instead from the Minister of Railways and Canals, Hon. W. C. Kennedy. It is believed almost a score of the C. G. M. M. vessels have been lying idle because of the shortage of cargoes. When the annual statement is brought in there is little likelihood according to reports current, of anything but a loss on the year's operation being shown.

Still another Buffalo concern has decided to locate a branch plant at Bridgeburg, Ontario. Announcement has been made that the Acme Pattern and Tool Co., of New York has leased the Thrope factory on Courtright Street and will manufacture knitted goods, etc. The concern will eventually construct a plant of its own if this Canadian branch proves to be a success. This is the third Buffalo plant to establish a Canadian branch at Bridgeburg, since the first of the year, the other two being the Silk Voile Manufacturing Co., and the Dominion Rotogravure. The first company now has a force of sixty working at its Courtright street branch, while the second is installing its machinery in the Jarvis Street Building it has leased.

Further strength in changes of Canadian exchange on February 16th makes the Canadian dollar worth $96.43 cents, the highest price for over two years. One year Canadian dollars were selling in New York for 12% discount. While strength in Sterling exchange is thought to have been primarily responsible for this increase in the value of Canadian money, financial authorities attribute the steady recovery of the Canadian dollar mainly to the excellent trade conditions of the Dominion. Expansion in Canada's trade, while exports from the United States through the Dominion have been declining sharply, seems to be the best explanation for the improvement in Canadian currency in the New York money market.



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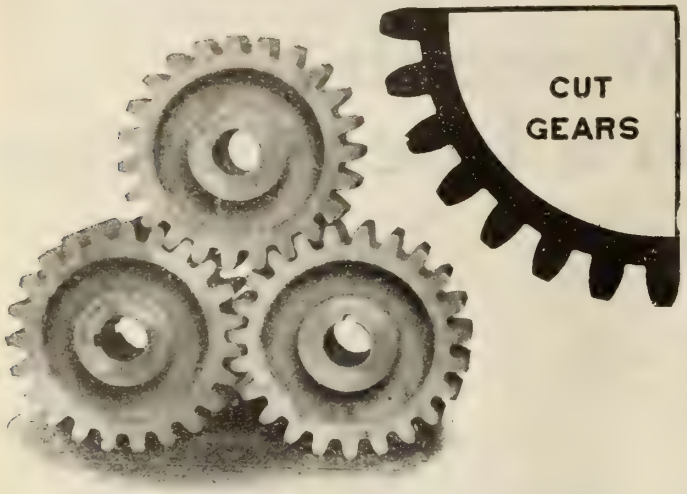
In February 16 issue appeared an article entitled "Producing Work at High Speed." We should have mentioned that we were indebted to the Gisholt Machine Co., Madison, Wis., but unfortunately this was omitted.

The activity displayed by the Quebec Provincial Government in the building of iron bridges has greatly contributed to the solution of the problem of labor in the provinces, says the report of the Department of public works and labor. The Batiscan Bridge, which completes the Montreal-Quebec highway, was regularly opened for traffic on the first of November last. This bridge is not only solid, but it is remarkable from the standpoint of civil engineering owing to the difficulties met with while it was being built. It is 1,219 feet long with an open roadway of 18 feet of re-inforced concrete and a movable span for the purposes of admitting ships.

At least one hundred more men will be taken on in the beaverboard plant at Thorold as a result of a decision of the company to transfer all their orders for beaverboard, which ordinarily would be cared for by their New York mills, to the mill at Thorold. The mill will be speeded up to full capacity as soon as possible to care for the additional orders. Manager superintendent Robertson stated that it was the intention of the company to manufacture all their beaverboard in Thorold hereafter. The business now diverted by reason of the shut down of the New York plant would not be returned to that unit when repairs were completed unless demand for beaverboard so increased that Canadian mills could not take care of it.

Possibilities are said to be strong for the sale by the city of Port Arthur, of a block of Hydro Power in the neighborhood of 5,000 H. P. to the Palatine Corp. for use in the block service which they have acquired from the Port Arthur harbor front. Considerable renovation to the old plant has been done by the Hancock Construction Co. of Fort William, and it is stated that the general repair of smelting machinery will be carried on early in the Spring. It is stated of the condition of the plant that it could be put in readiness for operation in less than three months. At the present time the plant is equipped with a steam power plant but it is said that this will be augmented in a considerable degree by electric power. Electricity will in all likelihood be used for the furnaces and in this connection an expert engineer of the company's staff, is at present making an inspection of smelting plants equipped with electric furnaces in Sweden

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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

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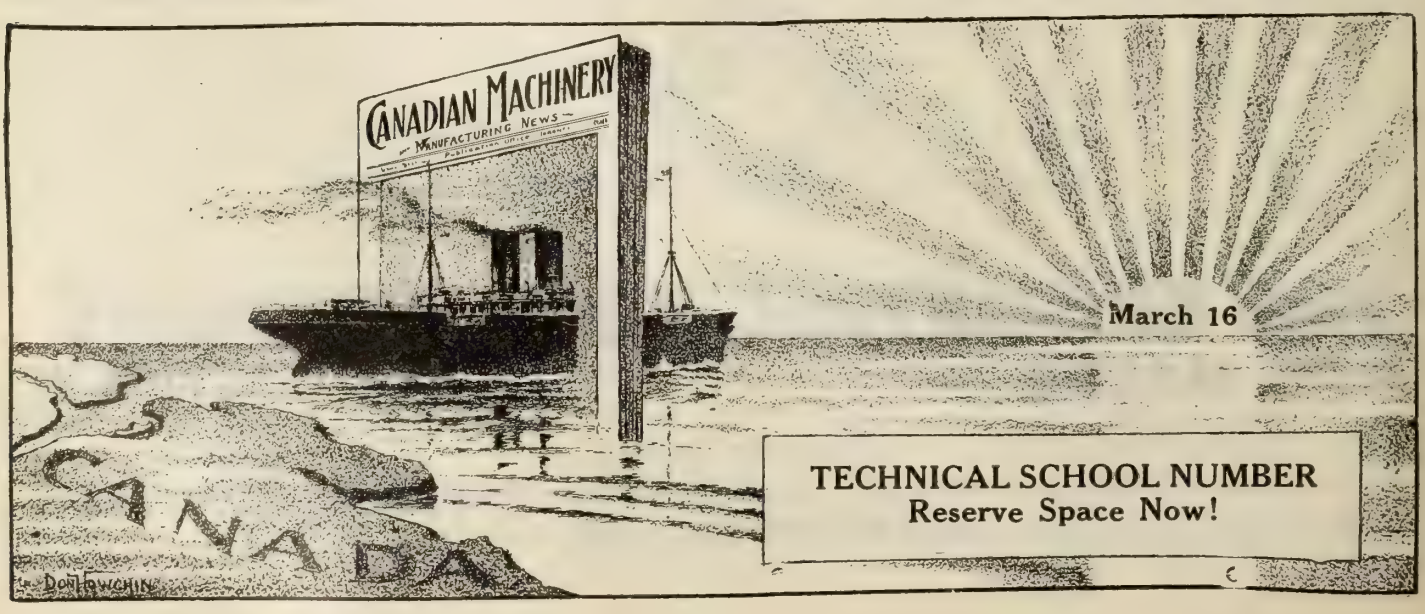
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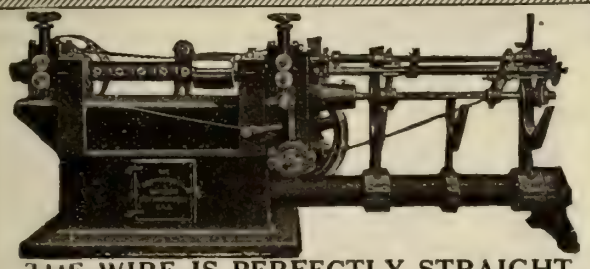


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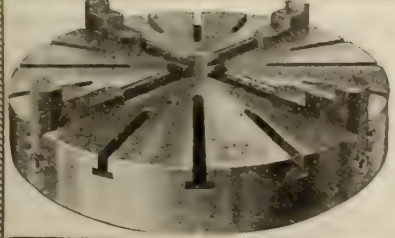
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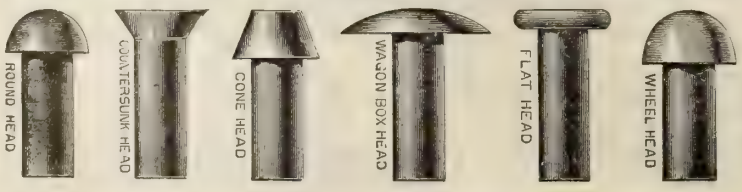
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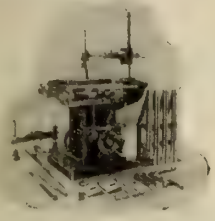
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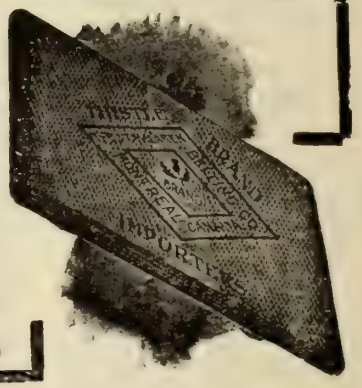


Have You Seen Page 46?

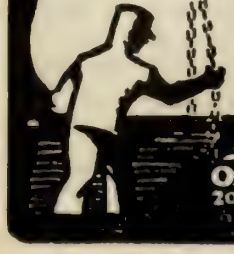
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Oakey & Sons, Ltd., John, London, S.E. Eng.

Acetylene, Dissolved
National Electro Products Co., Ltd., Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Attachments, Tapping
William I. Procunier, Chicago, Ill.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.

Babbitt Metal
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Fittings, Ltd., Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd, Montreal, Que.

Belting, Fabric
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Ltd., Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach. Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que

Castings, Grey Iron
Fittings Ltd., Oshawa, Ont.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont
Dominion Engineering Works, Limited Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que
Rattle Foundry Co., Galt, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks,
Chicago Watchman's Clock Co., Chicago, Ill.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Can. Mathews Gravity Carrier Co., Port Hope, Ont.
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electric Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que. Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machines, Bench
Burke Machine Tool Co., Conneau Ohio.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Perfect Machine Co., Ltd., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drill Press Sleeves.
Preston & Schwartz, Galt, Ont

BUYERS' DIRECTORY

Drills, Center

Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont

Drills, Combination Centre.

Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist

Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet

Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat

Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings

Steel Co of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment

Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments

Bristol Co., Waterbury, Conn.

Electrical Supplies

Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U S Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices

Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)

Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors

Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety

Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan

Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical

Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube

Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric

Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust

Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating

Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre

Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps

Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines

Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)

Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes

Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe

International Malleable Iron Co., Guelph Ont.
Fittings Ltd., Oshawa, Ont.

Flexible Shafts

Aikenhead Hardware Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Forging Machinery

Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop

Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer

British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment

Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies

Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid

Can. Steel Foundries, Montreal, Que.

Furnaces, Electric

Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal

Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas

Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City

Furnaces, Lapwelded.

Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing

Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric

Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording

Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard

Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing

Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed

L'Air Liquide Society, Toronto, Ont

Gas, Compressed

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets

Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure

Taylor Instrument Co., Toronto, Ont.

Gear Blanks

Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited. Montreal, Que.

Gear Counters

Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines

Bertram & Son Co., Ltd, The John. Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiten Machine Co., D. E., New London, Conn.

Gear Testing Machines

Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast

Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut

Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited Montreal, Que.

Gears, Dressed

Kennedy & Sons, Wm., Owen Sound, Ont

Gears, Forged

Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone

Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)

Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain

Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal Quebec

Gears, Worm

Dom. Steel Products Co., Brantford, Ont
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene

L'Air Liquide Society, Toronto, Ont.

Generators, Electric

Northern Electric Co., Montreal, Que

Gloves, Protective

Industrial Glove Co., Toronto, Ont.

Goggles, Safety

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets

Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers

Mathews Gravity Carrier Co.; Port Hope, Ont.

Grease Cups, Pressed Steel and Brass

Can. Winkley Co., Ltd, Windsor, Ont

Greases, Lubricating

Canadian SKF Co., Toronto, Ont

Grinding Machines

Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt

Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench

Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Center

U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical

Pratt & Whitney Co., of Canada, Ltd., Dundas Ont.
Norton Co., of Canada, Ltd., Hamilton

Grinding Machines, Die

National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc

Ford-Smith Machine Co., Hamilton, On.

Grinding Machines, Drill

Bellevue Industrial Furnace Co Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont

Grinding Machines, Electric

Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face

Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool

Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie Ltd., H. W., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.

Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable

Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel

Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging

Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post

Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal

Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.

Grinding Wheels

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel

Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery

Steinle Turret Machine Co., Madison, Wis

Hack Saws, Power

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping

Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop

Bertram & Son Co., Ltd., The John. Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Alkenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, rower
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Lisbon Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Alkenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal, Q.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison. Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Prybil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelofson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Ill.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Alkenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal
Northern Electric Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa.

BUYERS' DIRECTORY

Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shi
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Teol Co., Toronto, Ont.

Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited. Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rochester Co., F. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Screens
Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Alkenhead Hardware Ltd., Toronto, Ont
Bristol Co., Waterbury, Conn.

Tanks and Pumps
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwartz, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis

Tyres.
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Supplies
Carter Welding Co Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Wheels, Industrial
American Pulley Co., Philadelphia, Pa
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wiping Cloths
The Levi's, Toronto, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Schuster Co., F. B., New Haven, Conn
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

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H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

WOODWORKING MACHINERY

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Garlock Machinery Ltd., Toronto.

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A. R. Williams Machinery Co., Toronto, Ont.

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WEST PENN. BY-PRODUCTS CO.

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CONNELLSVILLE, PA.

BRITISH-AMERICAN FUEL & METALS LIMITED
McKINNON BUILDING TEL. MAIN 7815 TORONTO

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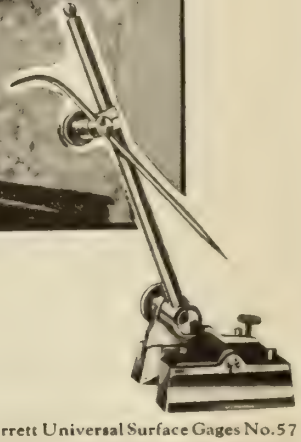


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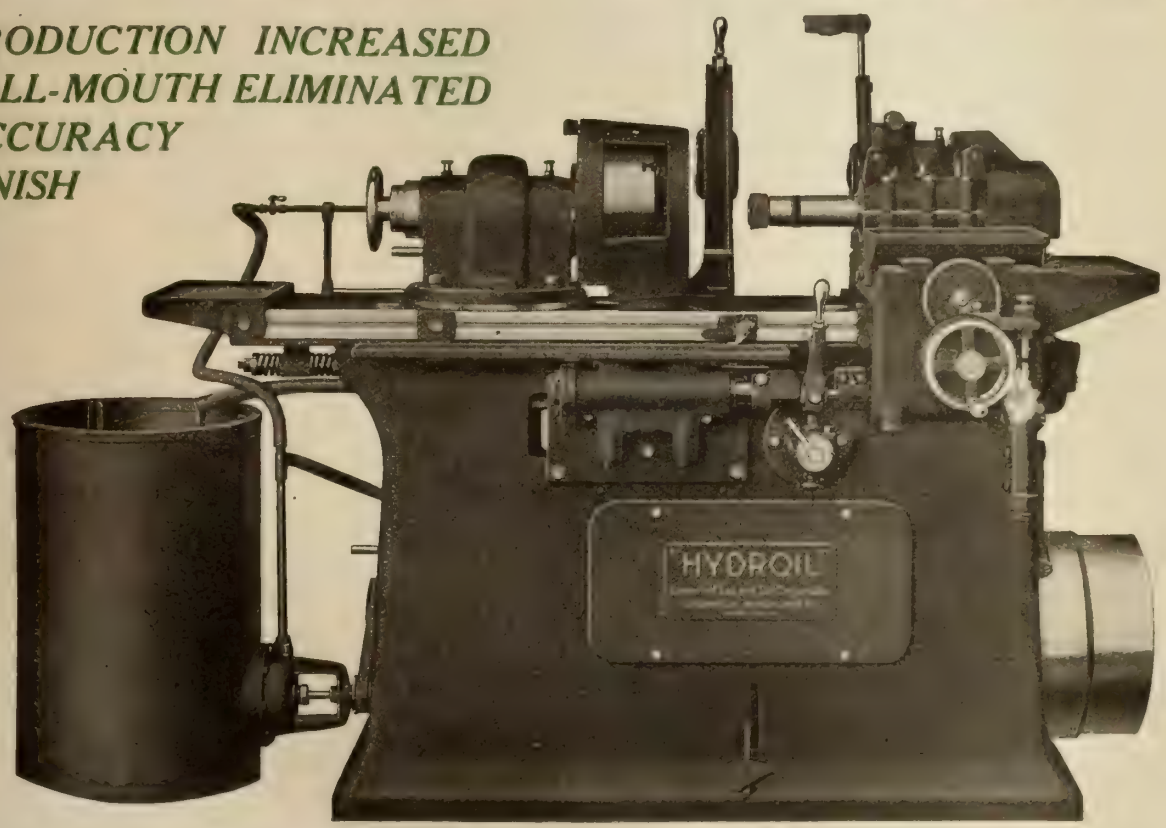
CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVII. No. 9 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | March 2, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

"HYDROIL" INTERNAL GRINDER

PRODUCTION INCREASED
BELL-MOUTH ELIMINATED
ACCURACY
FINISH



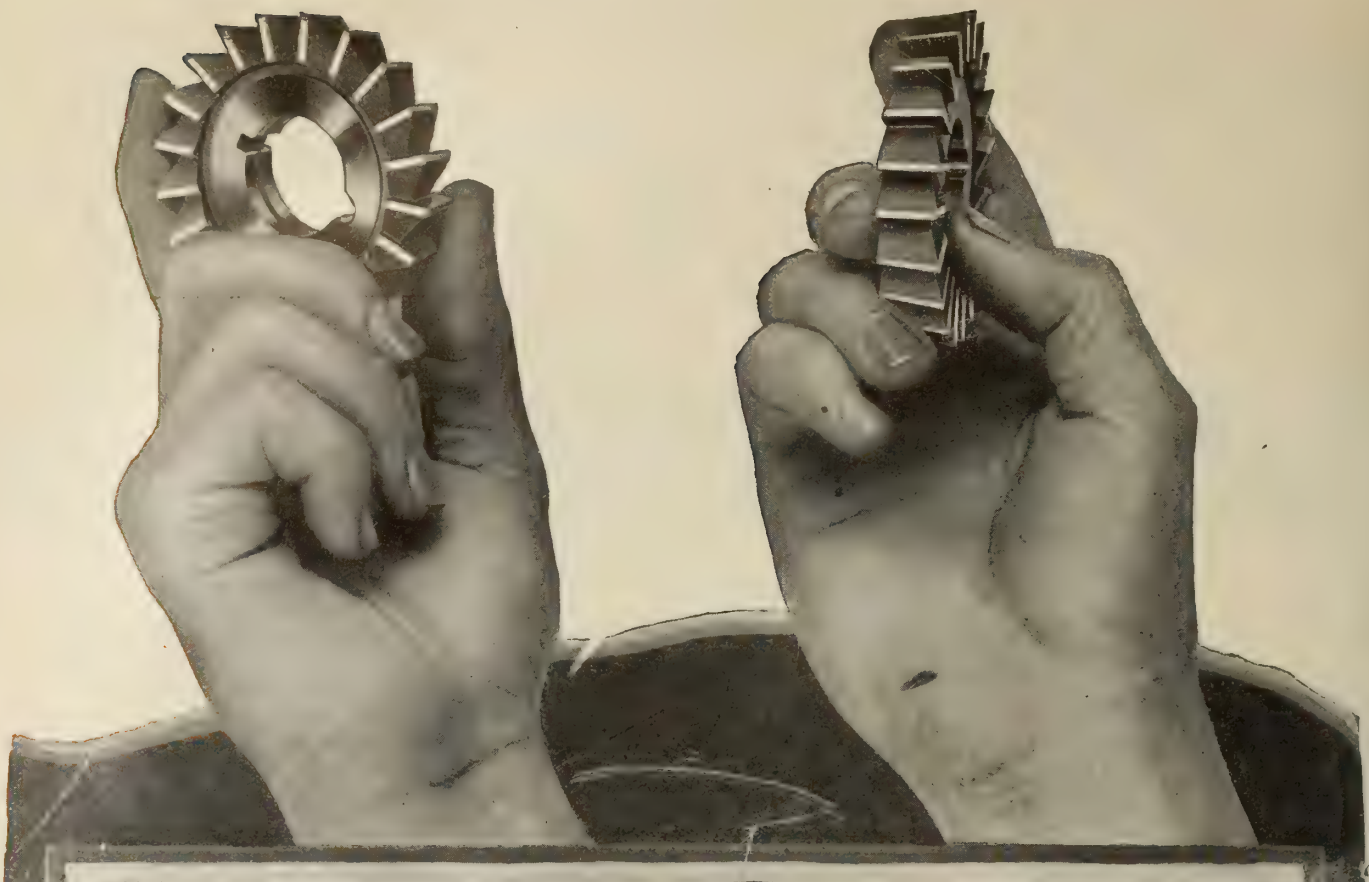
"Hydroil" Grinders have opened up an entirely new era for the grinding of internal surfaces thru high table speeds up to 30 odd feet a minute, or on short strokes (1-2 inch) reversed 300 times a minute without shock or hand operation, permitting the use of the full face of wheels varying from 3-4 to 2 inches, determined by application.

"Hydroil" Grinders will remove one cubic inch of hardened steel a minute with an average wheel wear of 17th of the material removed in roughing operations.

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GREENFIELD TAP AND DIE CORPORATION
OF CANADA, LIMITED GALT, ONTARIO



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They're designed for free, fast cutting. And tempered and seasoned to last longer.

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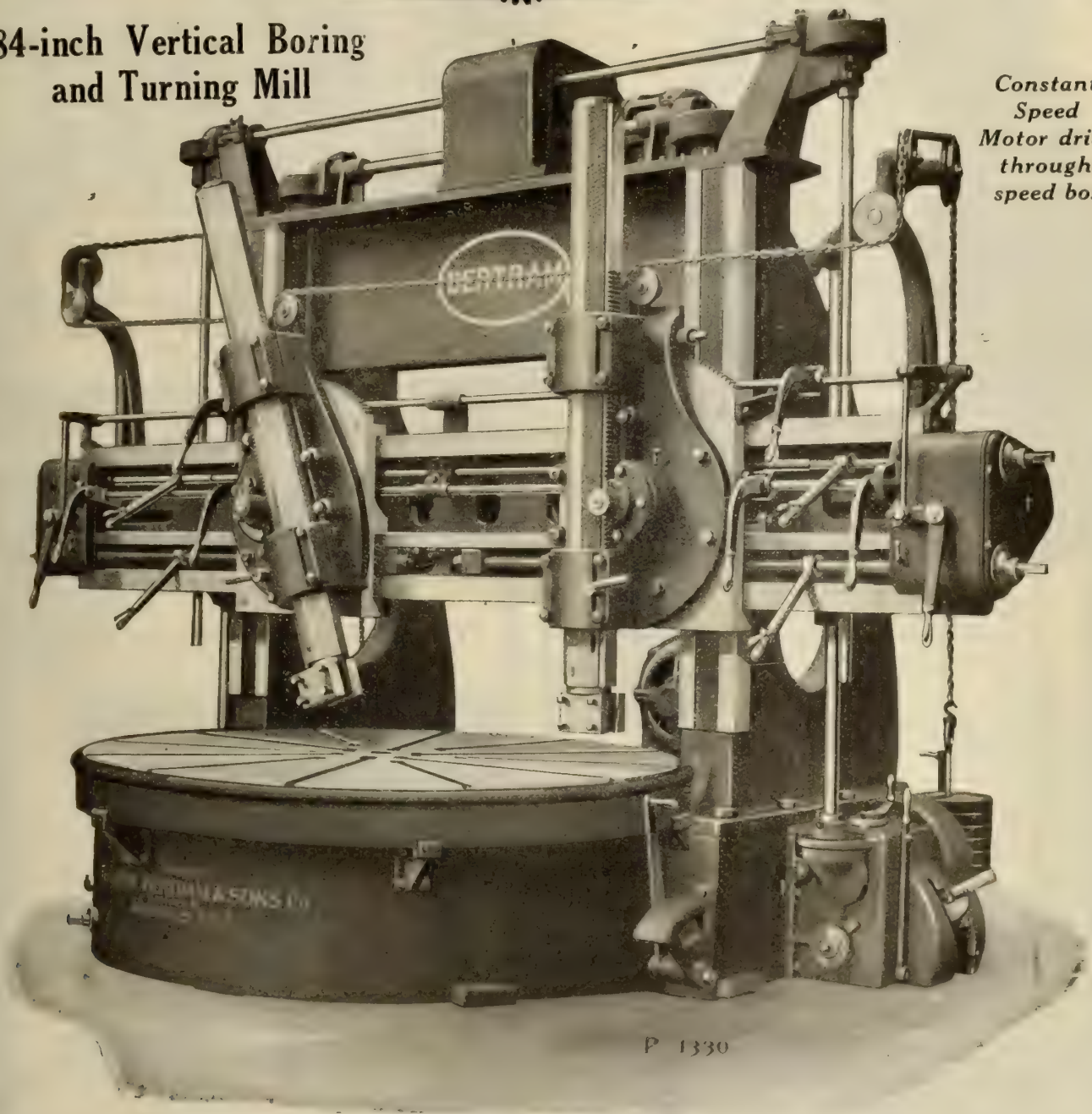
VANCOUVER
B. C. Equipment Co.

The BERTRAM Page

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Constant Speed Motor drive through speed box



P 1330

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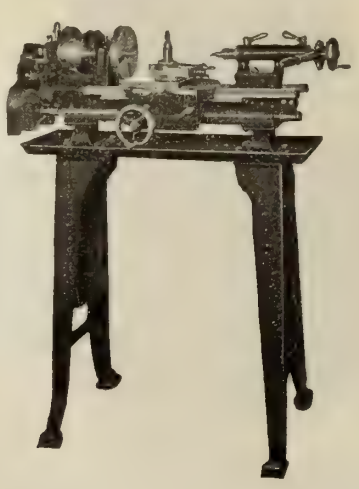
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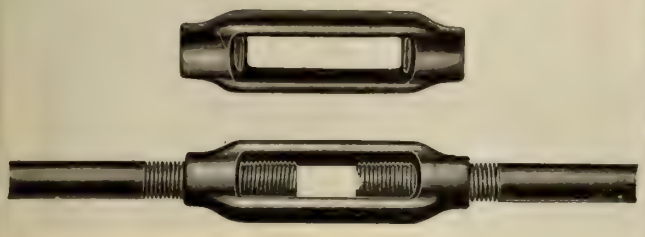
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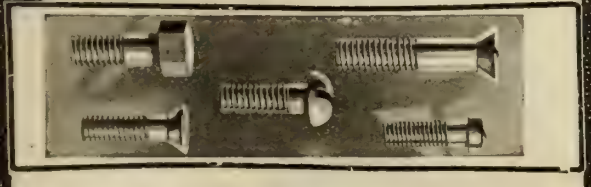
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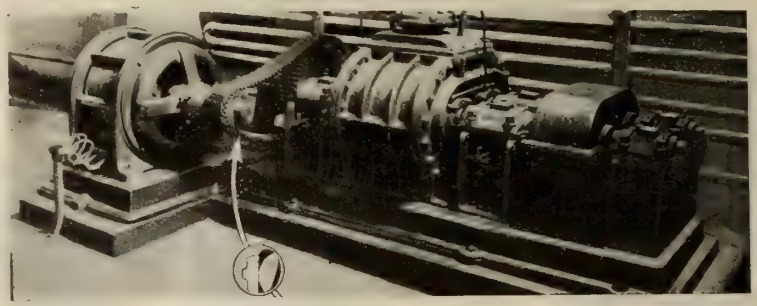
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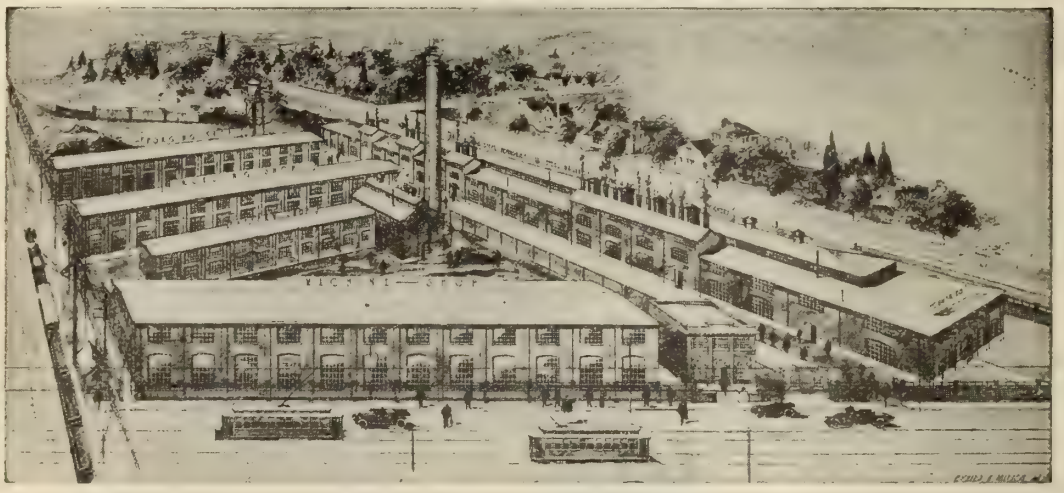


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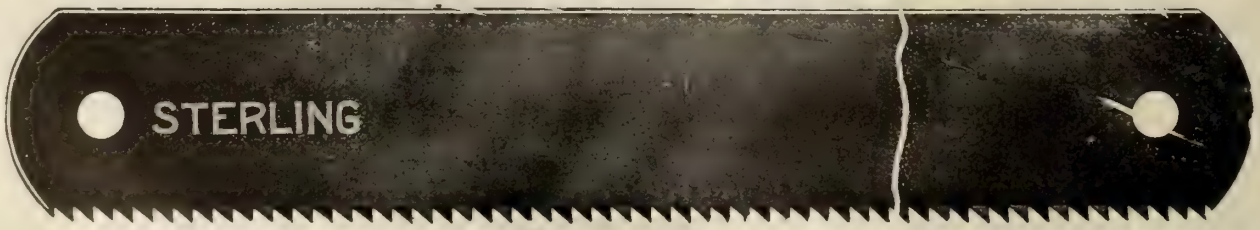


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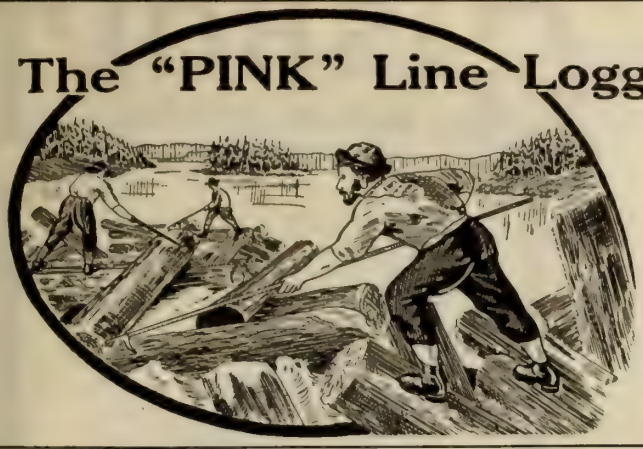
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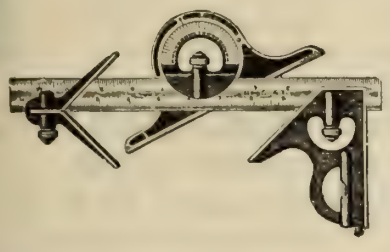
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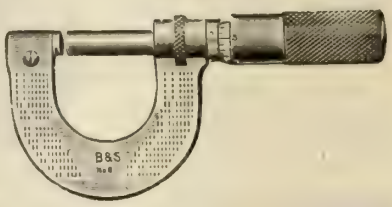
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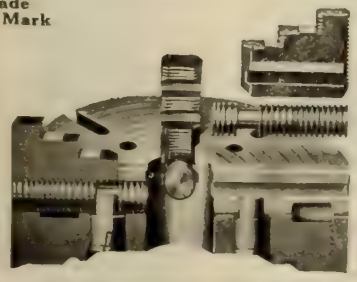
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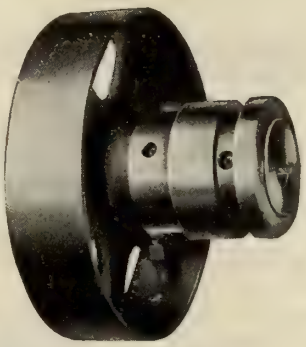
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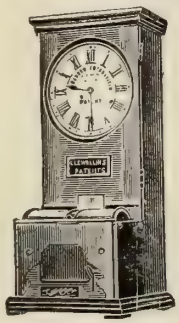
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For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING and DRILLING MACHINES
CYLINDER GRINDERS
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO
1207 E. Washington Avenue
Madison, Wisconsin, U. S. A.

Time Checking Machines, Time Recorders, Watchman's Watches, Recorders for all purposes



Watches check the rounds of watchmen ensuring less risk from fire etc. with a consequent reduction in insurance premiums

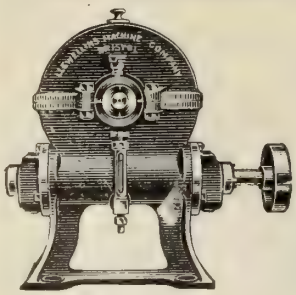
018 Class, Patent Card Recorder



Watchman's Watch

GEARS Machine Cut Machine Moulded

Sizes and Descriptions



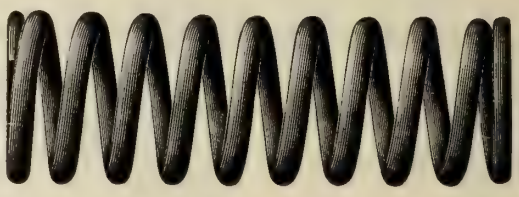
Totally enclosed Worm Reduction Gear.

Specialists in High-Speed-Reducing and Accelerating Gears.



D.H. Stag Tooth Wheel & Pinion

Llewellin Machine Co., Bristol, Eng.



Springs

CARBON OR VANADIUM STEEL, BRASS OR BRONZE

Round, Square, Flat, Extension, Compression, Torsion and a multitude of other shapes. Heat treated the **Raymond** way for accuracy and durability.



RAYMOND SPRINGS give dependable service. Write for catalogue and engineering advice.

Raymond Mfg. Co., Ltd.
Corry, Pa., U.S.A.



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Articulated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

Transportation Building, Montreal



A Short Cut to Production

With the

"PROCUNIER"

SAFETY TAPPING ATTACHMENT

Tapping ½" open hearth steel couplings for a magnet drive with a 5/16" - 18" thread isn't exactly child's play, yet this sturdy youngster doesn't let it worry him any.

There are 16 holes in each piece and like all work of this class it must be accurate. With the "PROCUNIER" Safety Tapping Attachment, the boy shoves the work right along—one completed piece every 80 seconds, 720 holes per hour.

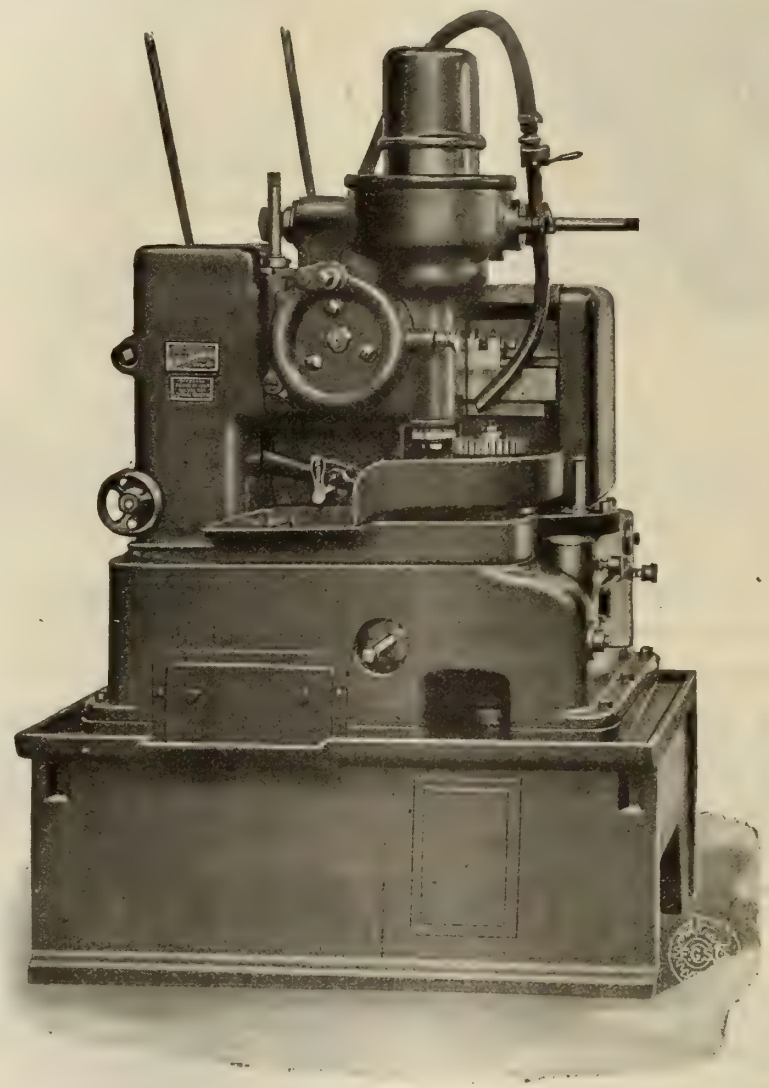


The "PROCUNIER" Safety Tapping Attachment reverses at twice its forward speed. Equipped with Safety Friction and balanced reversing mechanism that eliminates all torsion. Cut your costs with our Tapping Attachments, Safety Tapping Chucks and Tap Holders, which are all equipped with a patented "DOUBLE-JAW" Chuck. Ask for facts and figures.

WILLIAM L. PROCUNIER, 18 South Clinton Street, Chicago, Ill.

Ontario Distributor: **H. A. HARRISON, 220 King Street West, Toronto, Ontario**

CUT GEAR COSTS
WITH THE
New Production Gear Shaper



The new production Gear Shaper, illustrated, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result, and still one of the outstanding features of the Gear Shaper principle—accuracy—has been maintained.
It is designed to cut one gear at a time and at a speed which eclipses all other methods.
All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for 10 machines.
It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.
See illustrated article in all technical magazines.
Send for our booklet, "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now.

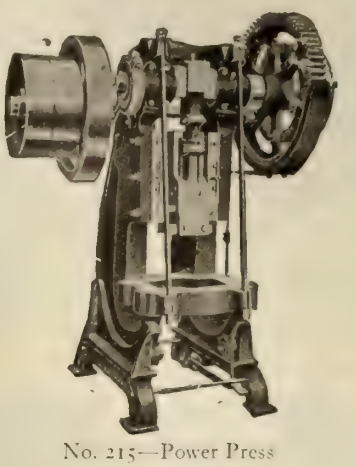
THE FELLOWS GEAR SHAPER COMPANY,
SPRINGFIELD, VERMONT, U.S.A.

Foreign Agents:—Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India) Ltd., Head Office, Calcutta, India.

BROWN-BOGGS

B B

Not Sometime—
Right Now!
"B-B" Tools Mean Bigger Opportunities



No. 215—Power Press

Is it really Consistent Practice in times of retrenchment to cut down your men's wages and still retain machines and methods of practice that are out-of-date, slow and costly? If economy demands adjustments a good place to start is an investment in a machine that will cut down operating expenses.

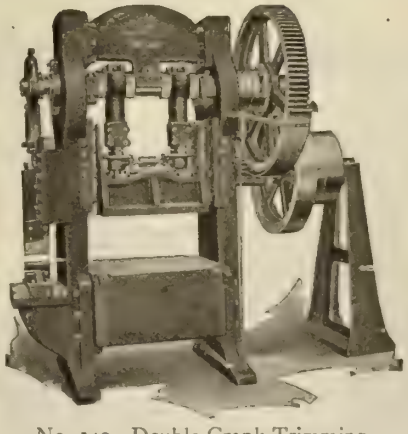
That's why we urge you at this time to investigate "B-B" Metal Working Tools.

What they will save you NOW can be approximately figured by the profits they have built up in brisker days.

Rigidly tested and guaranteed—presses, dies, shears, punches, drop hammers, and tinsmiths' tools of every description.

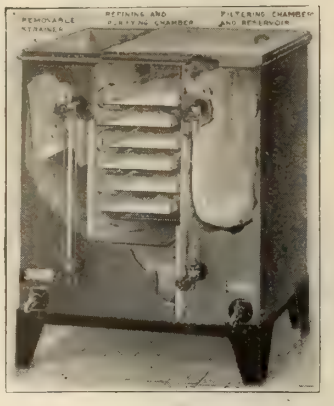
What our catalogue does not explain we will be glad to.

Easy-Running
Long Lasting
Sturdily Built
Greater Production



No. 140—Double Crank Trimming Press

THE BROWN-BOGGS CO. LIMITED
HAMILTON, CANADA.



The Life Blood of the Factory

Dirty, gritty lubricating oil will junk your machinery long before its time. *Friction is production's worst enemy,* and the wear and tear caused by dirt and grit in oil slowly but surely wears out expensive bearings and other machinery parts.

Clean oil prolongs the life of machinery. Bowser Lubricating and Filtering Systems assure clean filtered oil on all bearings and restore the oil to its original lubricating quality. Try the Bowser Perfected Process of Seepage Filtration.

Installation takes a minimum of floor space.

WRITE FOR ILLUSTRATED BOOKLET C-13

Bowser Equipment is MADE IN CANADA by

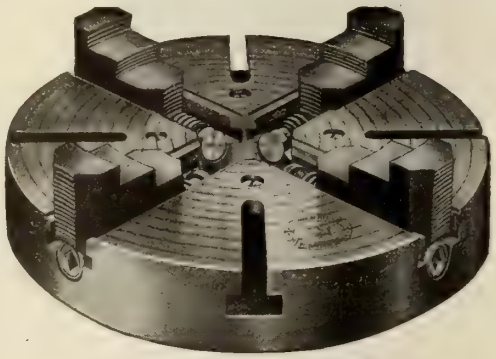
S. F. Bowser Co. Ltd., 1368 Fraser St., Toronto, Ont.

BOWSER ESTABLISHED 1885

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

Union Manufacturing Company

New Britain, Conn.

New York Office: 26 Cortlandt Street

Makers of a complete line of chucks

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some make-shift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. **Write.**

The Walton Co.

Hartford, Conn.

BOLTS

Machine Bolts Blank Bolts End Spring Bolts
Carriage Bolts Stud Bolts Cant Dog Bolts
Plow Bolts Bridge Bolts Coupling Bolts

ALSO

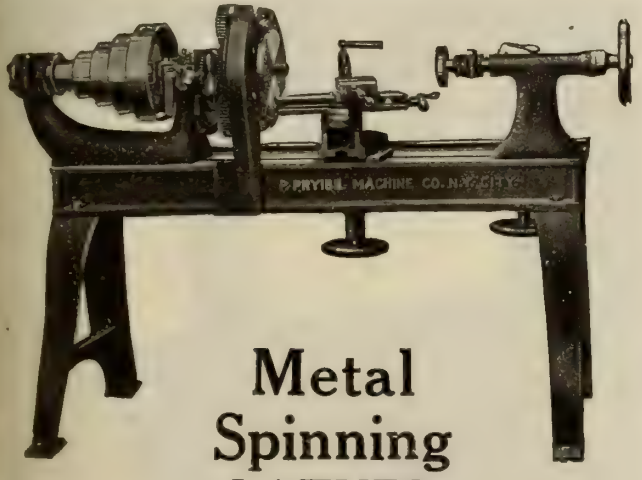
NUTS, WASHERS AND RIVETS

OF EVERY DESCRIPTION

THE STEEL COMPANY OF CANADA LIMITED

HAMILTON MONTREAL





Metal Spinning LATHES

TOOLS and ACCESSORIES

for Round and Oval work in sizes from 15 to 60 inch swing. Illustration is our 22-inch Ball Bearing Model with 6-inch Oval Chuck and Compound Rest.

Let us advise on a suitable size for your shop.

P. Pryibil Machine Company
New York City
Established 1859

Bring on Your Big Jobs!

No plant need turn down orders for lack of rugged, accurate equipment if they install

"JARDINE" Power Hammers



There's a size and type for every job, light, heavy or exacting work—all can be handled on a "Jardine" Hammer.

Take this Canadian Giant Power Hammer for instance. It is built to stand enormous shocks. Note the great strength of the anvil block. In two sizes; Nos. 25 and 50.

"Jardine" Hammers and other tools are described in catalogue No. 18. Write for a copy.

REGISTERED J TRADE MARK

A. B. JARDINE & CO., Ltd.
HESPELER, ONTARIO

5¼"

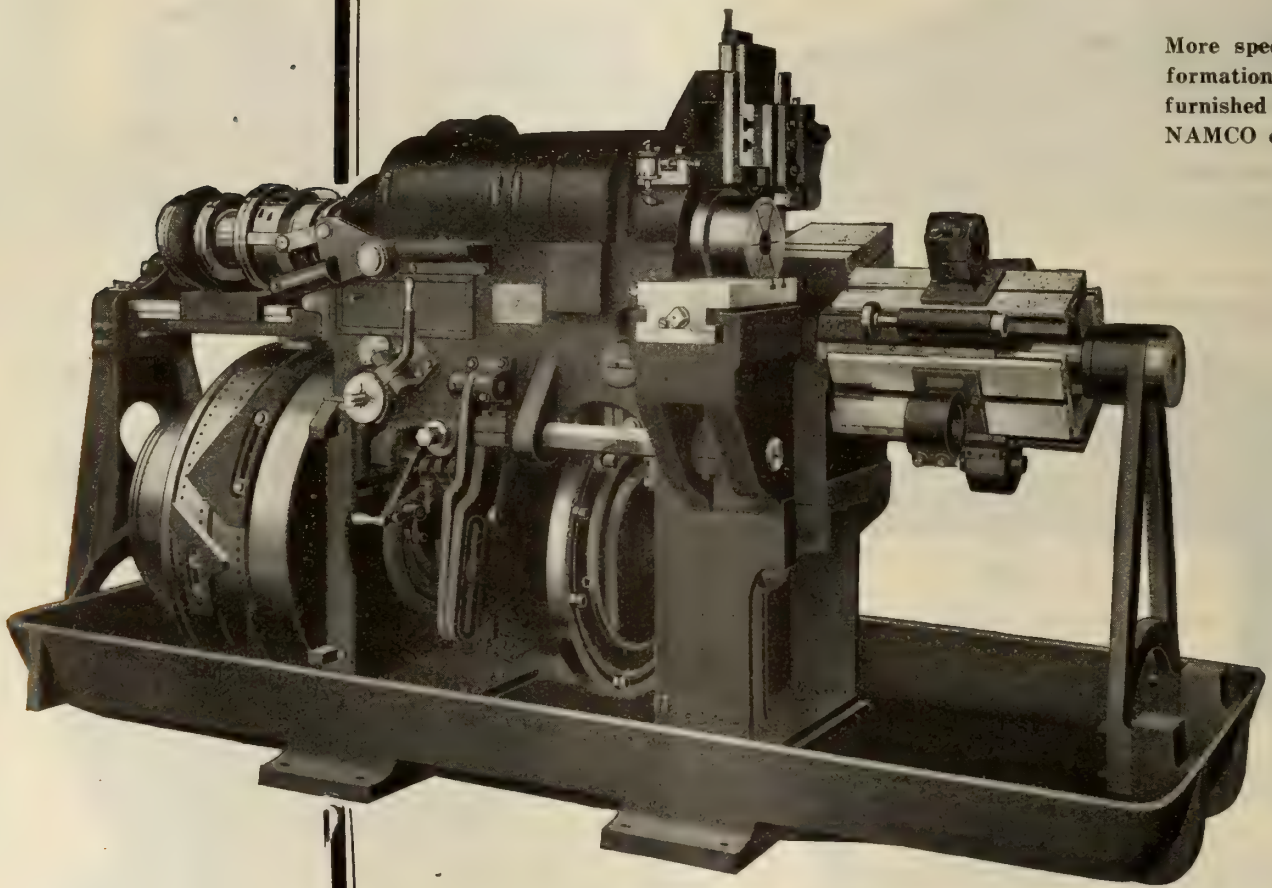
Another New GRIDLEY

Now a part of the line of GRIDLEY SINGLE SPINDLE AUTOMATIC TURRET LATHES is this completely new automatic lathe.

Built with a capacity of 5¼ in. diameter this machine not only embodies well-known GRIDLEY principles but is also constructed to meet fully all the strict requirements for automatic forming, drilling, boring and turning of such heavy bar stock.

The new features include single belt drive, mechanically positive feeding of stock, gear transmission with automatic shifts, improved cross-slides, new top slide, new indexing mechanism and spindle bearings, and full support of stock and tool slides.

More specific information gladly furnished by any NAMCO office.



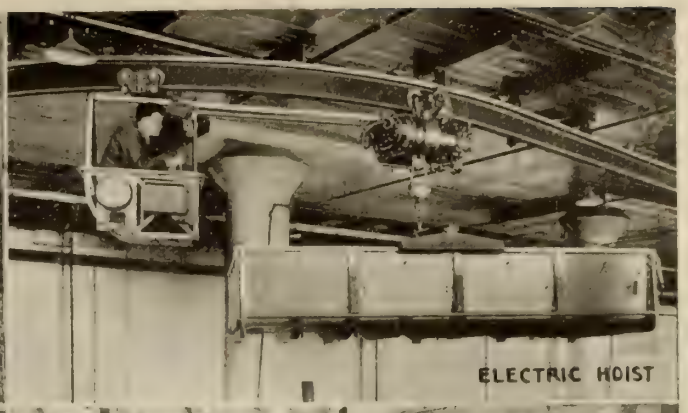
THE NATIONAL ACME CO.

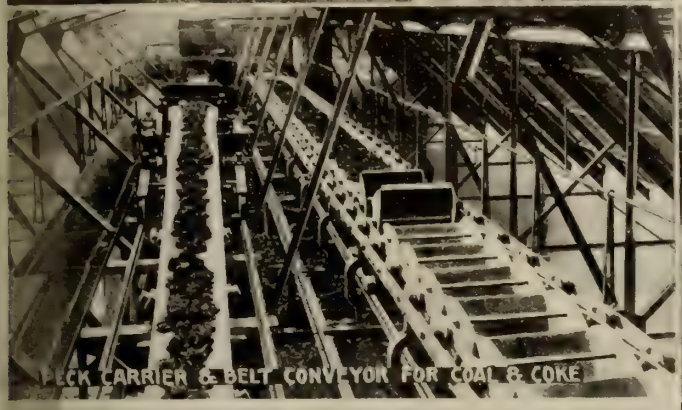
CLEVELAND - OHIO

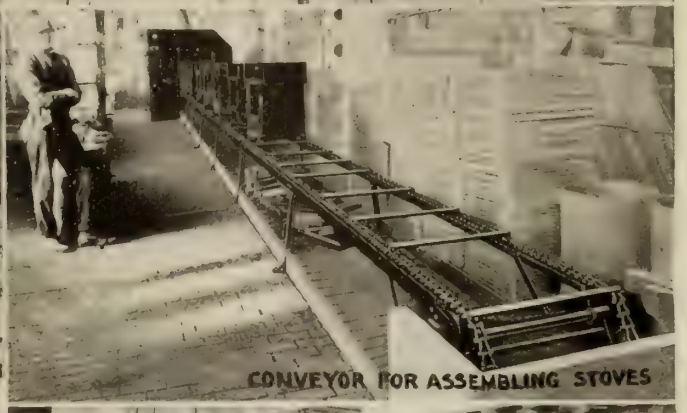
Main Offices:
Cleveland, Ohio

Branch Offices:
New York, Boston, Chicago, Buffalo, Detroit













Link-Belt Equipment for Cutting Handling Costs

THE cost of handling materials is an important factor in maintaining low production costs.

Thru many years of experience we have developed machinery that will handle raw or finished products economically, and which require little attention or labor, operating almost automatically.

The above are a few typical illustrations of Link-Belt machinery.

To find out whether there is a more economical way of handling your material, talk the matter over with our experienced engineers.

CANADIAN LINK-BELT COMPANY, LIMITED

TORONTO - Wellington & Peter Sts. Montreal - 10 St. Michael's Lane

LINK-BELT

A FEW MONEL USES

ALVES—
Seats
Rings
Guide Stems
Clappers
Wedges
Spindles
Dash Pots
Pistons

PUMPS—
Pump Liners
Runners
Valve Seats
Trim
Hand Hole Covers
Plunger Rods
Stuffing Boxes
Plungers

METERS—
Cylinders
Bushings
Valves
Valve Parts
Spindles
Screws
Gears
Wheels

GAS & OIL ENGINES—
Valves
Ignition Chambers
Ignition Tubes
Fuel Filters
Scavenger Valves

TURBINES—
Poppet Valve Parts
Blading

GAUGES—
Pins
Pivots
Diaphragms

CONVEYING APPARATUS—
Chains
Buckets
Hoppers

AIR COMPRESSORS—
Valves

BLOWER FANS—
Blading

THERMOMETERS—
Bulbs

SPECIAL APPARATUS—
Watchman Recorders
Watthour Recorders



Monel metal measures power plant efficiency

DEVICES depended upon to detect and "show up" inefficient power plant operation can do their work no better than each metal part in them.

Coal, hot flue gases, steaming boiler feed water, high pressure and superheated steam, all act to wear out the device used to measure, handle or control them.

Metals commonly used for contact parts in these devices yield to corrosion—rust out. Of the commercial metals, only Monel combines the strength of steel with the ability to stand up under the attacks of most acids and alkalies and of high heats and high speed vapor erosion. Therefore, vital parts of automatic coal-weighing scales, CO_2 Recorders, Venturi meters, flow meters, hot water meters, gauges, etc., are made of Monel.

In addition to the few uses for Monel listed above, leading designers specify Monel. Monel is now used in many places where other metals have been tried and have failed. For instance, Chapman, Crane, Jenkins, Lunkenheimer, Nelson, Pratt & Cady use Monel for valve stems, seats, rings, clappers, spindles, etc. It has a prominent place in the specifications of the largest engineering organizations in the country.

THE INTERNATIONAL NICKEL COMPANY OF CANADA, LIMITED

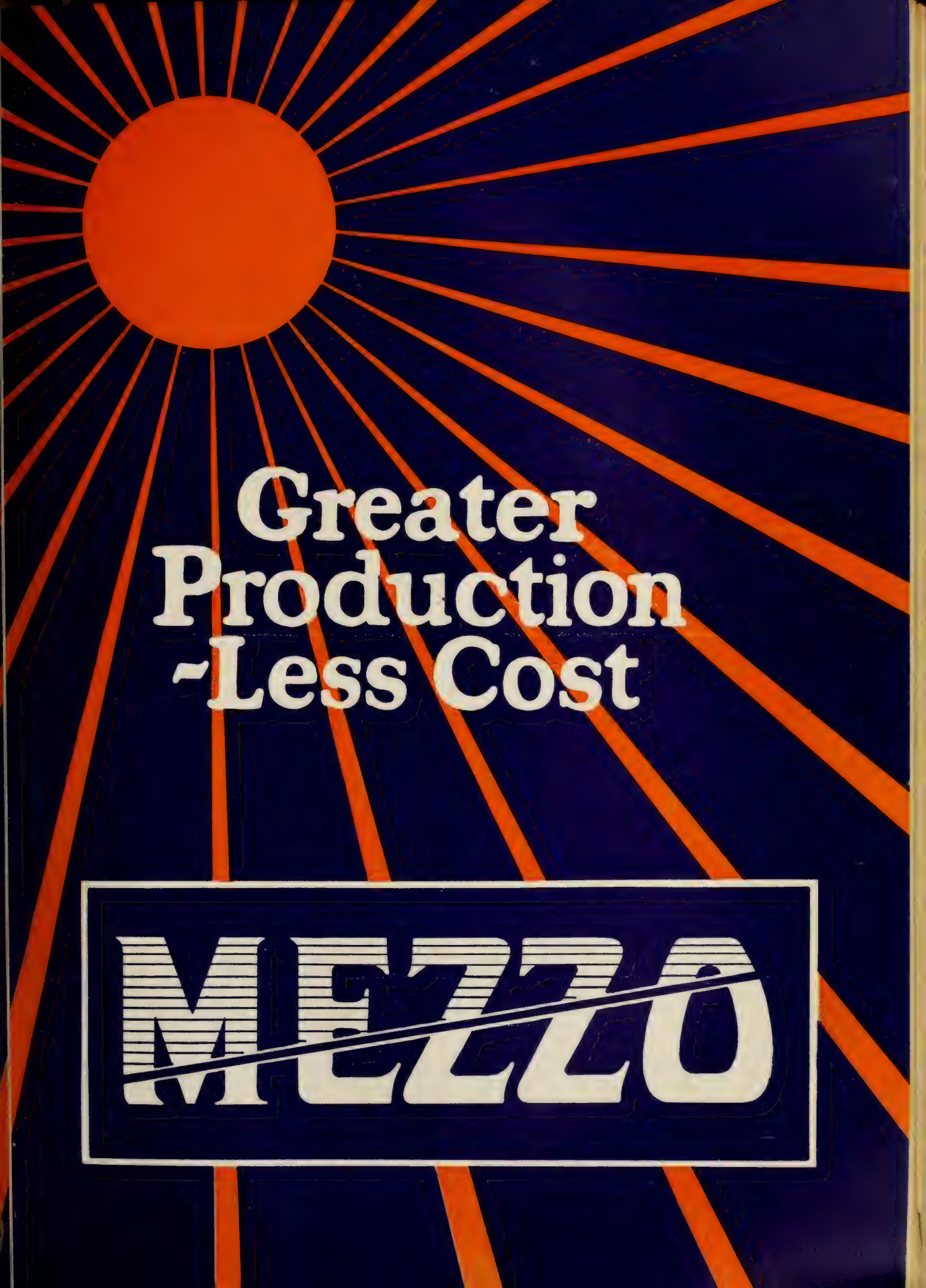
HARBOR COMMISSION BUILDING
TORONTO, ONTARIO

The name Monel identifies the natural nickel alloy—67% nickel, 28% copper and 5% other metals—produced by The International Nickel Company. Monel products include Monel blocks, Monel rods, Monel castings, Monel sheet, Monel wire, Monel strip stock, etc.

INCo Monel metal

THE INTERNATIONAL NICKEL COMPANY

INCo MONEL METAL INCo NICKEL


Greater
Production
-Less Cost
MEZZO



Greater Production ~Less Cost

The cry of the present day is Greater Production—but lower cost.

We have realized that a large number of shops are not properly equipped to obtain the most economical production from either high speed or carbon drills.

High Speed drills require great speed, and rigid machinery, factors which are lacking in a great number of plants.

Carbon Drills do not give these plants sufficient production.

To meet this demand, we have perfected a new drill.

MEZZO

We firmly believe that "MEZZO" is the greatest advance in drill manufacture in the last twenty years.

"MEZZO" performs best at speeds and feeds which would soon burn the point of a carbon drill. In fact we recommend that "MEZZO" be used at approximately double the feeds and speeds at which carbon drills under average conditions work satisfactorily. At these speeds and feeds "MEZZO'S" durability and production have astonished many of the wiser heads in the cutting tool field.

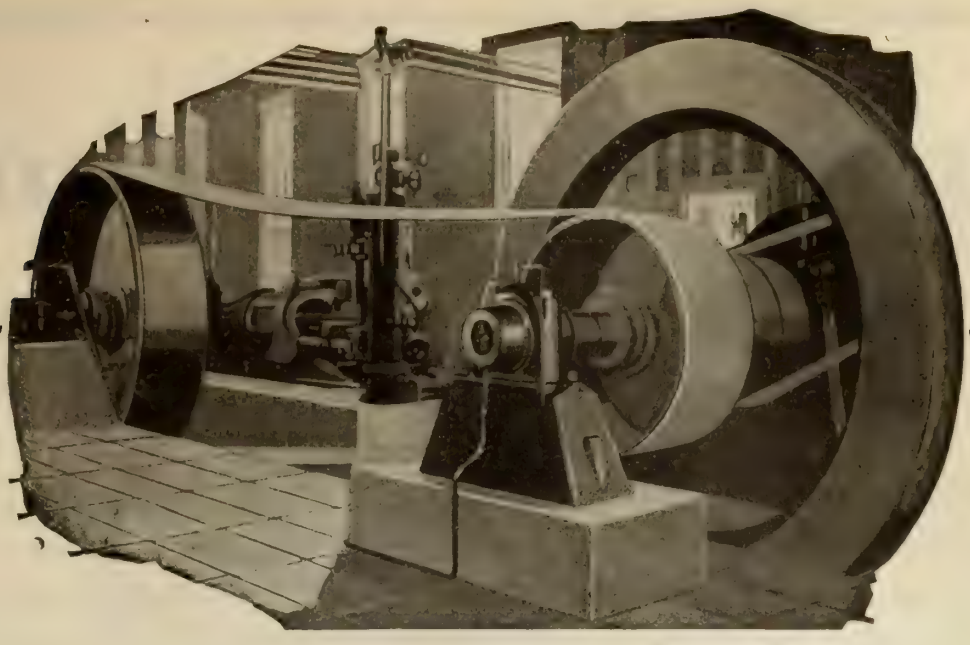
Heating the cutting edge of "MEZZO" even to a dark blue color will not draw its temper. In fact "MEZZO" works at its best efficiency this way.

And "MEZZO" is reasonably priced; gives greater production—reduces production costs.

Write for the *"Story of Mezzo."* It will tell you how you can obtain this greater production at less cost—right in your own plant.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND NEW YORK - CHICAGO - LONDON

TRADE MARK REG. IN U. S. AND FOREIGN COUNTRIES



WHAT DO YOU LOOK FOR IN A BELT?

Dependability

Dominion Friction Surface Belting assures trouble-free service. Once adjusted you simply forget it. It runs absolutely true, pulls evenly without slippage and consequent loss of valuable power. The extreme flexibility, toughness and pulley-hugging qualities guarantee perfect transmission even under varying conditions of temperature and load.

Endurance

Dominion Friction Surface Belting assures consistent operation. Made of several uniform lengths of heavily impregnated plies, all securely cemented together under extreme pressure, it is built for sincere service—and gives it.

Cost

Dominion Friction Surface Belting is by far the most economical, even in purchase price. Many plants throughout Canada have demonstrated to their satisfaction the many distinct money-saving and power-conserving features of Dominion Friction Surface Belting.

Our engineers are at your disposal—their recommendations obligate you in no way whatever. Write our nearest service branch about your belting problems.

Dominion Rubber System

Service Branches

Halifax	Ottawa	Windsor	Winnipeg	Calgary
St. John	Toronto	Kitchener	Regina	Lethbridge
Quebec	Hamilton	North Bay	Saskatoon	Vancouver
Montreal	London	Fort William	Edmonton	Victoria

Now is the Time for Repairs

Many a Factory and Mill can confidently look forward to an early date when their plant will be running full time. Every factory should be gone over and needed repairs to BELTING attended to now. It would be disastrous to stop at a rush time and it would be foolish to run the risk of a hold-up through neglect.

Look Over the Belting

To make sure your wheels will never stop turning through the breakdown of Belts, equip every machine with

"P. M. S" Belting

GUTTA PERCHA & RUBBER, LIMITED
TRADE P.M.S MARK
TORONTO, CANADA

Manufactured exclusively by

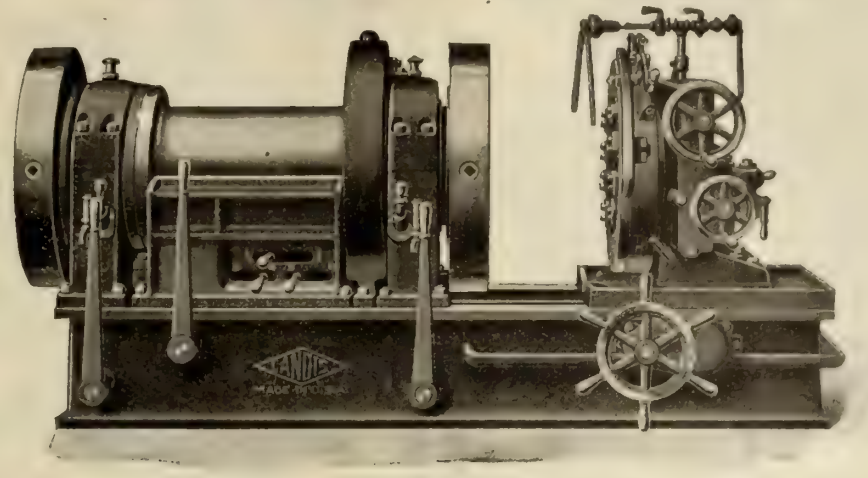
Gutta Percha & Rubber, Limited

Head Offices and Factory: Toronto

ANNOUNCING

The New Landis 12" Pipe Threading and Cutting Machine

WITH QUICK POWER TRAVERSE



Insistent demand by pipe machine users who know, has brought forth this new member to the well known family of Landis Pipe Threading and Cutting Machines—a demand for a machine rigid and powerful enough to afford the proper support for the high speed Landis Die Head and Chasers.

This new Landis embodies the latest in machine tool design and makes enviable progress in the threading and cutting of pipe and oil well casing efficiently and economically. Some of the most important points are:

1. Power traverse for carriage.
2. Double lever friction clutch for starting and stopping machine.
3. Reversing feature for flange work.
4. Reaming tool locked, eliminating human effort when reaming.
5. Single pulley drive and eight (8) rotative speeds for pipe.
6. Gear box is in one unit and is mounted on ways of machine under main spindle.
7. Quick convertible feature for motor drive.
8. All gears in gear box run in oil bath. Spindle bearings are lubricated by flat link chain running in oil.
9. Weight 13,000 pounds.
10. Landis Die Heads and Chasers employed.

May we send you leaflet giving details?

LANDIS MACHINE COMPANY

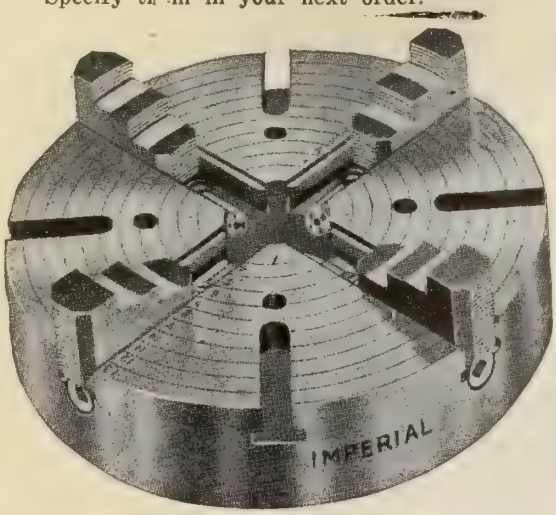
Waynesboro, Penn., U.S.A.

LANDIS

IMPERIAL LATHE CHUCKS

Highly Endorsed by Canada's Best Manufacturers

Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere. Specify them in your next order.

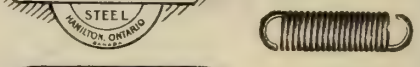


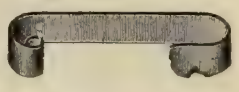
Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED

SPRINGS

THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO







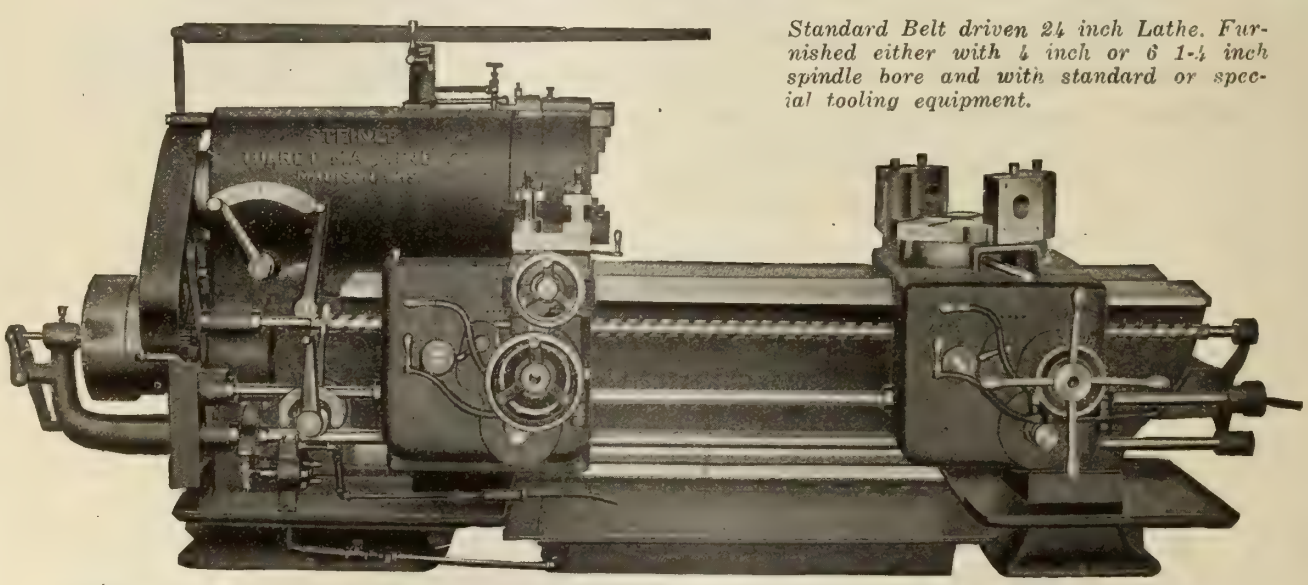


Quality

of product is our aim. Customers' specifications carefully followed. Tempered wire shapes and forms of varied description; springs for manufacturers of machinery, engines, motors, electrical devices, and springs for all mechanical devices, are amongst our regular output.

The Wallace Barnes Co.
Limited
Main St. W., Hamilton
FIFTY YEARS OF QUALITY

Standard Belt driven 24 inch Lathe. Furnished either with 4 inch or 6 1-4 inch spindle bore and with standard or special tooling equipment.



STEINLE TURRET LATHES FOR BAR OR CHUCKING WORK

Send us drawings of your work so that our Engineering Department can estimate STEINLE production, or ask to have a qualified representative call upon you to determine what work can be produced to advantage on our machines.

STEINLE TURRET MACHINE COMPANY
MADISON, WISCONSIN, U. S. A.

BURKE

Sensitive Drill Presses

—Universally Used
—Universally Liked





BURKE

More Burke Drill Presses are in use than any other. Extremely sensitive construction; interchangeability of parts; table surface ground for accuracy and spindle and quill ground to size are some of the features that appeal to all users. These machines are now selling at reduced prices. Write our nearest dealer for details.

THE BURKE MACHINE TOOL CO.
520 Sandusky St., Conneaut, Ohio, U. S. A.

Canadian Dealers:—H. W. Petrie, Ltd., National Machinery & Supply Co., A. R. Williams Machinery and Supply Co., Canadian Fairbanks-Morse Co., Williams & Wilson, Garlock-Walker Machinery Co., Yeates Machinery Co., Cope & Sons.

What Makes the Value of Babbitt Metal?



The Long Run

Buy Harris Heavy Pressure for all-round machinery work, and you get

THE LONG RUN

or

IMPERIAL GENUINE



for heavy engines and you get

THE LONG RUN

The first cost may be more, but **THE LONG RUN** makes the value, and, if combined with no trouble, the profits are accumulative. Buy your Babbitt from Life-Long Babbitt Men, and get

THE LONG RUN

Write us regarding your problems

THE CANADA METAL CO., LIMITED
TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

If You Can Use A Welding Torch You Can Make Your Own Couples

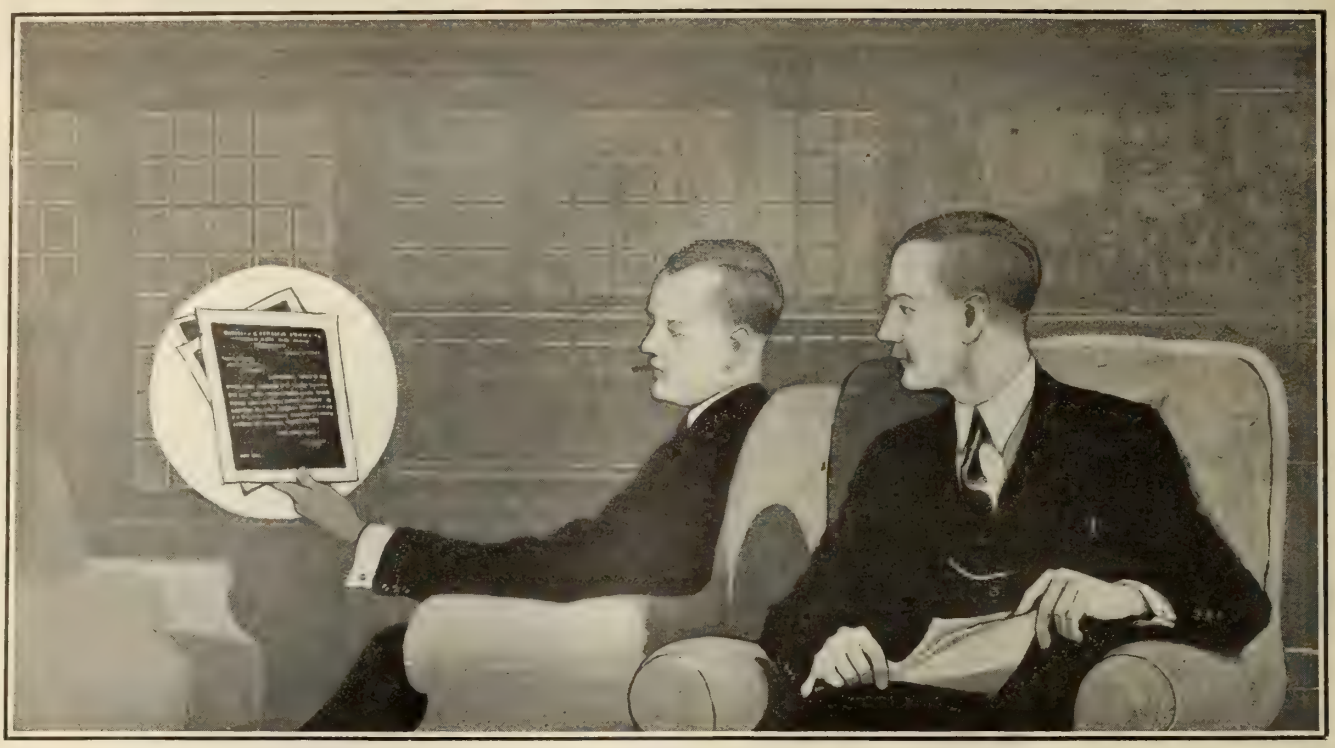


If you can weld two pieces of wire together at one end, you can make your own thermo couples for Hoskins Pyrometers. One of these wires is Chromel, while the other is Alumel. These alloys are used in the majority of pyrometer installations, not just because the man can make his own thermo couples from them, but because they have proved to be the best base metal alloys ever developed.

A pyrometer installation for which the user can make his own thermo couples without calibration is cheaper to maintain. The low first cost of Chromel couples, their long life, and their low maintenance cost makes them very economical. Their accuracy makes them absolutely reliable.

Hoskins Pyrometer and Couples are described in Catalogue 31R. Send for it today.

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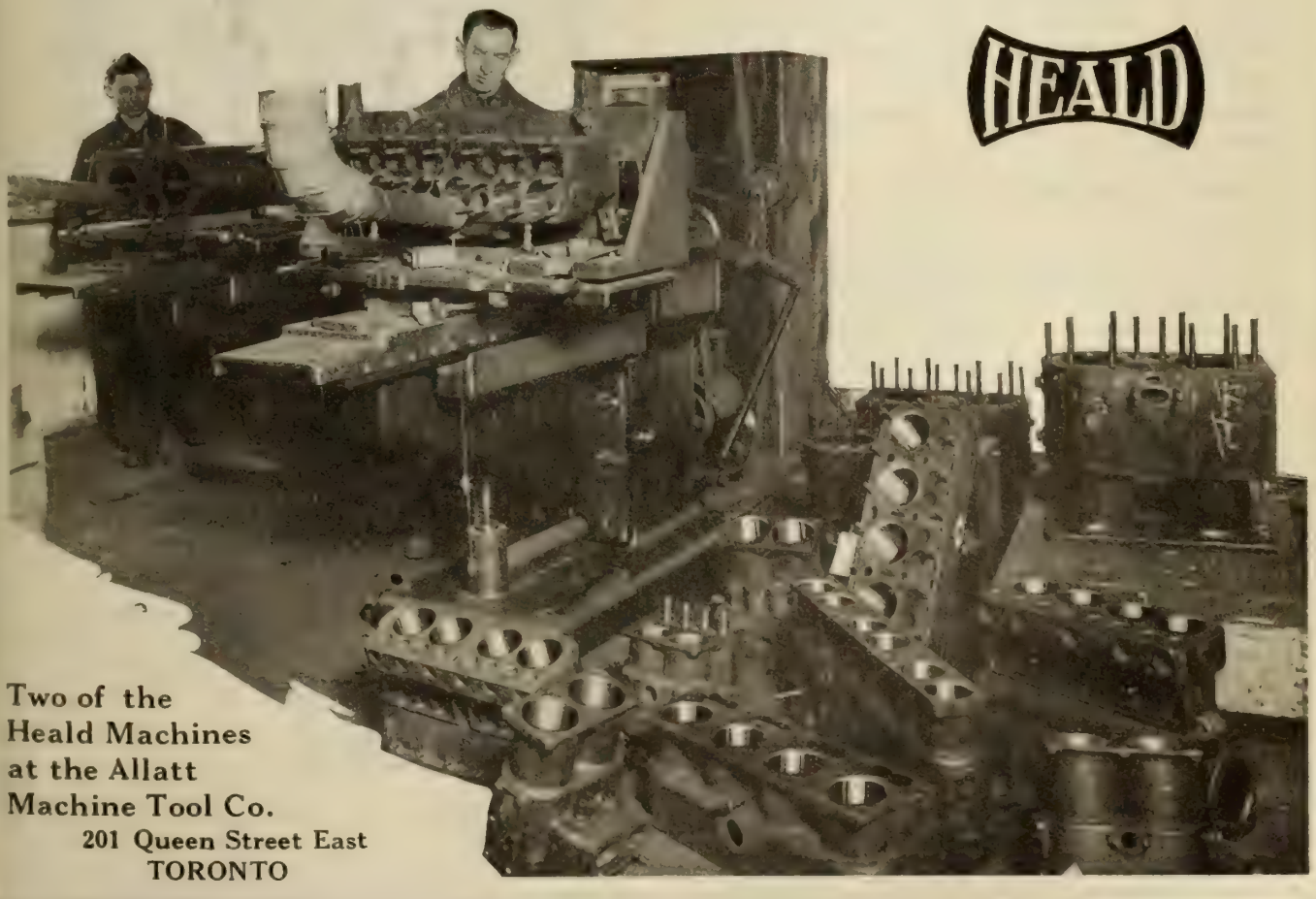
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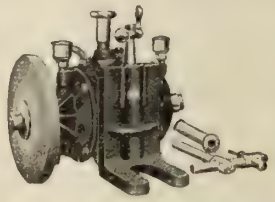
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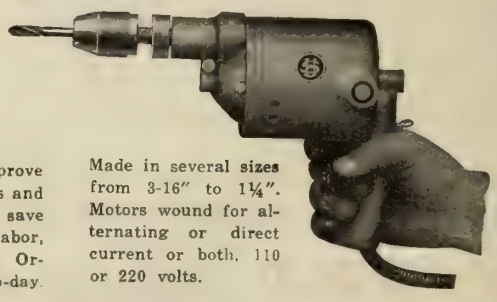
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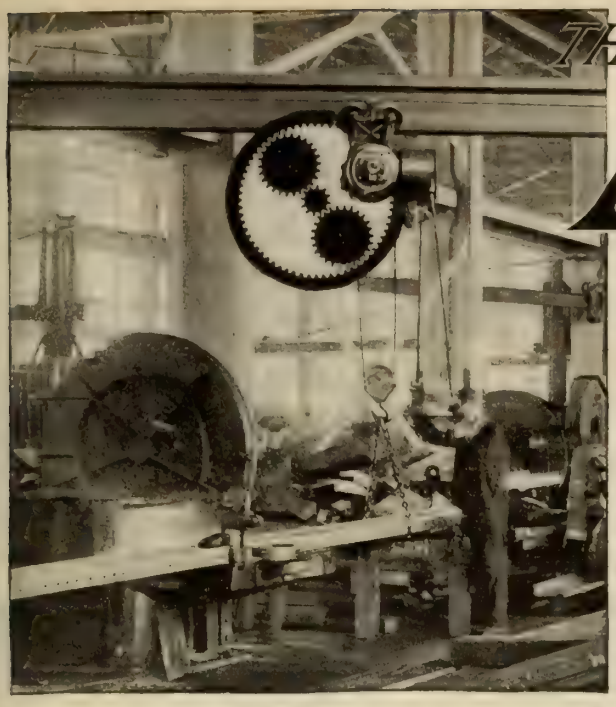


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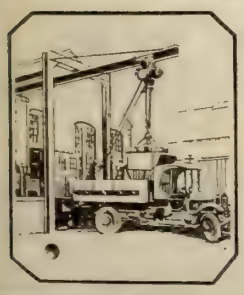
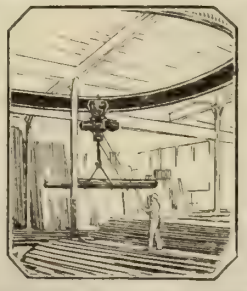
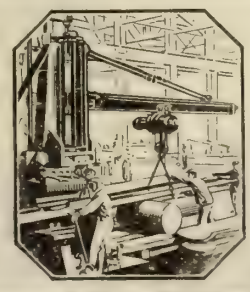
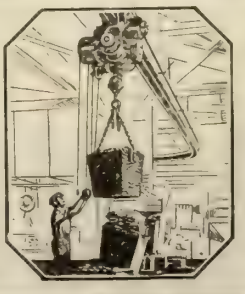
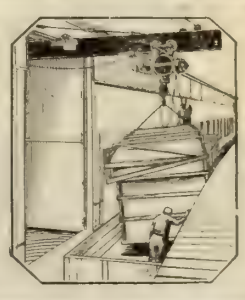
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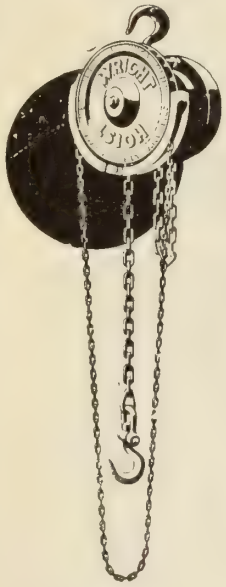
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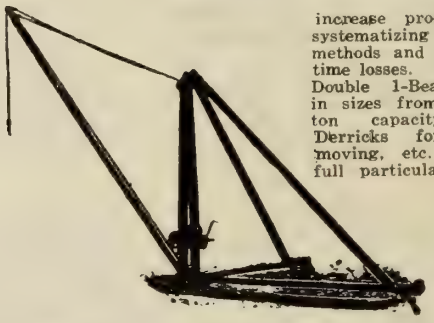
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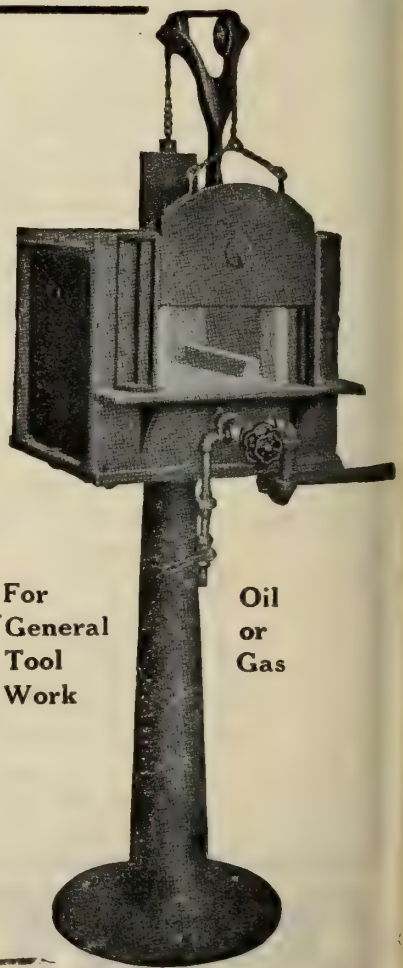
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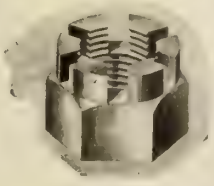
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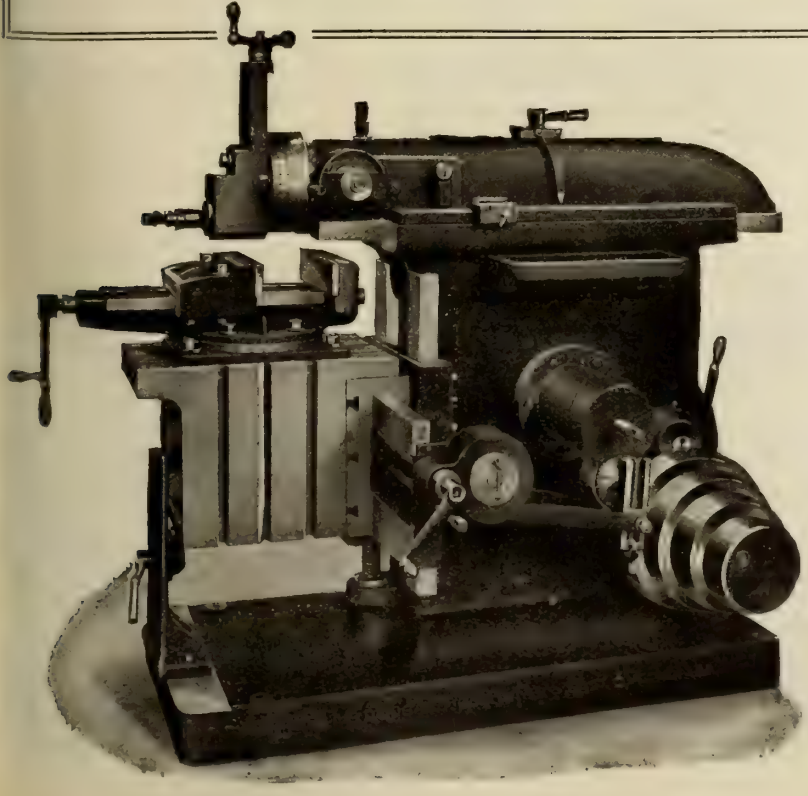
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII, No. 9 MARCH 2, 1922

Precision Instruments Will Improve Product

Passing of the Vulgar Fraction in Shop Practice—Standardization Only Possible Through Precision Tools—Measuring to a Millionth of an Inch—Application of Gauge Blocks.

By H. A. WILSON

THE USE of precision instruments in machine shops and manufacturing industries has become more or less a matter of course, with the result we find many examples of delicate measuring instruments in industry to-day. Very few people, even among those whose daily duties take them into the machine shops of our country, realize just what a tremendous part precision instruments have played in modern manufacturing methods. The present state of civilization calls for quantity production in a multitude of ways, and were it not for precision instruments, quantity production could not have been developed. Standardization has given us at a reasonable cost, a large proportion of articles we use in our daily duties and pleasures. Many of these are considered as necessities at the present time.

Measuring by Caliper

Before the advent of the micrometer, one of the commonest of precision measuring instruments, the caliper, was the one universally used in machine shops. With this tool, measurements smaller than 1/64 of an inch were rarely used. With the micrometer, the decimal system replaced the only method of using fractions. Thus, the inch was divided into a thousand parts. It was not long until micrometers were manufactured that accurately measured to within one ten thousandth part of an inch. Such instruments are now in daily use.

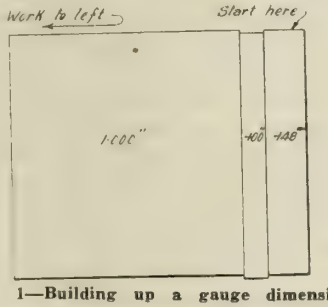


Fig. 1—Building up a gauge dimension.

Modern machine shop methods, in dealing with the shaping of metals to conform with the ideas of the designer, as expressed by blue-prints, involve a great number of measurements in order that component parts of an article will fit in a manner that will permit them to function properly. Thus, the very success of a machine shop depends on measurements. It is claimed that all important discoveries have been made through the medium of fine measurement. In the measurement of time, mass, and length, the latter mentioned is the most difficult, and it is in the precise measurement of length that exists the very centre of control in modern machine production. With the development and growth of the machine industry, the necessity of accuracy in measurement has become more and more important, until to-day the establishment and maintenance of sizes in both tools and product is one of the great problems before the machine shop world.

Evolving Modern Methods

In the days of the caliper the men who worked in machine shops were "all-round" machinists, that is to say they were experts in the operation of the various standard machine tools, as well as in bench work and assembling. Factories were also "all-round" shops, which produced complete machines, not one or more parts of some machine. To-day conditions have changed, and we find the "all-round" man has given way to

Illustration and information by courtesy of C. E. Johansson, Inc.



Fig. 2—Checking location of holes in drill jig.

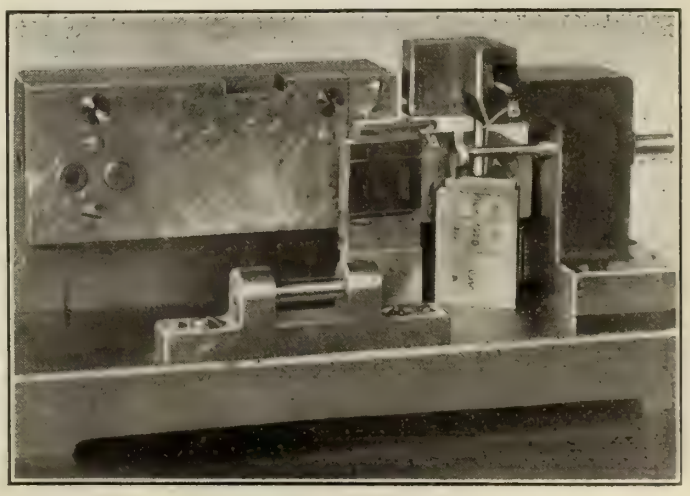


Fig. 3—Checking accuracy of special gauge.

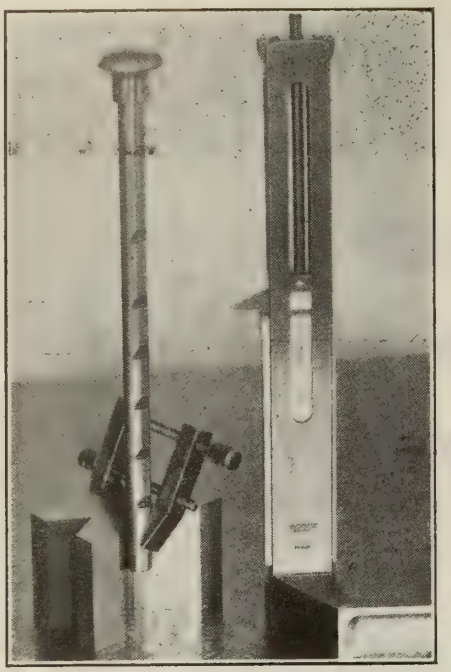


Fig. 4—Testing notches in measuring rod with height gauge.

the highly specialized operator. It is quite within the realms of possibility that in shops which employ a large number of workmen, there might not be more than a dozen or so "all-round" men outside of the tool-room or experimental department.

No one doubts the fact that these modern methods are with us permanently. The fact that the practices have decreased manufacturing costs and have greatly increased both the quantity and quality of the work produced, is sufficient reason for their general adoption. Under the old order of things the securing of a proper fit between mating parts was made by the "cut and try" method, which is simplicity itself, but slow and expensive, both as to original manufacture and subsequent upkeep. Moreover, the very system itself was such that errors in workmanship could be corrected. That is to say if a workman turned a shaft a bit under size he corrected his error when he came to bore the hole into which the shaft fitted. But with modern methods impregnating the entire industry, the opportunity to correct variations from standard sizes is gone. Under these modern conditions the workman in one department may never see the workman in another department, and neither of them may ever see the assembled product, as they continue to devote their entire efforts to the machining of a component part. Obviously each part produced in a shop under this manufacturing system, known as quantity or interchangeable production, must be true to the blue print, so that component parts selected at random from the stock accumulation of various departments will assemble with the minimum expense of time and effort.

The principles involved in interchangeable manufacture, have been applied also in a broader field than that of the departmentalization of shops. The production of various parts of a given machine is often accomplished in entirely different shops located hundreds miles apart, and all these component parts are shipped to one place where they are assembled. The problem of having pieces machined to close limits at a dozen different places in the country, and then shipping same to some central point where they are inspected and later assembled without undue difficulty, is one of the highest industrial importance, and one which has been solved by the successful application of precision measuring.

To accomplish this engineering feat two things are necessary, first, the departments of the single shop, and the departments of different shops must be in accord, and know beyond the possibility of a dispute just precisely what constitutes an inch or any fractional part of an inch; and second, these departments and shops must not only know what an inch is, but they must also use measuring tools which permit them to work in inches and fractions with the least possibility of error. Any measuring tool that makes possible such uniformity:—

(1) Must give both external and internal measurements in the ten thousandth part of an inch.

(2) Must give the same result any number of times.

(3) Must give the same result in the hands of different mechanics.

(4) Must be capable of being used direct on the work, so that the possibility of error, due to transferring fine measurements, is eliminated.

(5) Must be so seasoned that the well known changes taking place in hardened steel are reduced to a point where they do not impair the accuracy.

(6) Must be self checking, so that error due to wear becomes known at once.

Developments of Gauges and Standards

After reading the foregoing one sees that the practical shop application of the science of precision measuring is to develop a system of gauges, standards, gauge blocks, master gauges, etc. Experience has shown this method to be among the best, and with the assumption that this statement is correct a few illustrations on the use of gauges, gauge blocks, and standards will be shown.

A gauge block is a piece of hardened steel that has to conform to a stiff set of specifications, some of which are that it must be accurate to almost perfection, say to the one hundred thousandth part of an inch, it must be flat, its sides must be parallel, it must be thoroughly seasoned so that it is only slightly affected by temperature changes, and if affected it must expand and contract uniformly. It must return to size when it is again brought to normal temperature, and many other more or less important conditions. Simple as these rectangular blocks of steel are, their possibilities in the hands of a mechanic are only limited by his experience and resourcefulness. A number of blocks are often combined to obtain a measurement equal to the sum of the combined blocks. No inaccuracy results from this practice and this method is very useful in checking one block against another, or even a series of blocks. It will be found, that the surfaces of such blocks are so accurate, that they will adhere to each other, thus allowing the mechanic to use them in the same manner as a solid gauge if necessary. When blocks are combined

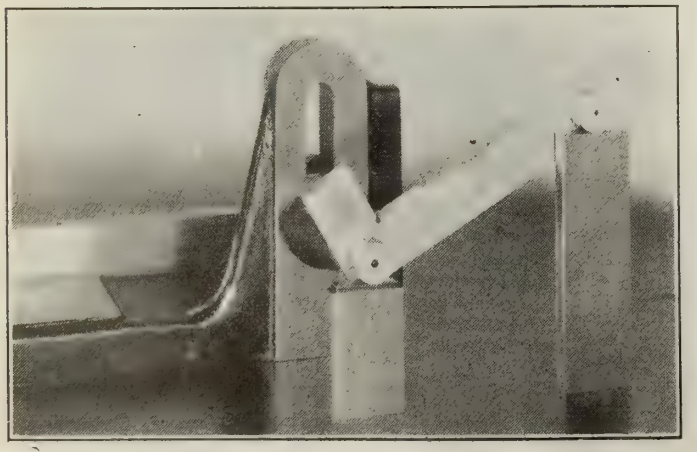


Fig. 5—Setting sine bar by use of blocks.

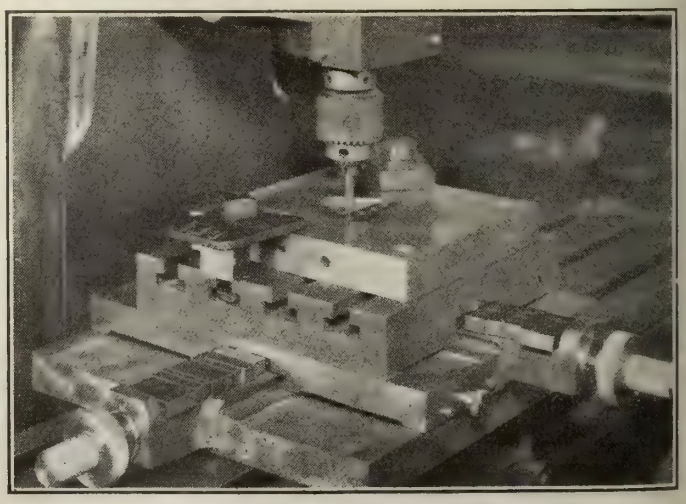


Fig. 7—Accurate spacing of holes by means of gauge blocks.

to get a certain measurement, a little care is necessary to save time and get best results.

In building up blocks the first point to study is the elimination of the extreme right hand figure, for example, suppose we desire to build up to 1.248 in. Looking over the blocks we pick out as shown in Fig. 1, a block .148 in. thick. This gets rid of, as mentioned above, the extreme right hand figure. We next secure a block .100 in. and another 1.000 in. which we assemble together, this making 1.248 in. total. In all cases endeavor to work from right to left using the smallest possible number of blocks to obtain the desired number of blocks.

Gauge blocks are valuable as reference standards for establishing and maintaining important dimensions. To a great extent master gauges can be eliminated, and as the blocks are not of special design they can be used over and over again on various jobs and do not become obsolete. These types of blocks are generally used on layout work, building and checking, inspection, and working gauges, as well as dies, jigs, fixtures and tools. A few accessories are manufactured and marketed with these precision blocks which expand their field of usefulness.

Practical Use of Gauge Blocks

Fig. 2 shows gauge blocks used directly to check the location of holes in a drill jig. The cut tells its own story and is a good example of the use of gauge blocks for precision measuring.

Fig. 3 shows another example of precision measuring with gauge blocks. Here is shown a special gauge being checked for accuracy. Fig. 4 shows the accessory clamp and base used in connection with the gauge blocks in the capacity of a precision height gauge. The particular job shown is the checking of the notch spacing on a measuring rod. Fig. 5 shows the gauge block method of setting a sine bar, while Fig. 6 shows

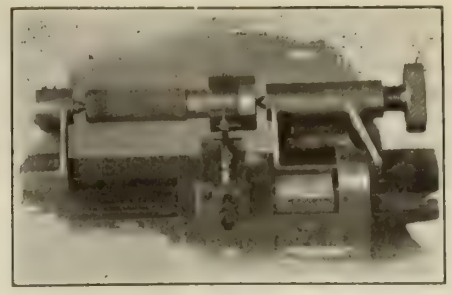


Fig. 8—Testing lead of thread by use of gauge blocks.

the use of blocks to locate holes in work on the face plate. Fig. 7 shows the blocks used to space holes in die work, while Fig. 8 depicts the blocks in use as a part of a thread-lead testing machine. All these examples are self explanatory and each contains many interesting features for anyone anxious to study the field of application of these precision measuring blocks. The above are only a few of the manifold applications.

Fig. 9 is another interesting and rather unique application of gauge blocks in the gauging of steel balls. The two plates are spaced by gauge blocks, being a little closer at the top than at the bottom. The balls roll down the plates, dropping into chutes after they pass through the proper spacing. The balls are placed in the hopper at top, and as the base revolves, balls from the hopper are discharged at proper intervals into the troughs, and in these troughs they are not only gauged but sorted. The edges of the plates that do the gauging are ground to a knife edge, and these need constant attention and are usually re-ground after approximately twenty thousand balls have been gauged. There are from four to six pairs of plates on each of these machines.

Absolute Measurements Impossible

Sooner or later a mechanical man comes up against the fact that absolute precision is an ideal not possible of attainment in the sphere of mechanical operations. Furthermore there are a variety of fits in even the most simple machine. Fig. 10 shows how many fits are required in the simple little drill press and each measurement has a certain variation in size which is permissible, this being defined by two dimensions. Such work as this must also be gauged, both instruments such as micrometers, and gauge blocks would not be suitable to this work as speed is required and is quite as essential as accurate results. Thus a new method of precision gauging had to be evolved.

In all production shops it has been found that it is not desirable to supply operators with micrometers, as these tools are expensive, and at the same time if used constantly, wear sooner or later, with results which render the instrument readings inaccurate. Even with the best of care the errors due to wear will creep in. But such tools do not always receive the best of care, thus the micrometer is usually only found in the tool room and experimental departments. In most parts, even when machined to so-called fine measurements, a limit of a few thousandths, or ten thousandths is essential. For that reason snap gauges have replaced the micrometer in some cases. There are several reasons for this, which are more or less obvious. Snap gauges are comparatively cheap as compared to micrometers or

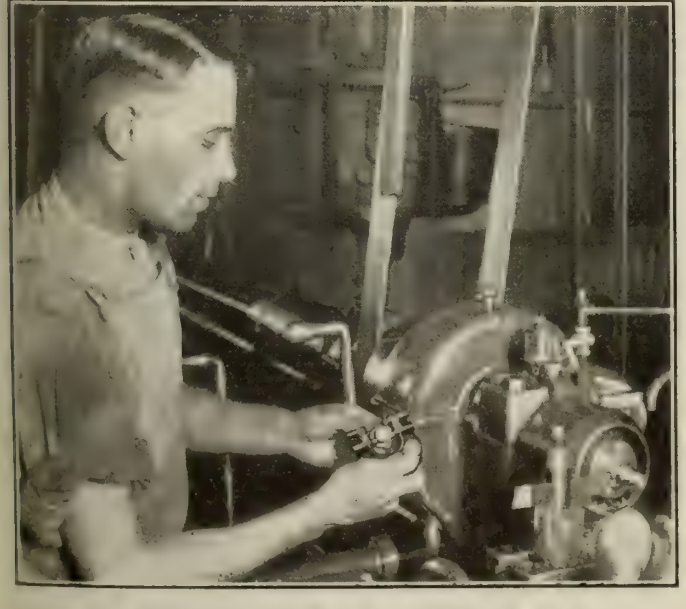


Fig. 12—Gauging work with adjustable snap gauge.

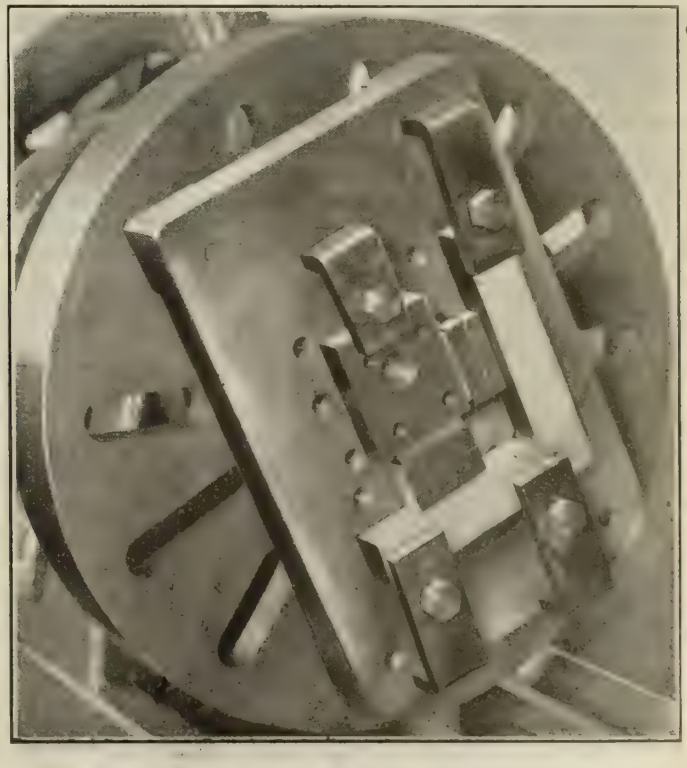


Fig. 6—Application of blocks in locating holes on faceplate work.

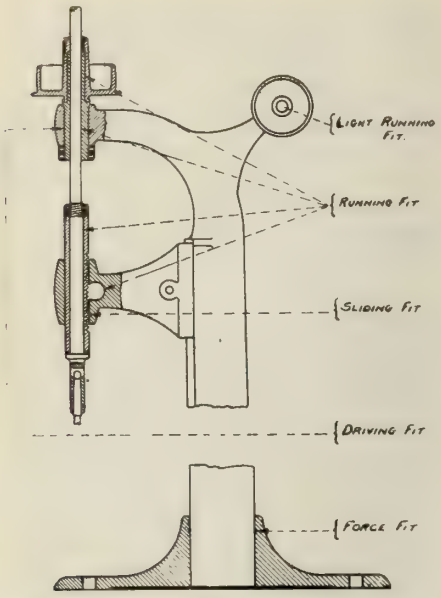


Fig. 10—Different fits required in drill press construction.

other precision instruments. They are usually rugged and can stand a great deal of hard usage, that would be termed abuse to a more delicate instrument. Snap gauges can be made adjustable over a fair range of limiting dimensions. Worn anvils can be replaced. A high and low limiting set of anvils can be placed in one holder which saves a great deal of time in gauging. All these reasons have made the snap gauge a popular type of gauge for handling precision work. It is the system of machining work limits that created the demand for a limit snap gauge. Drawings are usually marked with certain dimensions, plus or minus, between which limits it is necessary to keep, in order that the work may be suitable. Care, and practical shop experience, are desirable in placing limit dimensions on drawings. It is very easy to specify too close limits and waste money, or to go to the other extreme and specify too wide limits and miss the result sought. Many variable quantities enter into the problem of determining these limits, but it must never be lost sight of that production hinges upon the equation, (as one might term it)—closeness of fit versus cost. The closer the limits, the greater the costs, therefore for commercial purposes we should find out just how inaccurate work can be machined and still be suitable for its purpose, then make the limits as wide as possible.

Interchangeability is sometimes confused with precision manufacturing. Precision manufacturing usually means interchangeability, but interchangeability does not always mean precision work. Take for example the cast iron stove lid. It is surely interchangeable but cannot be thought of as representing close limits. In discussing the range of limits, the nature of the product must be considered. The diameter of a large pulley can have a wider range of limits than the diameter of a gas engine crank shaft.

Now it has been shown that limits are necessary to the commercial success of manufacturing, and that these limits vary with different classes of product. It is not wise to leave to the judgment or skill of the individual operator the final decision as to the amount of variation from the nominal dimension that will be tolerated. Therein lies anot reason for the snap gauge, which is an instrument of fixed dimensions thus being largely free from errors due to the human factor.

Gauge Construction

The general appearance and design of a snap gauge is well known to all who have even a bowing acquaintance with shop practice. The details of construction which permit of the adjustable features, however, are not so well known. Fig 11 shows a cross section of one end of an adjustable limit snap gauge. There is also shown the construction of the thumb and finger insulated grip, which feature prevents the heat of the hand from expanding the gauge. The cast iron frame gives rigidity with lightness. The Swedish cast iron is not liable to distortion as it will not bend, warp or spring under any normal, and many abnormal, conditions of use. The gauging plugs or anvils have a flat side which prevents rotation and only permits of end motion. These anvils are bevelled so that they slide on the work easily without marring it. The bevel is always in the correct position as there is no rotation of the gauging plug. The two adjusting screws are headless set screws. The clamping screws hold the gauging plugs firmly in place. The adjusting screws can be sealed with wax to prevent tampering after the gauge has been set. This type of gauge when set, can be depended upon to give excellent service in precision gauging. It is really fool proof and gives the same result in the hands of any operator, mechanic, or inspector. The gauges can, of course, be set with standard gauge blocks.

Fig. 12 shows the application of the adjustable limit snap gauge in checking work as it comes from the machine. Errors are thus detected at the outset before a large number of pieces are spoiled. The plug gauge is no less important in the shop than the snap gauge. The former takes care of external dimensions while the latter is used on internal dimensions. Usually there are two plugs, the low limit or "go" end, and the high limit or "no go" end, located on a central handle. Thread gauges are usually of the same design but these as well as plug gauges, will be discussed later.

PROTECTING IRON FROM RUST

Protection of iron from rust or oxidation is a matter of more than ordinary concern. It has been tinned, painted in oils and coated with tar and varnish, with the intention of preventing weather influences operating upon it. Whilst the three latter methods are unquestionably economical in first cost, says a writer in the Practical Engineer, they but imperfectly serve their purpose, whereas the protection by means of coating with zinc, or galvanizing, unites together the requisites of perfect protection at a comparative minimum of cost. Zinc is preferable to lead, as chemical experiments have demonstrated that while it effectually protects, it is not operated upon by water in the same manner as lead.

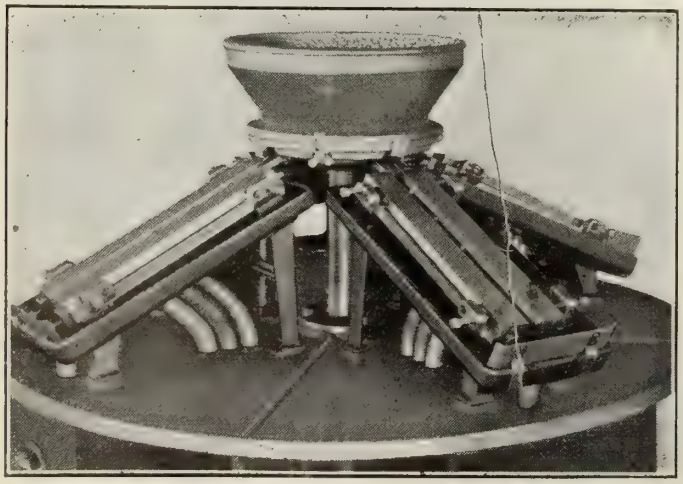


Fig. 9—Gauging and sorting hardened steel balls.

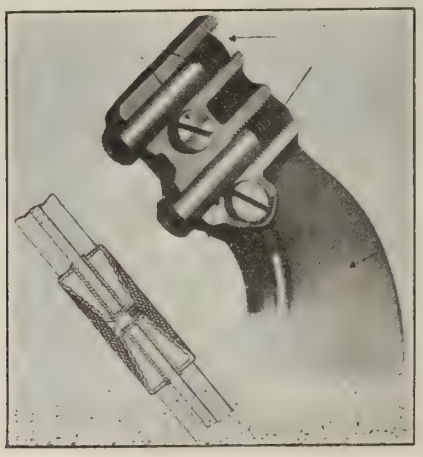


Fig. 11—Construction details of adjustable limit snap gauge, with section of insulated holder.

How Executives Can Show A Steady Profit

Fear of Failure Must Not Be Entertained—Put Service Before Profit—A Well Conducted Business Will Show on Right Side of Ledger—Standardization Alone Will Not Bring Business.

EVERY executive is interested in making a profit, especially at the present time. Henry Ford believes in making a steady profit, and here are a few of the things he claims are responsible for his firm's past achievements.

"It used to be taken for granted," says Mr. Ford, "that our theories and methods were fundamentally unsound. Events have killed that kind of comment, but there remains a wholly sincere belief that what our company has done could not be done by any other company, that we have been touched by a wand, that neither we nor anyone else could make shoes, or hats, or sewing machines, or watches, or typewriters, or any other necessity after the manner in which we make automobiles and tractors. And that if only we ventured into other fields we should right quickly discover our errors.

"I do not agree with any of this. Nothing has come to us out of the air. We have nothing that others might not have. We have had no good fortune except that which always attends anyone who puts his best into his work. There was nothing that could be called 'favorable' about our beginning. We began with almost nothing. What we have, we earned; we earned it by unremitting labor and faith in a principle.

"The institution we have erected, differs as a whole, although not in every respect, from all other businesses that I know of. It differs because we made it differently. If we had not done so it would not be there. It is founded on essentially this creed:

"1. An absence of unreasoning fear of the future or veneration for the past. One who fears the future, who without reason fears failure, limits his activities. Failure is only the opportunity more intelligently to begin again. There is no disgrace in honest failure; there is disgrace in fearing to fail. What is past is useful only as it suggests ways and means for progress.

"2. A disregard of competition. Whoever does a thing best ought to be the one to do it. It is criminal to try to get business away from another man—criminal because one is then trying to lower for personal gain the condition of one's fellow men, to rule by force instead of by intelligence.

"3. The putting of service before profit. Without a profit, business cannot extend. There is nothing inherently wrong about making a profit. Well-conducted business enterprise cannot fail to return a profit, but profit must and inevitably will come as a reward for good service. It cannot be the basis—it must be the result of service.

"4. Manufacturing is not buying low and selling high. It is the process of buying materials fairly and, with the smallest possible addition of cost, transforming those materials into a consumable product and giving it to the consumer. Gambling, speculating and sharp dealing tend only to clog this progression.

"These principles have been put into effect by a process which is very loosely called 'standardization'—as though the program called for machines rather than for principles. Standardization and simplification—all the terms that gather 'round them—mean nothing of themselves. One must first get at the motives.

"Standardization? Standardization for what? To make a higher profit on each article sold? That kind of standardization inevitably results in failure. If I were making and selling a shoe at $5 at a profit, under wasteful methods, I could undoubtedly by accepting that shoe as a standard and arranging my manufacturing processes accordingly, make a much higher profit on that shoe's sale at $5.

"That is the way most standardization goes. A manufacturer turns out, let us say, a dozen styles of articles. He decides to standardize his processes of manufacture. He cuts the dozen articles to three. Inevitably he cuts his costs and he finds for a while that he is making more money on the three articles than he did before on the twelve. He has not cut the price to the consumer. He has not been thinking of the consumer, excepting as someone who will give him money.

"Before long he finds his sales falling off. His distributors report that they are overstocked and they begin to ask for new styles. Eventually the manufacturer finds that he differs from his former condition only in that instead of having a poor business in a dozen articles he has now a poor business in three articles. Standardization alone will not bring business.

"The place to start standardization for volume output (and no other kind of standardization is of any consequence) is with the consumer. One must work back from the consumer, and the points to decide are: 1. Am I able to make what the people want—make it better than anyone else? What price can the consumer afford to pay? Can I trust myself to remain faithful to my principles?

"This is not illogical; it is simply keeping in mind that the consumer is going to control the business and you therefore accept his control first instead of last. The public wants a definite number of things. I spent 12 years, day and night at the drawing board and in the shop before I knew that I could make something which the people would want.

"The price of our products has ever been made on what it ought to cost to manufacture that product. We have always taken the price and worked back. Every price has been a challenge to ourselves. It has always been below the lowest cost we could figure out in advance. Then we have gone ahead with that price hanging over us and found so many new, better and less expensive ways of doing things that the price which once, under the ordinary method of calculation, would have been considered impossible, became very profitable.

"When this year we cut the price of cars we cut them below our cost figures of production and for about a month we sold at a loss. But of course we caught up on our own price. We found ways and means of cutting expenses that made the losing price a very profitable one. I am quite certain that if instead of estimating what the consumer would pay and pricing accordingly, we had taken our costs and found the lowest price we could sell at, our business would to-day be dull instead of being better and more profitable than it has ever been."

"During the war, continues Mr. Ford in a recent article in System, "we had considerably lessened our efficiency, unconsciously, of course. We had acquired certain luxuries—although we had never thought of them as luxuries. We employed 15 men per car per day. Now we are employing 9 per car per day. We made that cut by applying the rule that everything and everybody must produce or get out.

"We cut our office forces in halves and offered the office workers better jobs in the shops. Most of them took the jobs. We abolished every order blank and every form of statistics that did not directly aid in the production of a car. We had been collecting tons of statistics because they were interesting. But statistics will not construct automobiles—so out they went.

"We took out 60 per cent. of our telephone extensions. Only a comparatively few men in any organization need telephones. We formerly had a foreman for every 10 men; now we have a foreman for every 17 men. The other foremen are working.

"We cut the overhead charge from $146 a car to $93 a car, and when you realize what this means on more than 4,000 cars a day you will have an idea how, not by economy, not by wage-cutting, but by the elimination of waste, it is possible to make an 'impossible' price. The saving of only a dollar a car mounts up to a big sum of money in a year.

(Continued on page 50)

Production of Dies on Accurate Cost Basis

Standardizing Parts—Careful Study of Details Necessary—Economy of Unit Sizes—Record of Each Operation Kept—Methods of Manufacturing Dies for Jewelry—Details of Construction—Quantity Required a Big Factor.

By CHAS. E. HALL

IN THE following article, an attempt will be made to briefly outline the method adopted in a manufacturing jewelry plant, in the production of their blanking and piercing dies.

We occasionally hear plant managers make the statement, that "there is no money made in the tool-room" and they seem to regard this department as a necessary evil, which must be maintained, and the excessive cost of the tools, etc., added to the cost of the final product. If one is manufacturing articles in large quantities, the additional cost per unit is perhaps negligible. But why not have the tool room on a paying basis as well as any other department?

A little attention given to standardization of such parts as may be in general use, and having them made up in small or large quantities, varying with the requirements in the particular plant, will result in a substantial saving on each job as it comes along with the added advantage of getting it out sooner, which makes for quicker deliveries and future business. This is of special importance when orders are not as plentiful as the sales department would like. These parts may be numbered or lettered and the cost figured on each separate lot. This, divided by the number of parts in the lot, gives the cost per unit, which can be charged against the job in hand as it comes from the stock room.

Study Work Closely

Now fully realizing that perhaps no two places are alike in regard to product or methods, but speaking generally, there is usually some point at which a saving may be effected by careful study of the various circumstances; and in plants where metal stampings are being manufactured, these suggestions can no doubt be adopted to advantage. In the plant referred to in this article, the blanks are necessarily small in comparison with the general run of metal stamping, and consequently but few standard parts need be kept in stock.

Standard Die Blocks

The question has been raised on one or two occasions, "Why do you use the same size of die block for a very small blank, as for one of larger dimensions, when tool steel prices are so high?" The answer is: The reduced cost of standard parts, made up in quantities, more than makes up for the additional use of tool steel as we will attempt to show.

In this shop, the die block which almost covers the entire field is about 2½ in. x 2 in. x ½ in. and weighs approximately 1 lb. before machining. Now suppose these to be made up in lots of one hundred. Then 100 lbs. at 35c. a lb. = $35 for tool steel. Now if these be made up singly, and each block cut to minimum proportions with a saving averaging say, ¼ lb. per block, we have a gain of ¼ lb. x 100 x 35c. = $8.75 per hundred blocks. But you would also have one hundred "set ups" on the shaper, much greater time being taken on each block, and the innumerable delays which inevitably accompany the changing from one machine tool operation to another, and with the high labor costs, far outbalancing the comparatively small saving in tool steel.

Again, fewer press bolsters are required which is another saving, both in money and storage space. By having these parts ready for use, each job is completed sooner (as before mentioned) than if it had to be done with each order, which is a point to be remembered when work is wanted in a hurry; and in this shop prompt delivery receives foremost consideration and very often secures orders which might otherwise go to a competitor, especially when estimates have been pared down to a very close margin. These reasons, we believe, sufficiently justify the small additional tool steel used.

Without taking up the various sizes of standard parts used, let us consider the aforementioned size as an example, viz 2½ x 2 x ½ in. The lengths are chalked off on the bar and cut in half. The two halves put in the saw again and cut into four. Then the four short bars are put in together and the blocks cut off the required lengths four at once, the saw being attended by an apprentice, who, by the way, does all the work on the blanks. They are then planed back and front in the shaper one at a time. This method we find quicker than shaping longer pieces and cutting off afterwards, because all our work on the shaper being very short, the countershaft is speeded up to the limit which gives good production results. A pair of bevel parallels are provided of the required angle and the "faced" blocks held between them in the vise, ten at a time and the angle planed on the edges Fig. 1.

The faces are now smoothed off on an emery covered lapp and the "lot letter" (or number) stamped on the end of each block and charged against each job as used. The standard punch blanks are about 3½ inches long over all, see Fig. 2. The shanks are 1 in. x 2 in. with —.003 in. tolerance on the diameter and

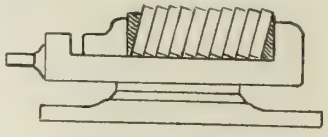


FIG. 1.

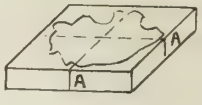


FIG. 3

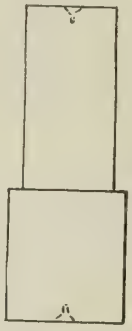


FIG 2.

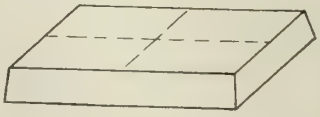


FIG. 4

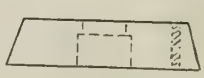


FIG. 5.

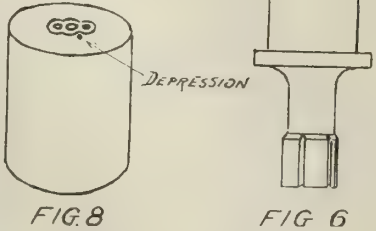


FIG. 8

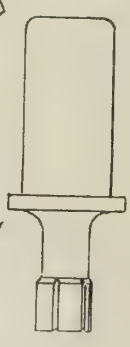


FIG 6



FIG. 7
— ENLARGED —

Fig. 1.—Edges planed at angle. Fig. 2.—Standard punch block. Fig. 3.—Locating impression. Fig. 4.—Intersecting lines on die block. Fig. 5.—Die relieved. Fig. 6.—Relieving punch. Fig. 7.—Work. Fig. 8.—Pilot depression.

are made from 1¼ inch. round annealed steel. They are cut off the required length, centered, and the shanks turned to the desired dimensions. Then holding the shank in a universal chuck, the center mark is turned out and the end smoothly faced, the lot letter stamped on the end of the shank, and the cost figured as before.

As nearly all the work in this plant is embossed, and often of intricate outline, the method used to transfer the shape of the blank to the punching die block is as follows:—A die and punch blank is secured from the stock room and the cost of each entered on the order. The smooth faces of both die and punch blank are sandblasted and coppered. Special mention is made of the sandblasting as it leaves a fine dull surface on which, when coppered, the faintest mark is easily discernible. A piece of annealed steel about ⅛ inch or 3/16 inch thick, and just slightly larger than the blank is placed on the embossing die and a light blow given it with the drop hammer. This gives a perfect outline of the article.

Two fine lines at right angles are scribed across the face of the impression thus obtained, and a file mark made on the edge at the end of the line as shown at A. A. Fig. 3. This is hardened and the temper drawn to a purple tint and impression placed downwards on the coppered die block, on which two fine lines at right angles, and intersecting in the center of the block, have been scribed, Fig. 4. The marks on the edges of the "print" are lined up with those on the die block, which insures it being placed centrally, and held in place by a couple of pieces of soft wax of any kind pushed against opposite sides of the print. Usually it is not necessary to use the wax; but it is resorted to should the print for any reason have a tendency to move. It is then struck lightly with the drop hammer o screw press, which gives a positive and accurate outline of the embossed blank, regardless of the shape of the contour, and also one which is readily seen and cannot be obliterated.

Marking the Dies

The marked blank is then drilled for the stripper screws, the back of the block relieved under the impression, by drilling or turning to within about ⅛ in. from the front of the die, Fig.5. (the exact length of die wall being governed by the character of the outline) and the impression usually sawn out with a jeweler's saw, if small, or drilled out if larger, filed up to the line on a die filing machine if the impression is over ¼ inch. in diameter. If smaller than this it is filed up by hand.

The majority of these dies are quite small and usually have a few ugly points projecting into the outline which sometimes make it difficult to obtain needle files small enough to negotiate them. In such cases the files are carefully ground down very thin and used for finishing only. The finer sizes of jeweler's saws, as well as fine half-round and knife-edge gravers are a great help in cleaning out a corner rapidly and well. With the impression marked in this way which only takes a few minutes, it is only necessary to file till the line disappears, and there is no necessity of working templates through the die. No template need be made at all as the print takes its place.

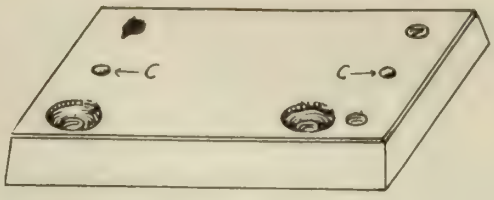
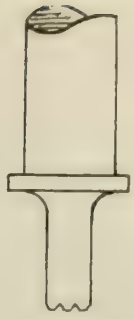


FIG. 9.


FIG. 11

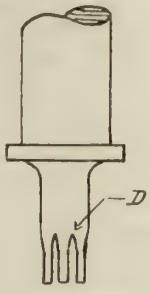


FIG. 12

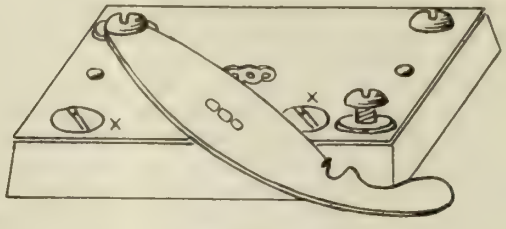

FIG. 10

Fig. 9.—Drilling in standard blocks. Fig. 10.—Arrangement of stripper. Fig. 11—Punch notched for fitting. Fig. 12.—Die outline on punch.

By using an eye-glass occasionally the slightest trace of the outline can be rapidly seen, and extreme accuracy, coupled with speed of production, is easily obtainable. The hand filing is done in a vertical direction, the block being placed face up on the work peg projecting from the edge of the bench, so that the die-maker has his eye constantly on the line. The matter of clearance is largly one of practice and a good man does not have to refer to the back of the die very often. Working in a seated posture also tends to speed up production as it is less fatiguing than the twisting and turning which accompanies filing at the vise.

The die is then heated in a gas furnace of the semi-muffle-type and hardened in the usual way. The face of the die is then polished on a very fine emery lap and the temper drawn evenly by laying it on a heated iron plate. By wiping the polished surface with a clean oily rag the changes in color are more easily noted than on a dry polished surface.

Fitting the Punch

The die proper is now ready. A punch blank is clamped to the face of it and the outline scribed through the back of the die. It is then placed on a milling attachment on the lathe, specially fitted up for this particular work and milled as close to the line as possible. The eye-glass is again used on this operation and results in very little metal being left to broach. Again using the eye-glass it is beveled on the end all round by hand filing at about a 45 deg. angle till the scribed outline just disappears. The punch end will then perfectly engage itself in the die, and a slight blow with a hand hammer will make it snug which aids in setting up in the screw press for broaching.

Broaching the Die

When properly set, the press is brought down about 1/32 inch in most cases, (the exact amount depending on the character of the die), the punch removed from the press and the burr raised in broaching taken off. The operation is repeated till the punch is broached to a sufficient length. If but a few thousand blanks are all that will ever be wanted, about ⅛ inch or even less, will be far enough to broach the punch. Any more time expended to make a "pretty" job is wasted.

Usually with each succeeding operation, the broaching can be carried a little farther than the preceding one, because when removing the burr any part with an excess of metal is easily seen and removed at the same time. When the broaching is completed, the punch is relieved in the lathe as shown at Fig 6, and cleaned up to a regular shape. It is then hardened on the end and the temper drawn back to a greater extent than the die, and when the stripper is made it is ready for use. It will not be necessary to go into details in regard to the stripper as it is familiar to anybody who may be interested in this article.

In regard to piercing dies, nearly all our punches are made solid, and it is

seldom we have occasion to use inserted punches.

For the purpose for which these dies are used by us, we find from experience that the solid type are more accurate, no possibility of one becoming loose, and possibly ruining the die, and they have a long life of usefulness.

As some of the blanks to be pierced are very small, it follows that the piercing punches from their slender nature must not be longer than is necessary, therefore the stripper must be as close as possible to the face of the die. Fig.7 may be taken as a simple example. The blank in this case is an I. O. O. F. emblem and is 9/32 in. long and 3/32 in. wide, outside measurements. Consequently the pierced holes in the links will be about 1/32 in. wide in the center link, and still less in the smaller ones. These are first embossed from small rectangular pieces of metal cut off in gauge on the shears, just sufficiently large to cover the impression in the embossing die. They are then struck up, trimmed out on the banking die, and finally they are pierced in the links. A small depression in the embossing die, close to the edge of the impression, Fig. 8, acts as a pilot in trimming out, a corresponding depression being in the trimming die. This insures the blanks being cut out the same way each time, besides making the "feeling in" easier and quicker.

Construction Features

The piercing die is made as follows:—An impression is struck from the embossing die, trimmed out, and the small holes to be pierced, accurately worked out by hand. This is used as a template. One of the standard blocks is drilled and tapped as shown at Fig. 9, (five holes in all) for 10 x 24 machine screws. The holes at c.c. are just "spotted" and are used for locating the guide plate. A piece of cold rolled steel is reduced by re-rolling to about .02 in. thick and cut to the size of the die. A hole the shape of the block is punched in the center on the trimming die, and lightly filed all round to allow the blank to enter easily, but snugly. In fitting the emblem, the plate must be held "burr side up" ad clamped on the die block in this position. The holes are marked from the back of the die and the plate drilled. The guide plate is now screwed in place and the holes x.x. Fig. 10, countersunk, as the screw heads here must be flush to enable the stripper to swing over them.

The stripper in this case is made as shown in Fig. 10, and has a thin washer under each end just thick enough to let the stripper clear the blank when placed in position. The screws which hold the stripper go but halfway through the block, and when finally screwed down just firm enough for the stripper to swing, two screws are put in from the back to lock them securely and are cut off flush. Of course these screws are put in after the die is hardened. With the die still soft and the guide plate securely fastened, a ball punch is held on the plate over the "spotted" holes and struck with a hammer, which leaves a concave depression in the plate and conforms to the hole beneath it. This makes a quick and positive job of re-locating the plate when taken off at any time.

Filing to Template

Now with the template in place, the piercing holes in the die are worked out after first relieving the back of the block. The filing is continued till the operator can just feel the template with the file which gives positive results, and eliminates eye-strain, attendant on working to a fine line. The die is then taken apart, hardened and tempered and is ready for the punch.

In this case the punch would be too small on the end to mark through the die, so it is roughed out to approximate size and the end filed as at Fig. 11, and the little tips beveled. This is held on the die and struck squarely on the end with a hammer, a very light but smart blow being all that is required. This leaves the exact outline of the die and it is milled to this line for about ½ in. back, leaving the punch as shown at Fig. 12. The space between the punches are not carried back any farther than will just clear the stripper and leave a little allowance for grinding if the punches become dull. Also the ends of these spaces D—Fig 12, should be nicely rounded away as shown, to give a gradual thickening of metal towards the base of the punch. This makes a stiffer job and eliminates hardening troubles. It is now carefully broached, the ends squared up, hardened and tempered.

The objection may be raised that if one tip breaks off the punch is ruined. This is true. But on the other hand, it is quickly replaced, and from experience we find that breakages seldom occur. In fact during the last ten years we have had but two misfortunes of this nature and they could have been avoided. The press hand neglected to close the stripper, the punch picked up the blank, and in attempting to remove it, broke one of the ends. There are many dies of this and similar kinds in the plant and the way they have stood up should be an argument in favor of the solid punch, independent of the fact that they can be made at a decided saving over the inserted method. More tool steel is used, but if the cost is less, why worry!

Of course what has been said by no means applies in all cases; neither is this article intended to be a "guide to diemaking," but simply to set forth briefly the method used by this firm in turning out its product. Like all other places, jobs occasionally come in which cannot be handled in this manner, and consequently receive different treatment, according to the exigencies of the case. The points we would specially emphasize, are the importance of an accurate cost system throughout the plant. Don't waste time in broaching a punch too far back, if the die is to be used for just a few thousand blanks and never used again. Make for rapid deliveries wherever possible, and finally, don't neglect your trade magazines, especially the advertising sections, and take full advantage of all new tools and special equipment likely to meet your needs and which tend towards better work and quicker production.

VALUES OF NICKEL AND CHROMIUM

The discovery by Mr. A. L. Marsh, in 1905, of the remarkable properties possessed by alloys of nickel and chromium, has a far-reaching effect upon the electrical heating and cooking industry. It has almost revolutionized it. "Prior to that time," says a writer in the Engineer, "electrical heating elements were unreliable, could be operated at only a low temperature, the dissipation of energy represented by the watts consumed per square inch of heated surface was small, and under the best conditions the elements possessed only a short life. The modern electric heating element possesses none of these disadvantages, and its present satisfactory state of development is directly attributable to the production of nickel-chromium alloys.

"The actual manufacture of nickel-chromium alloys is among the most difficult problems in metallurgy. Both metals melt only at very high temperatures, and the problem is further complicated by the fact that at its melting point chromium is readily oxidised and nickel is a solvent for carbon. The slightest variation in the process of manufacture is apt to affect results at some later stage, hence the most careful control must be exercised at all times. The alloys are commonly made in the form of rods of about ½ in. diameter, and the process of reducing the rods to the sizes required is now reduced to a comparatively simple process, alongside of the previously adopted methods.

CALL THE AMBULANCE

Septimus Wagge met his chum the other day.

"I say, Bill, I watched a wonderful machine at our shop this morning."

"And how does it work?"

'Well," was the reply, "by means of a pedal attachment, a fulcrum or lever converts a vertical reciprocating motion into a circular movement. The principal part of the machine is a huge disc that revolves in a vertical plane. Power is applied through the axis of the disc, and work is done on the periphery, and hardest substance by mere impact, may be reduced to any shape."

"What is this wonderful machine?" asked Bill.

"A grindstone," was the reply.

How to Place Employees to Best Advantage

Outlining a Successful System—Learning What a Man Knows—Trade Test a Paying Investment—List of Questions Asked—Testing a Workman's Ability for Service.

By RUSSELL J. WALDO

VALUABLE data have been published during the past two years relating to selection of employees, who can operate various complicated jobs without organizations. Although the methods discussed have been good if used by the man who made them out, they have in the writer's opinion, left entirely untouched one of the most valuable elements of aiding the interviewer in determining with greater accuracy how much a man knows of the task for which he applies.

In the majority of cases the practice is to ask and accept the applicant's information without requiring him to give definite information of what he knows. It is not enough to ask a man how long he has been with a given firm or what has been the extent of his experience, where he has worked or similar questions. Some method must be brought into use which will actually gather how much he really knows, not how long he has been gaining it.

If manufacturers expect to compete successfully with other corporations in lowering their prices they must adopt some system which will reduce their production costs. They must rely upon some method which will place every man who applies for a job in the position he is best fitted for and the one with the most responsibility. To do this requires the use of some method which will successfully draw the necessary information out of the applicant, then allow him to convince the interviewer that he knows what he is talking about. This is best done by the trade test, which is the purpose of this article. Inefficiency in the workman will show up in greater production costs and many of our larger industries seem content that they have selected the most efficient men for their respective tasks, when in reality they have not gone into details of the worker's experience at all.

Trade Test Advantages

The trade test which the writer worked out for use at the Studebaker Corporation at South Bend, and which was used by him during one of the most severe labor shortages this country has ever seen, not only fitted the task there, but if the same fundamental principles are worked out by any employment executive for their own use in other plants are capable of gaining the same results, equally accurate and dependable.

This can be proved in this way. Regardless of where a given machine is being used, the methods of successful operation remain the same whether they are used in an automobile shop or in a machine tool plant. The requirements for the operator remain the same, therefore the tests used in one plant—except for some additions which might be advisable for that particular plant—can be equally successful in another plant using the same machine.

For the benefit of business leaders who are trying to reduce their production costs, the writer outlines the tests as used by him, not as a system one hundred per cent. perfect—as none can be this—but a method that will prove the greatest investment possible in connection with the employment division.

The illustrated trade tests permit a man who knows but little about the given task to select employees with equal accuracy as the man who knows the task well. With the test he is in a position to convince the applicant that he must gain the place through actual ability and not be able to bluff his way through. To the man who will carefully weigh every reply and consider a man's relative merits, this test is capable of wonderful results. Others would be unable to gain results with any method except on perhaps machines they had actually worked upon. I have had men who failed in the tests, as well as those who have made good in them, frankly tell me they were the fairest sort of quesions that a man could expect.

These are not being passed on with the thought that others will use them exactly as they are stated, but are given with a hope that the findings so far will permit others to work out similar tests in their own way and thus assist organizations to reduce their production costs.

What the Test Is

The trade test is a fair opportunity for the applicant to convince the interviewer that he knows what he is talking about. It gives him a chance to actually show that he understands his work. The general belief is that the trade test is a catchy sort of method to make a fool out of a man. By the use of pictures a man is allowed to get nearer to natural conditions of the job and to point out things which he would not have thought of unless he were facing the actual machine. It is a carefully outlined method of procedure for the interviewing of applicants, which has for its main purpose that of making the interviewer doubly sure that he has not omitted some important question. It proves itself to be a legitimate method for the interviewer to determine a man's ability. The writer has failed to find an efficient man who could not point out equally well parts on a picture that were found on the original machine and tell of their functions.

The careful working out of these tests eliminates much that was formerly useless and burdensome, and which accomplished no definite purpose. In addition to this the use of pictures allows for closer questioning of the applicant. In working out the tests such questions as the following might be asked to show if the worker had a deep interest in the machine and took interest in studying it. Where is a certain automatic screw machine made? Where is a certain machine tool firm located? What do they make?

Mathematical problems such as are found in usual practice are also helpful in showing a man's ability to figure them. Spelling of names of tools and other terms used is also helpful. Reading a portion of a page from the operator's handbook of the machine he seeks

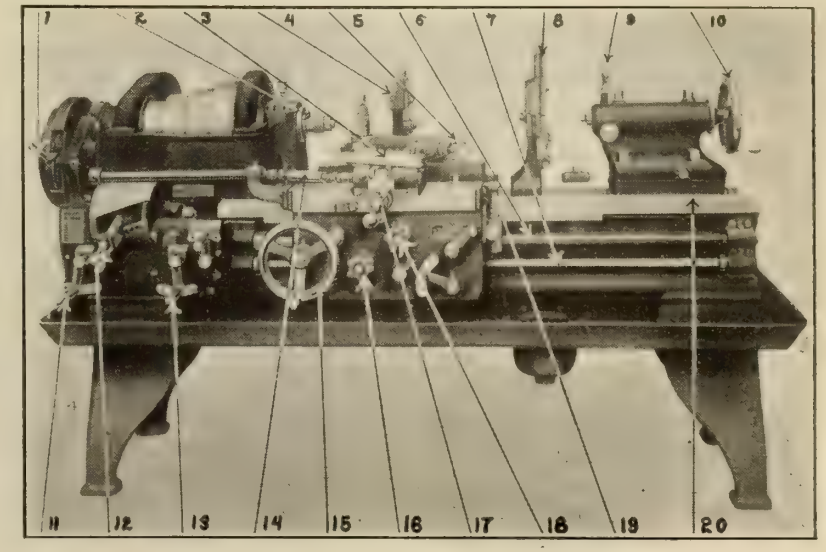


Fig. 4.—Diagram to test knowledge of machine parts.

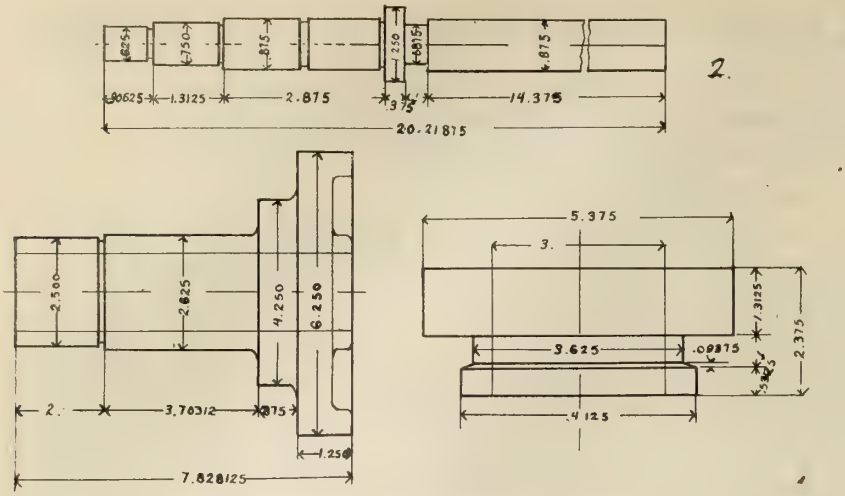


Fig. 3.—Method of testing knowledge of drawings.

a place upon, is also of value if the interviewer has the time.

One of the writer's first drawbacks in making out these tests was the overloading of the test with questions. However, later, questions were combined, some removed and other changes added that made them more valuable for the task of selecting. It would be useless to give a hard and fast rule regarding procedure. Typical questions may be used to illustrate this outline but the interviewer may make out a more satisfactory list for his own use when he knows the nature of the work the applicant will be required to do.

The Job Specification

Of first importance is the job specification. The writer shows with this outline the specification used for journeyman millwright. This is shown below.

Millwright Journeyman.

Duties—Laying out and installing machine tools, shafting and the maintaining of them.

Qualifications—Must be able to layout his work from blueprints or rough sketches, set up and keep in repair any and all machine tools used in the plant.

Should be able to install gravity conveyors, belting, cranes, machine tools, shafting, pulleys, hangers and other general equipment.

Should be a practical belt man fully capable of maintaining belting, should be able to erect stringers and hanger bases, and be able to handle blocks and jacks quickly and safely.

Must be capable of handling large machinery with the use of blocks, jacks skids, cribbing, in both favorable and unfavorable conditions.

Should be familiar with concrete work as concerns his own particular duties, especially foundations.

Should have had sufficient experience to supervise installing equipment and handling men to gain their best work.

It is highly important to use great care in making these out. First it must be known exactly what an employee must do once he is at work. There are various grades of millwrights controlled by the section of the plant they are in. However, in most plants the millwright must be one that is capable of being transferred to any department with equal results.

The job specification is nothing more than a carefully made out synopsis of what the millwright must do once hired and placed at work. In the requisition for employees it is possible for the foreman to suggest that a man, with certain qualifications, can be used in a stated department, if he has had no experience in other branches. The purpose of job specification is to show the interviewer what is expected of the man, and permits him to be more specific in selecting the applicant.

Question List for Applicants

Below is shown a reproduced page from my book showing typical questions asked.

Testing Workman's Ability

What is the capacity of the Cincinnati Automatic?
What are the spindle speeds?
What are the feed speeds?
What are the speeds in R. P. M.?
Do finished parts and chips drop in the same place?
How are tools controlled?
Of what metal are the spindle bearing boxes made?
How does the machine revolve?
Does it use right or left handed tools?
How many spindles can be locked in a stopping position when the machine is running?
How many tools can be operated at one time?
How many cross slides on the machine?
For what kinds of tools are these used mostly?
Can machine be run without chucking and feeding while setting up?
How many and where are the stopping levers?

In this case the questions were used in connection with the automatic screw machine construction. In making out these questions it is important to determine exactly what a good man should know, then build the test questions around the factors.

In Fig. 3 is shown three drawings. The purpose of showing these is to determine how much a man knows about the reading of drawings. Questions asking for certain dimensions are worked out. Questions for apprentices were much simpler than those for the experienced operator. The applicant was asked such as the meaning of turret, R. P. M., define lathe apron, micrometers, chuck and other parts of the machine. The skilled operator was asked questions regarding the actual operation of the machine similar to the questions shown in Figure 2.

Such questions as:—Where do you spend your evenings? Why are you seeking a place with this firm? If you had the job of your choice would you be willing to study and improve your ability? If you could have any job you choose what would it be? Do you have a hobby? What kind of reading do you prefer? These questions were very helpful in deciding upon the desirability for employees in exacting places.

The Use of Pictures

Illustrations in various forms have proved of great value in selecting employees. The picture shows up a given machine or part as it actually is. In Fig. 4 is shown a marked photograph of a 16 inch high duty tool room lathe. There are twenty parts indicated which correspond to the list below.

1. Handle on quadrant for relieving attachment drive; 2, Spindle nose with draw-in-collet; 3, Top slide of compound tool rest; 4, Follow rest; 5, Compound rest top slide adjusting screw ball crank; 6, Lead screw; 7, Feed rod; 8, Steady rest; 9, Tailstock spindle clamp lever; 10, Tailstock spindle moving handwheel; 11, Feed mechanism back gear lever; 12, Sliding tumbler for feed changes; 13, Feed mechanism back gear lever; 14, Telescoping shaft for relieving attachment; 15, Carriage moving handwheel; 16, Longitudinal

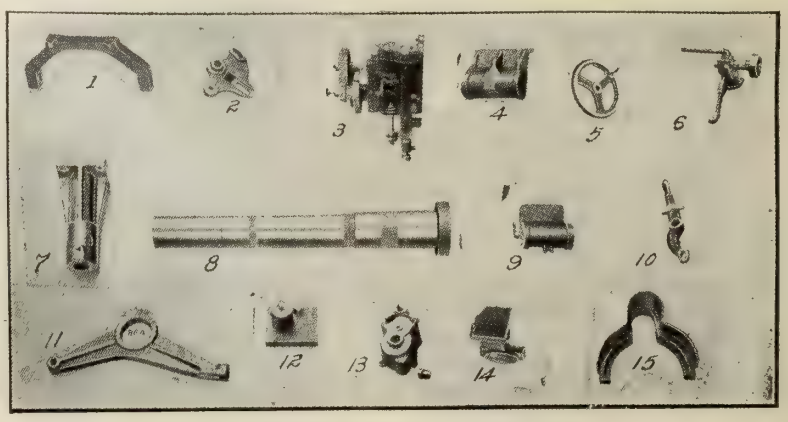


Fig. 6.—Individual test sheet of machine parts.

feed control knob; 17, Tool rest cross feed screw ball crank; 18, Cross feed friction control knob; 19, Chasing dial for thread cutting; 20, Front way or vee of bed.

With the aid of these, many questions can be worked out. The wri.er did not always refer to definitely arranged questions, but asked the function of some part by number, or to give the number of some part and have the applicant tell the function of it.

In Fig. 6 is shown an individual p test for a turret lathe, as used by the writer. The object of this test is to require the applicant to name the parts shown on the sheet. The parts are not assembled, yet the average experienced operator can easily name them. Great care must be exercised, however, in selecting the parts to be used to make sure that they are those that should be known by the workers. The list of parts kept before me in my work is as follows:—

1, Headstock Bracket; 2, Main Feed Box Quadrant; 3, Fine feed driving pinion; 4, Rapid traverse friction housing; 5, Carriage apron handwheel; 6, Oil Pump; 7, Drill Holder; 8, Headstock spindle; 9, Turret apron pilot shaft; 10, Feed change level; 11, Drill support; 12, Cross slide; 13, Cross feed housing; 14 Rapid traverse screw bracket; 15, Friction gear shield.

Some Miscellaneous Tests

The missing word test is very helpful. The writer found that by using these the applicant was not only checked as to his knowledge of the machine but he was checked as to his ability to think fast and clearly. The object is to have him fill in the necessary words as he reads. Following are ten sentences regarding the automatic screw machine used in the missing word test. The sentences as shown are from the writer's copy. The words shown in parentheses are those omitted in the applicant's copy.

1.—The master cam drum is on the (left) hand end of the machine.

2.—A (hand control) wheel is provided on both sides of the machine.

3.—All tools are held in contact with cams by (springs).

4.—For (left) hand threading the threading mechanism action is changed.

5.—This automatic is provided with (four) cross slides.

6.—The chucks are of the (stationary) type.

7.—Stock spindles revolve in a (forward) direction.

8.—The machine turns any length up to (three) inches.

9.—Cross slides are contro'led by a (positive stop).

10.—In case of accident the machine is provided with two (safety clutches).

In Fig. 7 is shown a typical operation test. This shows ten operations being performed upon a turret lathe, the object being to have the applicant name as many of the operations as he possibly can. The detailed list follows:—

1, Machining cast iron bearing bracket; 2, Machining steel cast genera'or frame; 3, Machining steel cast gear blank; 4, Machining cast iron driving gear; 5, Machining malleable iron wagon hub plate; 6, Machining malleable iron hub; 7, Machining steel cast rear truck wheel; 8, Machining steel cast gear blank; 9, Machining cast iron gear blank, first operation; 10, Machining cast iron gear blank, second operation.

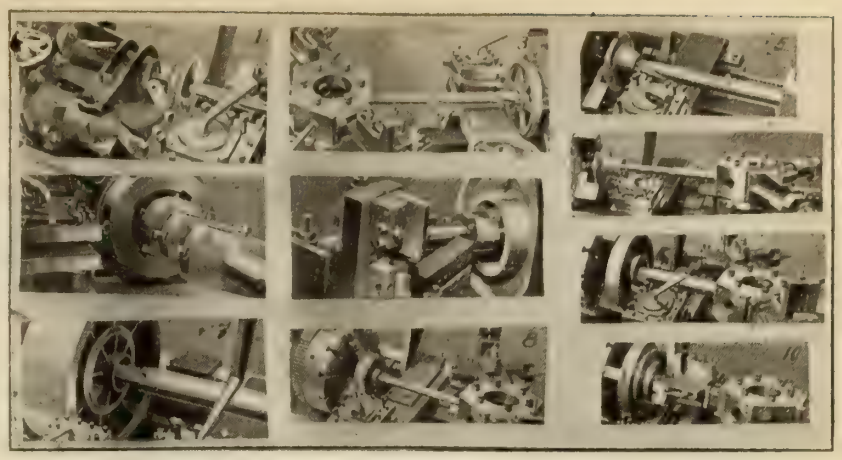


Fig. 7.—Typical operation test sheet.

It proved most interesting to ask the skilled operator to name all the attachments he could for a given machine. This practice is not always used, yet the more the man has to say about his experience the more desirous the writer would be to have him name the parts. Tes's with pictures of marked devices such as dividing heads, milling attachments for automatics and similar devices used in connection with various machines were prepared and used where the operator would be required to know the duties of them.

Future Value of Trade Test

Executives everywhere have heard much regarding the trade test and the possibility of its reducing their production costs. Now that good men are to be had, plant officials should adopt some method whereby they may know these men when they appear. To this end I have outlined the picture trade tests which proved so successful in my work at the Studebaker plant so that others might become familiar with it and find some'hing that would be of value in reducing their produc'ion costs. The idea is the same regardless of where it is used even if more must be added or some removed.

The Harding Co., of New York has just issued a new catalog, No. 12, covering their improved line of Quigley Fuel Systems and other equipment relating to the handling and burning of pulverized fuel. The bulletin treats on the subject in a thorough manner and is profusely illustrated.

Don't fail to subscribe for a trade paper, you owe it to yourself and your dependents to be efficient.

DON'TS FOR MACHINISTS

Don't grind round corners on the emery wheel.

Don't stamp steel letters or figures into cast iron scale.

Don't run the point of your lathe tool into the mandrel.

Don't tighten bolts and nuts tight enough to strip their threads.

Don't force a cap screw in a newly tapped hole without oiling it.

Don't use one mandrel to drive another out of a piece of work.

Don't try to drill a piece of work unless it is properly supported.

Don't put a mandrel into a newly bored hole without a lubricant of some kind on it.

Don't let the point of your drill touch your work and run along without feed on it.

Don't put a piece of work on centers unless you know that the internal centers are clean.

Don't turn a reamer backwards.

Don't file against the scale of cast iron.

Don't use a monkey wrench for a hammer.

Don't try to make a finishing cut on scale.

Don't drive a key too hard while fitting it.

Don't run a machine with the belt too loose.

Don't nail a piece of wood to the ceiling rafters to make the belt stay on.

Don't keep on using a drill after it begins to squeak without investigating the cause.

Don't straighten a heavy job between the lathe centers and take it for granted that the centers will run true afterwards.

Don't take a complicated piece of machinery apart without marking it properly to facilitate reassembling.

Don't take the live center out of a lathe without marking it, so that you can put it back in the same place.

Don't let the tail of a lathe dog pinch against the bottom of the slot in the face plate.

Don't drill sheet brass with a twist drill, use a flat or farmer drill.

Don't forget that a good center punch can be made from an old round file.

Production of Gears by the Rolling Process

Great Pressure Required—Machines of Heavy Construction—Gradual but Speedy Forming of Teeth—Die and Blank Positively Driven—Allowance for Shrinkage—Redressing Die Rolls.

IN THE actual process of rolling gears, the blanks are heated to a temperature of between 2,000 and 2,100 degree F. and are mounted on the work arbor of machine shown in article. They are securely clamped in place by means of powerful automatic chucks, mechanical, pneumatic, or hydraulic, the arbor carrying the blank and that carrying the die roll having been adjusted to the proper angle in respect to each other required by the type and dimensions of the gear to be rolled. The blank and die are then rolled precisely in synchronized contact under a rolling pressure of from ten to twenty tons. As the rolling commences, the die roll is automatically advanced to positive contact with blank.

As the rolling continues at high speed, the die roll is advanced until the teeth of die have penetrated to nearly full depth in the plastic gear blank. The advance is then slowed somewhat until the formation of the gear is completed and die and gear are in full engagement. This movement of the die roll is automatically produced by means of a positive cam mechanism which accomplishes a regular and constant progression in the first stage, and a gradual retardation as the die approaches full depth.

This cam mechanism is also designed to assure full penetration of the die roll tooth before heated blank has cooled below its critical temperature, and then continue the rolling with no die advancement until the blank has cooled somewhat below this point. As the rolling is done at an average speed of from four to seven hundred r. p. m., depending on the size of the machine and gear rolled, it is apparent that advance of the die roll per revolution is very slight. This assures a thorough kneading and working of the metal of the blank, and permits metal to flow freely and evenly. The fact that both die and blank are positively driven and accurately synchronized assures the die teeth penetrating the blank radially in exactly the same position on each revolution, and eliminates any slippage or tooth distortion in the finished product.

During the operation, the die is cooled by a stream of water directed against its face at a point farthest from the contact with the heated blank. Through the entire process, consuming only a few seconds, the temperature does not rise above a heat easily bearable to the hand. The chilling effect of the comparatively cold wet die on the heated blank causes a sudden contraction and consequent loosening of the scale formed, which is then thrown off by a centrifugal force resulting from the high speed of operation. Since the rolling is continued until the blank has cooled below the critical temperature, or in other words until after the formation of forging scale has ceased, the finished product of the process is free from scale and the formed teeth are not only perfectly shaped but are also highly polished on all contact surfaces. This fact eliminates any necessity for further finishing operations, except on the bore and faces of the hub, and on the ends of the teeth. For these operations, which may be semi-automatically perfomed, the gears are chucked on the rolled teeth, thus assuring accurate centering.

In order to assure the highest possible degree of precision of tooth form, machines designed for the production of accurate gears are equipped with additional mechanism for frequently and automatically reversing the shafts carrying the die and blank. This automatic reversing, or oscillation, at somewhat reduced speed, varying from about 80 to about 200 r. p. m., during the forming of the teeth, and nearly to the point of full engagement, assures displacement and building up of metal to an equal degree on both sides of the teeth, thus producing a symmetrical tooth.

The full cycle of operation on the oscillating type of machine, automatically controlled, is as follows: High speed direct rolling, the die advancing to positive contact with the gear blank; oscillating rolling at reduced speed until the teeth of the die roll reach within about 0.010 inch of full depth; planishing at high speed direct rolling until the die roll teeth engage the gear to full depth, and high speed withdrawal of the die roll.

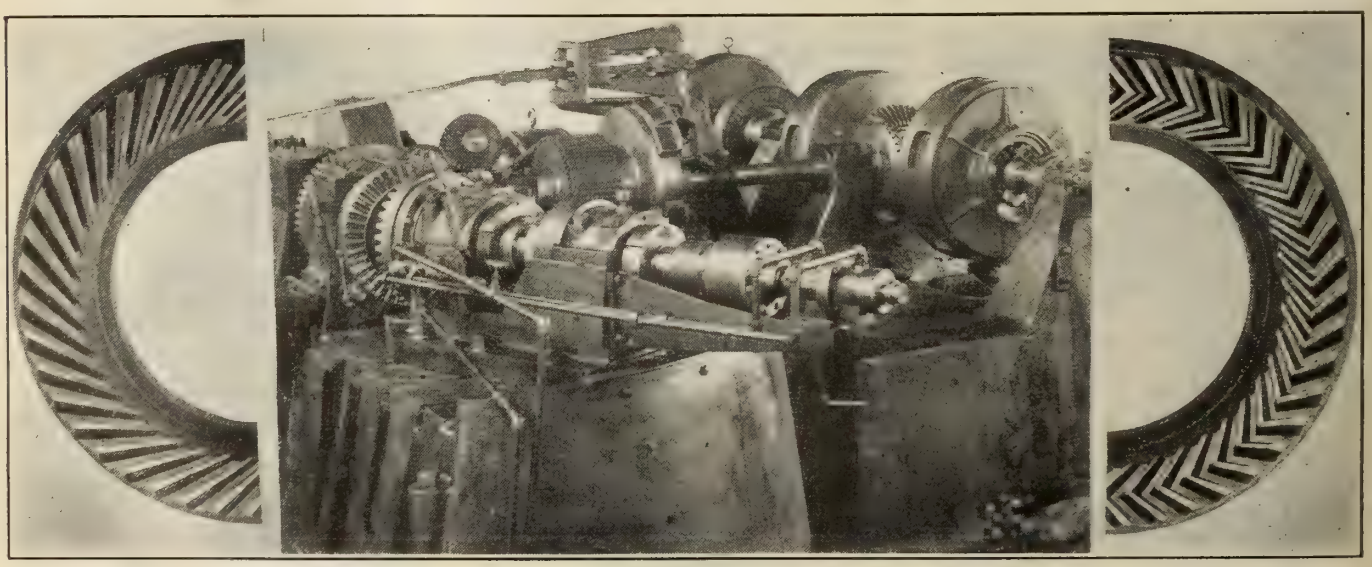
Shrouded Gears

The die rolls are somewhat narrower than the gear blanks and the effect of this is the production of gears which are partially or fully shrouded. Consequently if it is desired to strengthen the weaker member of a pair of gears, the shroud may be left on, either entirely or partially, or the shrouds of the two gears may be so proportioned as to equalize the strength of the two, increasing that of the combination.

Proportioning Die Rolls

As the actual operation of moulding the plastic gear blank ceases when the

We are indebted to the Anderson Rolled Gear Co. for the accompanying data and cuts.

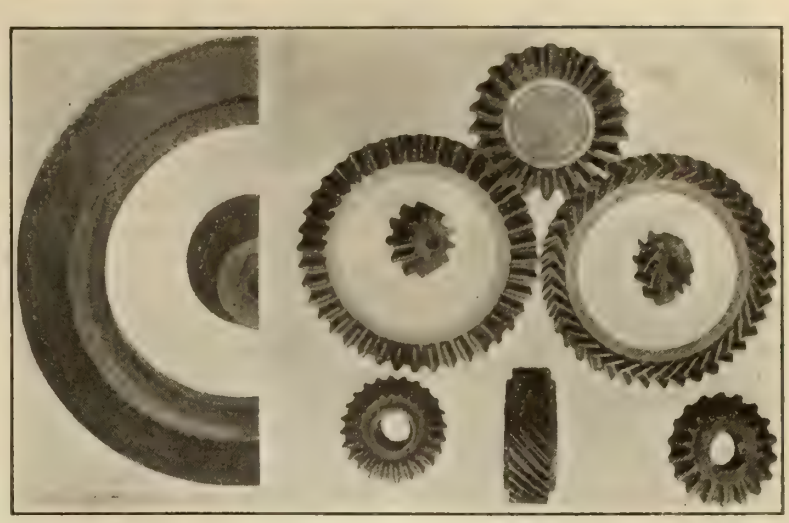


Centre.—Rolled gear machine showing operator's side. Left.—Two-piece ring die as cut. Right.—Two-piece die assembled for rolling herringbone gears.

heated blank has cooled below its critical temperature, and before there is any appreciable increase in the temperature of the die roll, it is of course necessary to design the proportion of the die roll for moulding the gears at that temperature. Consequently the dies must all be somewhat oversize as compared with the finished gears at normal temperatures. In designing the dies, this allowance for shrinkage of the moulded gears can only be determined empirically. However, the laws governing the action of metal under the fluctuations of temperature and the co-efficients of expansion have been so accurately established that a high degree of precision is obtainable in the proportions of the die rolls. Die rolls properly made and proportioned as above should as a rule permit of the production of at least five hundred accurately formed gears before any redressing becomes necessary, and should also permit a considerable number of redressings during the life of the die rolls.

All types and sizes of die rolls having the master form gear teeth can be redressed whenever wear or dulling makes it necessary. It might at first appear that this finishing, especially in the case of the gears of the spur type, would immediately introduce appreciable inaccuracies in the product due to the inevitable slight reduction in the diameter of the die roll, which must result from each refinishing. This would undoubtedly be true if the moulding were accomplished by a knurling process, that is if the blank were driven by the die roll or vice versa. It must be remembered, however, that both the gear blank and the die roll are mounted on shafts which are positively and independently driven and whose rotations are exactly synchronized by separate timing gears.

Thus, the angular distance between the teeth moulded on the blank is controlled and maintained constant, regardless of any slight reduction in the diameter of the die roll, or the size of the die teeth, the only effect of this reduction in diameter if it is appreciable at all, would be a very slight creep between the die and blank when in motion. This creep, however, would be held uniform and constant by the timing gears and, as the thickness of the molded teeth is dependent on, and controlled by, the width of the tooth space of the die, even a considerable amount of creep may be readily counteracted by reducing the thickness of the die roll teeth a slight amount necessary to maintain constant the width of the die roll tooth spaces. This modification of die roll proportioned, however, is unnecessary in the case of the crown or flat bevel tpe of dies used in the moulding of any type of bevel gears. With these forms the grinding of the teeth does not affect the diameter of the die rolls.

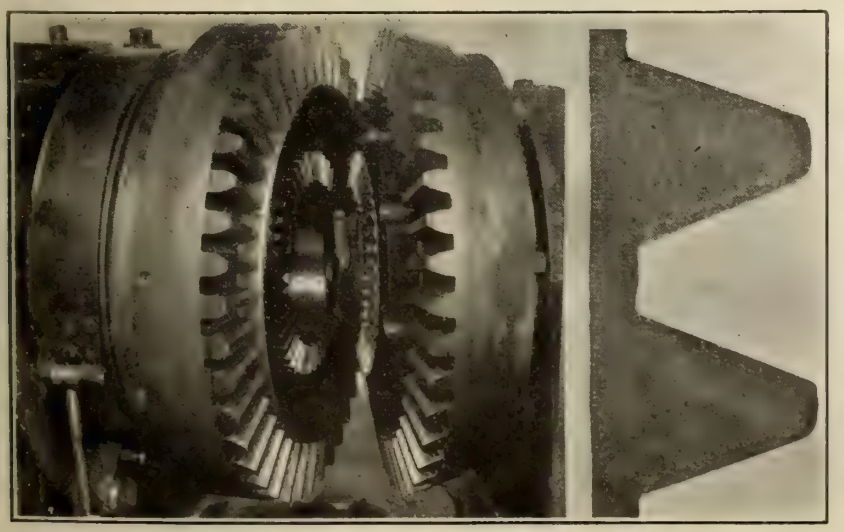


Left.—Group of rolled gears. Right.—Shows section of gear and pinion blank before rolling.

Inherent Strength

The inherent strength of rolled gears is due to the effect on the structure of the metal of rolling under high pressure. This process, and the thorough kneading action of the die teeth on the metal while in the plastic state, in addition to building up and compressing the metal into the formed teeth, gradually breaks up the coaster crystalline structure and produces a dense, thoroughly worked and fibrous structure. The minute crystals are rearranged in a trussed formation following the periphery of the finished gear thus tying the teeth to the body and equalizing the structural strains. The elimination of internal structural strains is so marked that no distortion occurs in subsequent heat treatment, and it has even been found unnecessary to use any clamp to hold the gear true in quenching.

The above factors of this rolling process are claimed to materially increase the harness and wearing qualities and make a more uniform result from subsequent case hardening or other heat treatment.



Left.—Showing work, die and turning gears.
Right.—Etched section of rolled gear.

NEW USE FOR COMPRESSED AIR

Compressed air is now being used in quarrying granite, and according to a writer in Popular Mechanics, has been found to have advantages over the usual method when the rock is devoid of joints. The method is as follows:

Two three-inch holes are drilled, a short distance apart and perpendicular to the rock, to a depth of eight feet. after removing the drills, a spoonful of black blasting powder is dropped to the bottom of each hole, tamped with clay, and the holes wired so that they can be electrically fired. The effect of the explosion is to start cracks in the rock at right angles to the holes. This operation is repeated a number of times, until it is certain that the cracks radiate from the bottom of the holes to a distance of about 75 feet. Into each hole, to slightly over half its depth, there is then inserted a one-inch pipe, and the space surrounding pipes in the holes is filled with sand, tamped so as to seal it against air pressure. Connections are then made between the upper ends of the pipes and the quarry air compressor, which continues to pump air at 100-pound pressure, into the holes until the block of rock above the cleavage already formed is torn from the surrounding rock.

Grinding Machine With Oil Feed Control

Developed During Quiet Period—High Traverse Speeds—Sensitive Throttle Valve—Flexibility of Table Movement—Shockless Reverse—Single Control Lever—Unit Type Spindles.

"IN TIME of peace prepare for War," is a well known saying, but several concerns have recently changed this to "In dull industrial periods prepare for the coming activity." They have been carrying on development work during the lull, with the result that they are now able to offer to the trade, new machines with several out of the ordinary features.

Take for example the machine shown. This is a new internal grinding machine, designed by R. L. Morgan, formerly principal owner of Churchill-Morgan-Crittsinger of Worcester, Mass. The Greenfield Tap & Die Corporation, Greenfield, Mass., have recently purchased the former mentioned firm, this now forming a part of the machine tool division with which Mr. Morgan is connected. W. H. Chapman, formerly assistant to C. H. Norton of the Norton Co., is assisting Mr. Morgan in this work.

Referring to the machine we find that the design is based upon the principle of high traverse speeds. The wheel spindle is carried on a wheel slide controlled by a feed-screw calibrated for feed increments 1/4,000 inch on the bore diameter of the work. The work table reciprocates upon ways at right angles to the wheel slide ways and carries a work head for holding and rotating the work piece.

The table traverse speed is controlled by the regulation of a highly sensitive throttle valve which admits oil under low pressure to a distributing valve, controlled by the table limit stops, and thence into either end of a double-acting cylinder and piston mechanism attached to a crosshead on the under side of the table. By a careful application of hydraulic principles a flexibility of table control is said to have been obtained which is practically impossible to get by mechanical means. Table speeds from two to thirty-six feet per minute are employed in the usual range of operation, while maximum speeds of fifty feet per minute are possible in the present designs. Special designs can provide for faster operation should an operator be found capable of keeping up to it.

There are no definite stations of speed setting as in mechanical drives, so that the most minute shading of speed is possible with no difficulty. Valve and piston design provides for shockless reversal due to cut-off and admission being controlled to cause acceleration curves to follow the law of uniformly accelerated motion. The element of time involved to accomplish a reversal is so small that on ½ in. stroke the table will reverse 320 times per minute without shock. A pressure relief valve allows the table to stop without damage when overloaded. This feature also allows accurate positioning of the table for grinding against a shoulder. A screw adjusted table stop locates the table which is held in place under oil pressure. By a combined use of reversing and locating stops, the table can be held to within .0005 in. limit on reversal, without any sacrifice in operating speed.

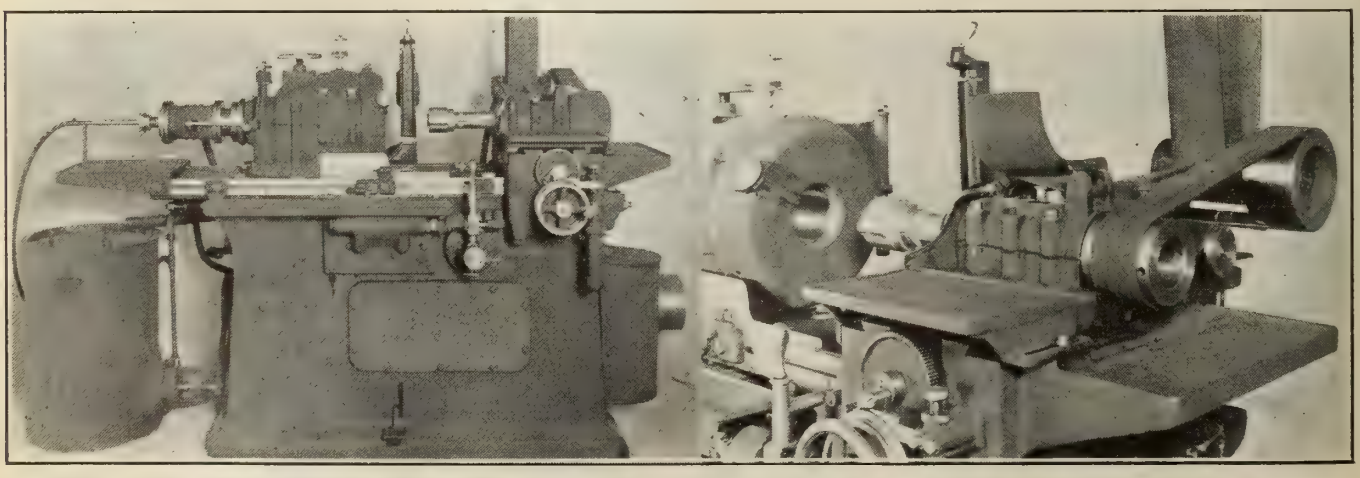
The work is revolved toward the operator at the top, while the wheel turns away from the operator at the top, the diamond contacts on the back of the wheel throwing the dust down instead of up into the air. Spindle bearing pressures are in the same direction whether the wheel is grinding or running free. This eliminates "hunting" in the bearings and overcomes one source of bell-mouth grinding. The standard spindle provided with the machine are mounted upon ball bearings so installed that thrust adjustment eliminates all shake in either axial or radial pressure action. A good commercial finish, free from chatter is obtainable with these spindles. Where exceptional mirror finish is desired, production rates are sacrificed to some extent and special types of spindles furnished. However the high operating speeds still show to advantage even in this class of work, and "fussy" finishing jobs are said to be accomplished more rapidly than on slower moving machines. The superiority of the machine is claimed to lie in its ability to remove stock rapidly in roughing operations. For holes 3 inches bore diameter or greater, the machine removes at least one cubic inch of hardened steel per minute, floor to floor, assuming a reasonably fast holding fixture.

For large bearing races having straight holes a special type of work head is provided which chucks several races end to end, holding them endwise between a plunger operated by oil pressure and an iris plate mechanism fashioned after a camera shutter. The plunger ejects the load at the end of the operation when the iris is opened. By the use of loading pots this fixture also grinds piston rings, etc. Machines in the field to-day, thus equipped are consistently showing floor to floor time of from ½ to 1/3 that of conventional machines now commonly used for this work. A single machine has ground 25,000 piston rings per 10 hr. day with a helper to load pots. The reason for these results is said to lie in the fact that the following points are featured:

1.—High table traverse allows the rapid exposure of work surface to the wheel face for depths of wheel feed well within the capacity of standard abrasive wheels. The wheel therefore actually cuts away more material in a given time without friction and heat losses attendant upon slow traverse operation.

2.—Rapid sizing is obtained because the rapid application of relatively light

(Continued on page 50)



Two views of the oil-feed grinding machine.

Overcoming Defects in Drop Forge Work

Fundamental Principles—Flow of Plastic Metal—Duplex Forging—Cause and Elimination of "Cold Sheets"—Producing Sound Forgings—Effect of Hammer Blows—Providing Space for Excess Metal—Alignment of Die Blocks.

By J. H. G. WILLIAMS

PURCHASERS of drop forgings often are of the opinion that once the dies are made, it is a simple matter to produce sound forgings, and the manufacturer often is of the opinion, privately of course, that the purchaser is unreasonable because he cannot understand how difficult it is to produce sound forgings, once the dies are made.

This disturbing situation is due to a lack of knowledge of the principles underlying the flow of metal in the plastic condition. Scientific research on the subject has not been linked up with the practical applications. The individual die makers have accumulated through experience an empirical knowledge. Every set of drop forge dies is largely the expression of an individual opinion as to the flow of plastic metal. Feeling that it is advantageous sometimes to study the reverse side, the accompanying set of photographs is exhibited to illustrate how metal did not flow in the manner originally planned.

Fig. 1 is a representation of a mechanic's square. That part marked A is the forging under discussion. The piece is forged double as shown in Fig. 2. There are at least two reasons for arranging to forge double in this manner: The rate of production is increased; and there is less weight of metal involved in the manufacture of two forgings by this arrangement, than would be if the two forgings were made singly. The flash or excess metal surrounding the outside of the forging is trimmed away and excess metal in the center is punched out, which leaves two forgings supposedly ready to machine for use.

At this stage of manufacture, the forgings are inspected, and during the production of the first few dozens, certain defects called "laps" and "cold shuts" were discovered, the causes and elimination of which constitute the basis of this paper. Low carbon steel 1½ x ½-inch is used as raw material. As originally made, the first operation consisted of redistributing the metal from the uniform section shown in Fig. 4, to that shown in Fig. 5. It will be observed in Fig. 5 that there is a mass or bunch of metal at A and B corresponding approximately to the positions that the bosses will occupy in the forging.

There are very substantial reasons for this preliminary distribution of metal.

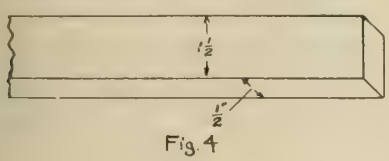
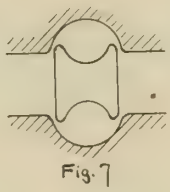


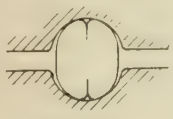
Fig. 4



Fig. 5


Fig. 6


Fig. 7


Fig. 8

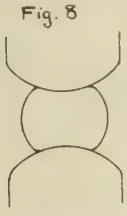
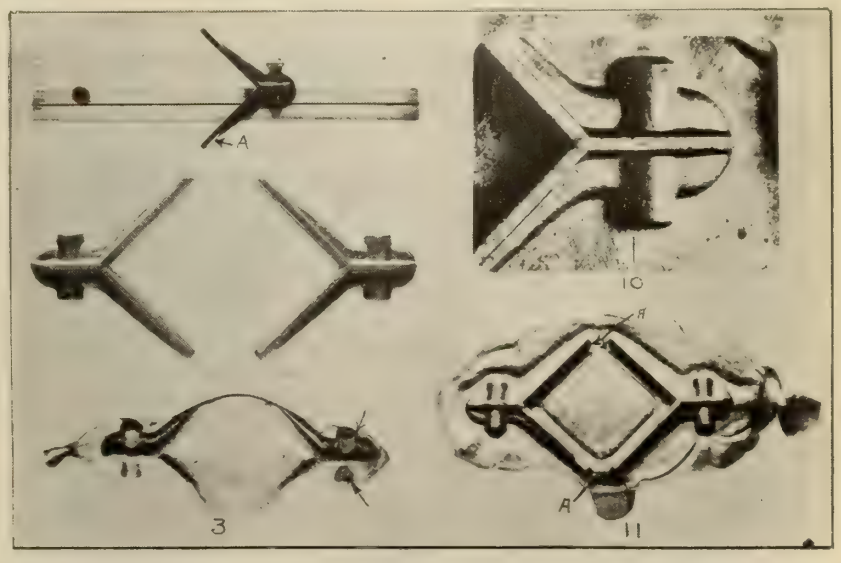

Fig. 9

Fig. 4.—A specimen of the stock used in producing the drop forged part. Fig. 5.—The uniform section of Fig. 4 is redistributed as shown, metal being massed at A and B at the approximate positions the bosses will occupy. Fig. 6.—The section of the partially formed forging as it comes from the first or "edger" operation. Fig. 7—For the second or "rough blank" operation, the piece is given a quarter turn. Fig. 8.—The lips of the cup-like section shown in Fig. 7 are lapped over by the pressure of the dies. A photograph of this operation is shown in Fig. 3. Fig. 9.—To eliminate the lapping effect, the edger may be rounded off somewhat as shown.

First, the productive life of the die blocks is prolonged by removing from the impressions the burden of this mass movement of metal. Second, by distributing the metal in masses to the approximate position required by the impressions in the dies, the formation of a true, sound forging is promoted. Fig. 3 shows the next forging step. It will be observed that this operation is an extension of the preceding operation. The original uniform section of the bar has now became a non-uniform section in which the metal has been distributed as masses into positions from which the forging impression can work or mold these masses into the desired finished shape. Particular attention is called to the boss indicated by the arrow. The formation of a forging defect, known as a "lap" is in progress.

The section of the partially formed forging as it comes from the first or "edger" operation is something like Fig. 6. When placed under the dies for the second or "rough blank" operation, it is given a quarter turn so that the cup shape faces the impression, Fig 7. The action of the dies upon the lips of the cup-like section is to lap them over somewhat as shown in Fig. 8, and it was the photographic representation of this action that was illustrated upon Fig. 3.

In order to eliminate this lap, it is necessary to modify the impression which changes the shape of the bar stock. Because this impression is sunk in the edge of the dies, both the operation and the impression, are referred to as the edger. It is clear enough that the desired redistribution of metal must be accomplished without the formation of the cup shape section of Fig 6. The



Top left.—Photograph of a mechanic's square, the portion marked A being the part of the forging under discussion. Left centre.—It has been found desirable to forge the piece double in the die as shown in this illustration. Fig. 3.—The third step in the forging operation, the arrows indicating the formation of the boss. Fig. 10.—A close up of the laps formed as shown in Fig. 8. Fig. 11.—After trimming, the forging was found to be split at the flash line as indicated by A.

edger may be rounded off somewhat, forming a section somewhat resembling Fig. 9, and this latter section will be found to operate under the rough blank impressions without the formation of a forging defect.

As a matter of fact, these laps were eliminated by omitting the use of the edgers. It was found after making the first dozen forgings, that the bar stock could be placed between the "breakdown" impressions, and produce the shape shown in Fig. 3, without the necessity for any previous preparation of stock, and without the formation of any laps. Fig. 10 is a close up of the laps just described. The rough blank shown in Fig. 3 is transferred to the finishing impressions, and emerges in the form shown in Fig. 11. This forging is ready to have the flash trimmed off and the center punched out.

Another interesting and at the same time instructive type of defect appeared at points A, Fig. 11. After trimming, the forging was found to be split at the flash line. Defects of this nature are common with piped stock, but an extended examination of the raw material demonstrated that the bar stock was sound and homogeneous. Figs. 12 and 13 show a magnified view of the metal in the vicinity of the split. The heavy black streak is iron oxide. It was noticed that this split was just above the flash line instead of in the center of the flash line as would be expected if the defect were due to the material itself.

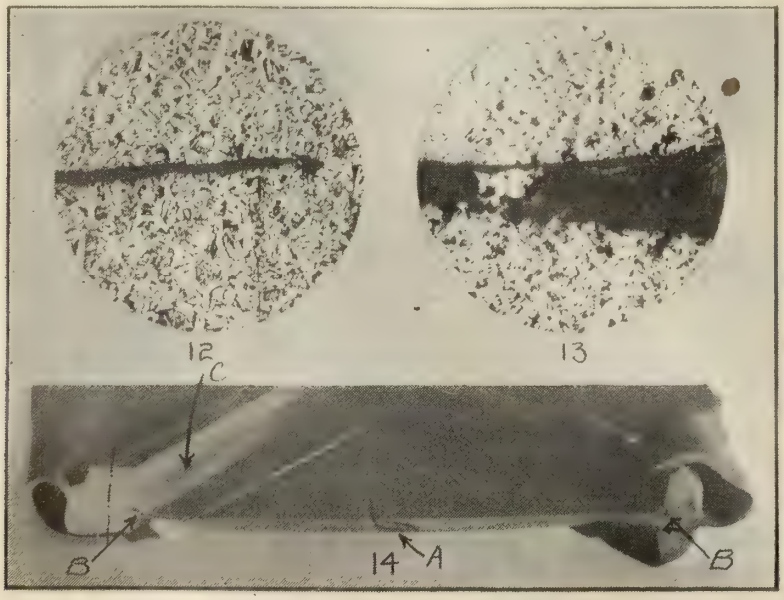
Fig. 14 shows a section of the forging that explains the formation of the defect. Any section of the blank must contain a greater area than the corresponding section of the finished piece. The forging operation consists of forcing out the excess metal while forcing the required metal into the shape contained by the impressions. As a direct result, this excess metal must flow sideways into the flash, that is, the excess will flow toward the outside, and toward the inside of the forging.

The laps in the center at A Fig. 14 illustrate waves of undulations of excess metal that traveled toward the center under the effect of each blow of the hammer, where they were folded over and compressed. Now, when this central web of metal is compressed by the blows of the hammer, the metal has no opportunity to flow elsewhere than to the outside and in so doing must pass through the arms of the forging. The effect of a flow such as just described is to fold the surface into the forging proper. This condition is shown by the black spots just above and below the flash on the right-side of the forging in Fig. 14, and also by the black streak in the left side. When the excess metal is trimmed off, the forgings will show splits or separations of metal at B, just above the flash line.

Several methods are used for removing the conditions which promote the formation of these defects and all are based upon the principle of providing a central web may be forged undersize may flow. For instance, the center can be punched out, or the thickness of the central web may me forged undersize previous to finish forging, or the bosses in the finish impression may be hollowed out.

Fig. 14 also illustrates one more forging defect, known as "mismatching." Referring to the arm on the left, it is obvious that the lower or bottom part of the forging is not symmetrical with the upper or top portion. A defect of this character is due to the upper and lower die blocks being slightly out of alignment. This photograph also demonstrates that the upper die impression shaved the edge of the blank, and formed the lap which is so clearly evident. While the lap was being folded over and pressed down, the metal in the central web may be forged undersize side and the inner surface of the lap and the upper surface of the web were pushed into the interior of the forging as indicated by the black streak at B.

The first forging produced after a hammer set up is carefully examined for forging defects, and adjustments or alterations are made to overcome the objectionable features. By carefully checking up each forging during this period of adjustment, the dies are finally brought into a condition such that a continuous run of perfect forgings may be produced.



Figs. 12 and 13.—A magnified view of the metal in the vicinity of the split shown in Fig. 11. X 100. The heavy black line is iron oxide. Fig. 14.—A section of the forging which explains the formation of the split defect. The illustration is about twice actual size.

HOW EXECUTIVES CAN SHOW A STEADY PROFIT

(Continued from page 39)

"Ordinarily business is conceived as starting with a manufacturing process and ending with a consumer. If that consumer does not want to buy what you have to sell him and has not the money to buy it, then the manufacturer blames the consumer and says that business is bad, and thus, hitching the cart before the horse, he goes on his way lamenting.

"There is no use waiting around for business to improve. If a man wants to perform his function, he must get his price down to what the people will pay. There is always, no matter what the condition, a price that the people can and will pay for a necessity, and always, if the will is there, that price can be met.

"It cannot be met by lowering quality or by short-sighted economy, which results only in a dissatisfied working force. It cannot be met by fussing and buzzing around. It can be met only by increasing the efficiency of production and, viewed in this fashion, each business depression, so-called, ought to be regarded as a challenge to the brains of the business communities."

GRINDING MACHINES

(Continued from page 48)

cuts minimizes spring away or gouging action of the wheel and draws out the surface uniformly.

3.—A single control lever controls all table motions. Pulling the lever toward the operator runs the table back to its station where it remains while size plugs are being used.

4.—A foot pedal stops and starts the work. 5.—Heavy construction minimizes distortion and vibration, and allows accurate positioning in spindle feeding. 6.—Feed index mechanism is located by feel as well as by sight, allowing the operator to watch his work.

7.—The diamond holder fixture swings out of the way, but can be instantly located at previous position on the table by a single motion. A water supply is provided for cooling the diamond. 8.—Spindles are of the unit type and exchanged as fast as a man can slide one out and put in another. 9.—The machine is self-contained except for a portable water tank which is made separate for quick cleaning. 10.—Engineering service is maintained and estimates are guaranteed as a performance on any particular job where all data with regard to fixtures, materials, etc., are submitted. The Canadian factory at Galt, is handling this machine in Canada.

Practical Ideas for Shop Executives

CAPACITY OF A PUNCH PRESS

By I. N. B.

To determine the rating of a punch press square the diameter of the crank pin and multiply by 3.5. This will give the capacity in tons. Suppose the diameter of crank pin is 3 in. Then:

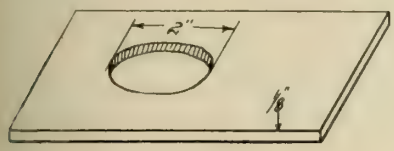


3 x 3 x 35 = 31.5 tons.

The above rule is used by one of the large press manufacturers in the States, and applies to presses of limited stroke only. This may be used to advantage when giving work to different presses.

To find the pressure in tone required to punch circular holes in sheet steel, multiply the diameter of the hole by the thickness of sheet and by 90.

Example:—To punch a 2 in. hole in ⅛ in. stock.

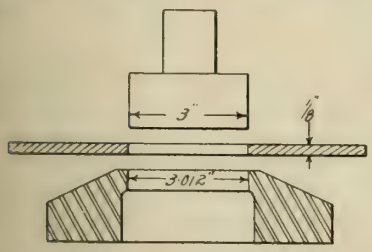


2 x .125 x 90=22.5 tons.

For brass, use the factor 75.

In calculating the pressure required for irregular holes take 1-3 the total length of outline and multiply by the thickness and the factor. Example: 2 in. square hole in ⅛ in. steel sheet.

1-3 of 8 x .125 x 90=29.92 tons.



It is understood that these rules are only approximate, as the pressure depends upon the composition of the metal, the shear given the cutting edges, and the clearance between the punch and die. Practice has demonstrated the following clearances to be about right: for soft steel, thickness of stock divided by 20; for medium hard divide by 16; hard rolled stock divide by 14. Example: clearance when punching ⅛ in. soft steel would be .125÷20=.006 in.

FIVE SIMPLE JIGS

By J. H. M.

In the making of parts for an "Ironer," several jigs of varied character, are necessary. The Sumbling Machinery Co., Toronto, make a varied line of ironers, and the illustration shows a few of the jigs used on this work. Take for example, A.

Here we have a jig for drilling the bearing link. There is a right and left hand casting for these links, the boss being on the opposite side as the case may be. The one jig does for both right and left styles. Adjustable screws with lock nuts provide the ganging points, and a ⅞ in. hole is drilled at (a), a 1 in. hole at (b), while the two bushings (c) and (d) drill a ½ in. hole in the right or left hand bosses, depending upon which is in the jig. A swinging support, not shown on photo, takes the thrust of the 1 in. hole while being drilled.

The jig B is used to drill the pressure link shown at (e) and a 15/16 in. and ½ in. hole are drilled at this operation. The method of holding down the bushing plate (f) is worthy of attention. The spring clip (g) fits into a small nick in the plate (f) which holds it sufficiently tight for this style of work. It is quick and effective for light work of this nature.

The jig C drills four ¼ in. holes, the piece being shown at (h). It is placed on the centre stud shown, which is threaded, and after drilling each hole, the jig body is turned over 90 degrees.

We next come to the jig D. This is used to drill the double eye hook shown at (k). This piece is drilled at the side with two ½ in. holes, and the end of boss is drilled for ½ in. tap.

The last jig shown in this group, E, is used for drilling the spring cage shown at (m). A ½ in. hole is drilled at end of boss, and a 33/64 at the other end. An eccentric form of clamp is used. These jigs, in principle, are applicable to any shop, and may contain some useful hints as they are simple in character, yet effective in their work.

MEETING EMERGENCIES

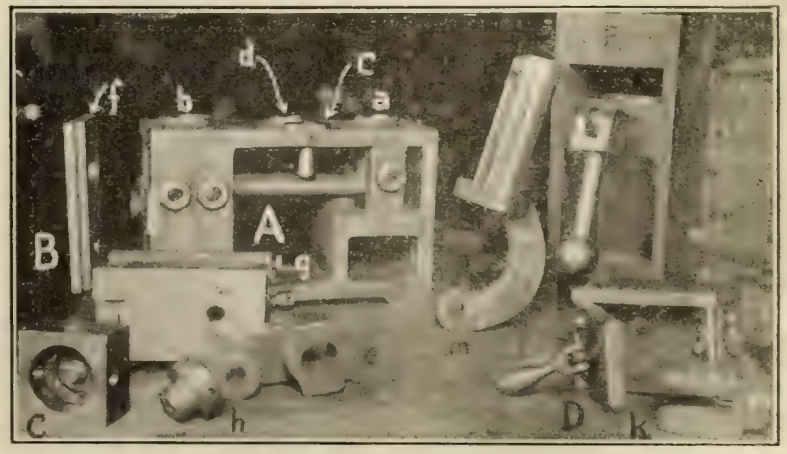
On one occasion our punch press was busy when we needed a quantity of leather washers in a hurry. Having the punch and die on hand, we rigged them up on a drill press equipped with lever feed. The die was secured to table and the latter locked in position. The operation was successfully performed by a girl.

At another time we were in need of some special bronze wire, No. 12 gauge. We had only No. 10 gauge in stock, so to avoid delay in getting the small quantity required, we made a drawplate with four holes in it, with a reduction in each case of about .005 in. The drawplate was held in the lathe chuck, which, of course, was stationary, and the end of the wire passed through the plate in the usual way and gripped in the tool post. The carriage was then moved along the bed to the limit of its travel, the wire released and the operation repeated until the required amount was obtained.

To overcome the constant slip of a 40 in. pulley, we replaced the split wooden bush with one of cast iron, through which passed a number of ⅝ in. set screws, impressions being made in the shaft to receive the points of the screws. This ended further trouble.

HARDENING HIGH-SPEED CUTTERS

A good method for hardening high-speed form cutters is to use a muffle gas or oil furnace for heating the cutter. The cutter should first be preheated to a temperature of from 1600 to 1700 deg. F., and then placed in a muffle furnace and heated to a temperature of 2200 deg. F. As soon as the cutting edges have attained the latter temperature, the cutter should be removed from the furnace immediately and quenched.



Five simple jigs for "ironer" parts.

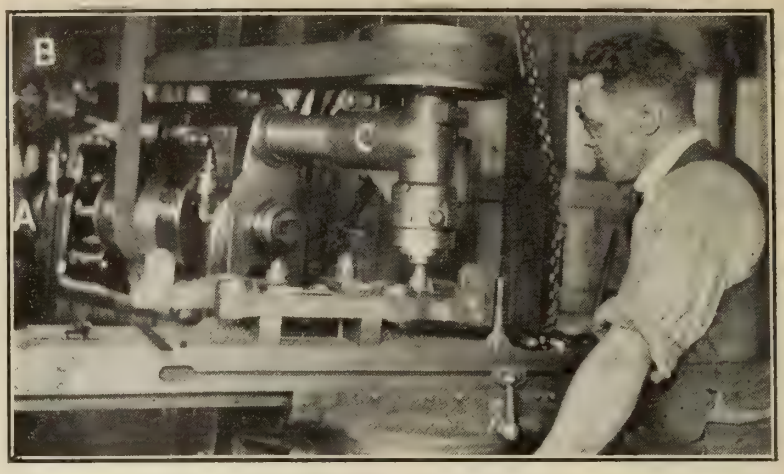
SIMPLE VERTICAL ATTACHMENT

By J. H. M.

For the shop which cannot afford the price of a regular vertical milling attachment, the idea shown in the photograph will be found to be well worth while. The device depicted was made at the Sumbling Machinery Co., Toronto, and briefly here are the necessary parts.

A pulley was placed on the rear end of spindle as shown at A. Two smaller pulleys, attached to a bracket were fastened to the frame of miller at B, being easily detached when not required, and a body portion C was bored out to fit on the over-arm of machine.

The spindle construction was of the usual design, ball thrust collars being located at the lower end. A pulley was fastened at top, this receiving its power from the spindle by means of the belt shown. The attachment has proved very useful for varied work, and could well be adopted by other plants.



Vertical Milling Attachment.

SCLEROSCOPE TEST

By J. Davies

I am much obliged to Mr. Brigham for his answer to my questions regarding the testing of balls with a scleroscope. I read his reply with great interest, but I do not think the way the balls are held, and the glancing blow, entirely explains the curious results. Since reading Mr. Brigham's reply I made another test.

I got a 1¼ in. ball which scleroscoped 95. Then I got a ⅜ in. ball which registered 42 under exactly the same conditions, great care being taken to get the blow exactly in the centre. The makers claim that these balls are of the same commercial hardness. An interesting fact is that the maker of these balls states that a 7/16 in. ball registers the same whether hard or soft.

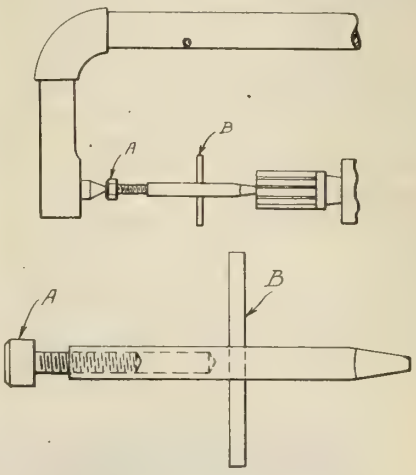
In reference to cutting the threads on the jaws of a universal chuck, I had in mind what would be the best method in an ordinary machine shop where they carried out their own repairs and had no special machines. How is the relieving done for the travel of the jaws? That is the most important part of the question.

TEMPERING OIL SPRINGS

Small coil springs may be tempered in a furnace burning wood by being first exposed to the flame, and then quenched in a mixture of 10 quarts of rosin, 12 quarts of tallow and a barrel of fish oil. More tallow should be added if the springs break after tempering, but if the break is only due to brittleness and not to hardness, a 6 in. diameter ball of yellow beeswax should be added The springs can be drawn to a reddish purple by being laid on a frame with horizontal radial arms mounted on a vertical rod. Held on this star-shaped contrivance, they should be lowered into a crucible of molten lead until drawn to the color desired.

REMOVING LIGHT SCREWS

Screws, used for holding shell mills on milling machine arbors, very often work themselves so tight that it is impossible to remove them with an ordinary screw driver and other drastic methods, such as a hammer and punch are brought into play, with results hardly beneficial to either the screw or the arbor. The tool shown in the drawing overcomes the objection to a hand operated screw driver, by compelling the blade to keep in the screw slot while turning. The back end of the tool is tapped out for a screw A the same pitch as the screws used on the arbors, the head of this screw being centre drilled. A hole drilled through the centre takes



Removing light screws

a piece of drill rod to act as a handle B to turn the screw driver. When it is desired to remove a stubborn screw the overarm support is brought down as shown and pushed snugly into the centre hole on the screw head, after which the nut binding the support is tightened. With a wrench on the screw A it can be adjusted to push the blade of the driver further into the slot if required. Most screws will yield to a gradual push on the handle B and the most stubborn to a light tap with a hammer. A wrench should be held on the screw A to prevent it from turning, as the screw is backed out of the arbor.

BABBITT FOR GRINDER SHAFTS

By D. A. Hampson

Like other shops, ours found that one of the ever recurring repair jobs was rebabbitting grinder spindles. In spite of educational campaigns, workmen will wear emery wheels out of round and they will monkey with the bearings, one time getting the latter so tight that the babbitt cuts and the next leaving the caps so loose that the boiler shop music starts—these little "attentions" coupled with the nature of the work generally makes the grinder a hard machine to keep in shape. Some form of adjustable bearing is necessary. The babbitt bearing, with its anti-friction properties, answers about as well as anything we know. Shops usually carry two or three grades of babbitt for general repair work—say, genuine babbitt for engines and high speed shafts, No. 4 metal for cheap work and filling purposes, and a grade between. And so when the grinder needs new bearings, one of these is selected. In the end, one does about as well as the other.

We had made some feeble attempts to get a more durable grade of babbitt for grinder work but we found the salesmen invariably passed off their most expensive metal on us without regard (or knowledge) of its qualities. Finally we hit upon a good idea. We went to the local street railway company and asked what they used in their motor case bearings. Now if there is anything that gets a pounding similar to that on a grinder it is these street railway bearings—and, knowing that trolley roads operate on a strictly utility basis, our conclusion was that they would have a durable bearing metal. We got the metal and it has proven better than we expected, so much so that we have put it in other bearings since. It is a bearing material made to stand heavier work than on grinders together with a higher surface speed of the journal. Which goes to show that it is possible for the progressive shop man to learn from other fields, even from the rather despised car barn practice.

New Things in Shop Equipment

HELICAL-FLUTE EXPANSION HAND REAMER

A helical flute expansion reamer in which the cutting action of the teeth is said to be such that all clatter is eliminated has recently been placed on the market. True and accurately sized holes can be produced. The reamer is made in various sizes by the Millersburg Reamer and Tool Co. of Millersburg, Pa.

MOTOR DRIVEN DISC GRINDER

A new disc grinder designed for sanding pieces such as segments, angles, core prints, circular and taper work, etc., has just been placed on the market. The machine is portable, of rigid construction, and fitted with exhaust system for dust deposit. The disc is of steel, 13 in. diameter and spindle has a speed of 1,725 R.P.M. Table is of cast iron, 9¼ in. by 21 in., and may be tilted to an angle of 45 deg.; 25 deg. by means of handwheel. Graduated index permits accurate setting. It is also provided with circle segments and duplicating gauge. Motor is direct connected to disc shaft and runs on ball bearings. The machine is made by the Oliver Machinery Co., Grand Rapids, Mich.

SPECIAL DRILL STAND

To accommodate portable electric drills so that they may be used as bench machines there has recently been placed on the market a special stand. The unit to which the drill is attached may be clamped in various positions along a vertical bar, according to the height of the work. The drill is then raised and lowered for the drilling operation through the manipulation of a long lever. The motion in this case being all in the unit, and the clamps remain rigidly attached to the vertical bar. The stand will accommodate the ⅜ and ½ inch drills manufactured by the same firm. The weight of the stand without the drill is 68 lb. The stand is manufactured by the United States Electrical Tool Co., of Cincinnati, Ohio.

NEW LIFT TRUCK PLATFORM

A platform which may be adapted for use with either hand or power lift trucks is now being manufactured. The platform consists of wood planks to the bottom of which are bolted two steel skids. Riveted to these skids are four steel brackets in each of which a wooden leg block is bolted to support the platform. The blocks are renewable and can be replaced as they become worn, and they also can be made of different heights to suit the truck used. The skids flare outward at each end which gives easy access to the truck. No projecting rivets, nuts or bolt heads which might come in contact with the truck are permitted in the construction of the platform. The platform is manufactured by the Standard Pressed Steel Co. of Jenkintown, Pa.

STAY BOLT THREADING MACHINE

A machine that has for its object the saving of time in the threading of staybolts has just been placed on the market. The makers have used their standard turret machine as a basis of construction for the staybolt threads, using a special attachment to carry the die heads. The regular slide may be used for ordinary work. The forward die is specially designed so that a large opening of the chasers permits of insertion of the button head before gripping in the chuck. A steady rest is provided between the two die heads. Die heads are operated automatically by means of cams on rear bar, these cams controlling the action of the chaser to suit the thread being cut. The machine is manufactured by C. H. Breaker, Indianapolis, Ind.

MOTOR DRIVEN HACK SAW

A hack-saw which is electrically driven by a motor which, together with its control switch, is built into the machine, so as to be out of the way and at the same time well protected, has recently been marketed. The slide of the hack saw is above the blade for the purpose of keeping it free from chips and dirt. The vise swivels and is graduated to facilitate setting for angular cuts. The stroke of the machine is adjustable from 5 to 7 inches. Two speeds, one of 45 and the other of 90 strokes per minute, are provided. A sixteen-inch blade is used, with gravity feed. An automatic stop shuts off the motor at the end of a cut. The motor is mounted on ball bearings and can be furnished for all standard circuits. An oil pump can be furnished if required. The machine weighs only 450 pounds and can be quite easily mounted on a platform on wheels for portable work. The Louisville Electric Mfg. Co., Louisville, Ky., are the manufacturers.

PORTABLE WELDING OUTFIT

An oxy-acetylene welding outfit which is also provided with a tube that adapts the apparatus for burning carbon from automobile and marine engine cylinders, has been recently placed on the market. It has been designed for use in machine shops and service garages. In addition to the carbon burning tube the equipment consists of a welding torch, five welding tips, single gauge oxygen and acetylene regulators, oxygen and acetylene hose, and several other necessary parts. The whole outfit is contained in a fibre case. The welding torch is 16 inches long, operating on the balanced pressure principle. Mixing takes place in the tip. The seats of the regulators close with the pressure rather than against it. The carbon-burning tube fits into the torch head similarly to a welding tip. It may be convienently attached and replaced as it becomes worn out. The outfit is manufactured by the Alexander Milburn Co. of Baltimore, Md.

BENCH AND FLOOR TYPE ELECTRIC GRINDER

An electric driven grinder having ½ h.p. motor, and designed to do duty as a bench machine, but which can also be fitted with a cast iron pedestal for floor work, has recently been placed on the market. The grinder is fitted with double-row ball bearings and a motor suitable for operating on either 110 or 220 volt circuits, single, two or three phase, alternating current. The grinding wheels are 8 inches diameter, ¾ inch face, with ⅝ in. hole. The wheels are extended well away from the motor casing, to permit the grinding of comparatively long or irregular-shaped pieces. One coarse and one fine wheel are regularly supplied. The switch is located on the top and centre of the motor housing and is of the make-and-break design. Ten feet of reinforced cord is regularly supplied with a plug. The bench type of machine weighs 110 pounds and the floor pedestal equipped machine weighs 225 pounds. The machine is manufactured by the Standard Electric Tool Co. of Cincinnati, Ohio.

RATCHET WRENCH SET

A set of ten wrench sockets which accommodate all sizes of nuts from 7/16 in. to 1 in. inclusive, adjustable T-handle, reversible ratchet, universal joint, extension piece, two screw drivers and a box wrench, all packed neatly in a well finished wooden cabinet, has recently been placed on the market. The wrench sockets are manufactured by a special process, which, it is claimed, gives the metal greater density and strength. The sockets are provided with hexagonal heads over which the wrench members fit when they are in use. The T-handle has an adjustable cross bar which can be used in a central position or adjusted to obtain the maximum leverage. The ratchet may be set for use either right or left hand. The extension piece is used between the T-handle and a socket, when required to get at nuts in inaccessible places. The Eastern Machine Screw Corporation of New Haven, Conn., are the manufacturers. The outfit is marketed under the trade name of "H & G."

STRAIGHTENING PRESS

A straightening press, intended for handling large quantities of parts without removing same from between centres, has recently been designed and placed on the market. A round bar, on which centre brackets are mounted, is fitted to a sliding head provided with a roller bearing. The bar can be moved freely to the right or the left to permit the straightening or bending of work at any point along its length. The sliding head unit is pivoted to the frame of the press, and held in a horizontal position by a vertical shaft equipped with a compression spring on both sides. The head has an up and down movement. An adjustable stop screw permits of set-ups of work that ordinarily would not clear the blocks. The press hand wheel is graduated into twenty-five equal spaces. By turning it through one space a movement of one one-thousandth part of an inch is obtained. The amount that the part to be straightened is out of truth can be read in thousandths from a dial indicator supplied with the machine ,and used on the work located between the centres. The press is used largely on internal combustion engine crankshafts and many similar parts. The machine has been developed by the P. A. Geier Co., of Cleveland, Ohio.

SAFETY TAP AND DRILL CHUCK

A safety chuck for straight shank drills and taps has just been offered to the trade. The chuck has a safety device intended to prevent small drills, taps, reamers, counterbores, etc., from breaking, it is intended for hand feed only. The safety device is a friction and a soft steel pin that shears when the cutting tool is overloaded. The drill or tool is held in a hardened collet by a Bristo hollow safety set screw which positions on a flat in the tool shank. A soft steel driving pin goe through the collet and a hardened male friction. The friction is adjusted by hand with a knurled nut which is on the outside of the chuck body. When the friction is too tight and the tool sticks, the pin shears before the tool breaks. The female part of the friction is keyed to the body, and the nut bears only on it, this prevents tightening and loosening when the tools are run forward or backwards. A ball race takes the end thrust. There are three sizes of pin holes in the standard collet, the smaller holes are for high speed drills which are weaker than carbon drills. For chucks that are used on one job only, collets with one pin hole are furnished or the other holes are plugged. The pins are held in place by a spring plunger. These drill chucks are made by the Save All Tool Co., Waltham, Mass.

FLEXIBLE SHAFT COUPLING

A flexible shaft coupling which has a free turning motion around hardened steel pins and a sliding motion in a tongue and groove connection is now being marketed. Two styles of this design of coupling are made. A uniform velocity ratio, between the shafts connected, is maintained, irrespective of the amount of angular or lateral misalignment. The design also permits of ample end float essential when coupling up alternating current motors. In such installations the two sliding members slide in and out as occasion demands. One design requires two hubs to be keyed on the ends of the shafts to be coupled. Two rings on the hubs engage each other by means of a tongue and groove construction, and bearing pins driven transversely into each hub. The other design is similar except that the pins are driven directly into the shaft ends, the hubs being omitted. The pin in one shaft engages the slotted ring mounted on the other shaft end. The component parts of the couplings are made of machine steel and are heat treated. It is claimed that with slight changes in the construction a positive transmission can be had between shafts set at any angle up to 90 degrees. The coupling is manufactured by C. H. Breaker, Indianapolis, Ind., and marketed under the trade name of Bartlett, the name of the inventor.

TUBE WELDING MACHINE

A new type of tube welding machine designed for the quantity production of large diameter thin gauge tubing has been recently brought out. This machine is especially adapted for use in tube manufacturing plants where it will be set up and used for long runs on one size tubing. There are two sets of rolls, one for feeding and one for welding. The drive is by belt to a three step cone pulley from which the drive to the rolls through the gearing, is taken off. The welding rolls have annular depressions feed rolls, in front, are adjustable. The welding rolls have annualar depressions on top to receive cooling water and a water circulating system can be provided if necessary.

The welding torch is made by the manufacturers of the machine, and is of the multiple-jet, water-cooled type. Both the tip and the barrel of the torch are cooled by circulating water, to maintain the conditions necessary for successful continuous welding. The torch holder permits of vertical and horizontal adjustments of the torch, and the varying of the angle at which the tip is presented to the seam to be welded.

The maximum capacity of the machine is for tubing 6 in. in diameter made from No. 10 gauge. Although designed and built for quantity production of one size and gauge of tubing, the machine can be set up for any diameter and gauge of tubing, within its capacity, by employing rolls grooved to suit the desired tube diameter. All rolls whether for large or small diameter tubes, are of the same size over all as the normal centre distance of the rolls and their mating gears must be maintained. The Davis-Bournonville Co., of Jersey City, N.J., have developed, and are marketing, the machine.

BALL BURNISHING BARREL

This new type of burnishing barrel differs from older types in the fact that it contains fixtures for holding the work during the burnishing operation. The usual method is to let the work tumble freely in the balls, soap and water. To some extent this caused the scratching of the work. The new design of barrel has an eight sided periphery, each side of which is fitted with a hand hole, hinged cover and lid. These eight sides are located between two circular discs which carry the gudgeon pins or shafts on which the barrel revolves. Each one of the eight covers has bevelled edges which fit into seats machined to suit, in the frame of the barrel. A packing ring makes them absolutely tight. Pressure is maintained between the surfaces by means of a flat spring located on the backs of the covers and which acts as a handle when removing the cover. The fixtures for handling the work are located on the inside of the lids which fit inside the covers. Several sets of interchangeable lids can be procured for one barrel which permits of extra pieces being placed in the fixtures on the inside of the lids while the burnishing process is going on. With work that is to be plated, plating operations can be carried on without removing the work from the lid, and then the lids can be placed in the barrel and the final burnishing can be accomplished without removing the work. The machine is belt driven, a fast and loose pulley with gear reduction being furnished. The barrel is manufactured by the Abbott Ball Co., Elmwood, Hartford, Conn.

BOOK REVIEWS

The Norton Co., Worcester, Mass., is circulating a 28 page illustrated booklet in which metal polishing is described. The booklet goes into detail as to the materials to be used in this work, and the various kinds of operations to which the different materials are best adapted. They have also published a booklet in which factors affecting grinding wheel selections are given. According to the booklet, grinding is such an important part in modern manufacturing processes that an understanding of the factors involved in selecting a grinding wheel for a certain job is extremely helpful to the shop superintendent, mechanical engineer, foreman and workman. The booklet points out just what factors have to be considered and the relative importance of each. Anyone desiring copies of these can secure them from the Canadian office situated at Hamilton, Ont.

The Ingersoll-Rand Co., of Sherbrooke, Que., are issuing a revised service information sheet on "General Instructions on the Use and Care of 'Little David' Air Tools."

The Steel Trough and Machine Co., of Tweed, Ont., have just issued a new catalogue, No. 32, covering their complete line of heavy sheet steel goods. It is well illustrated with valuable data.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Workers Want Longer Working Day

TO WEAKEN British competition in the world's markets, Germany some 30 years ago began propaganda in England, particularly in the machinery field, for shorter hours and reduced output. The campaign was pretty successful. It developed into a nation-wide strike of machinists in 1897. The machinists lost, but the propaganda has been carried on since, there and in Canada.

While the Germans were urging these means of increasing costs of British goods they showed no signs of carrying out this same policy in their own country until the defeat brought Socialists temporarily into power when in some parts and industries of Germany they adopted the eight-hour day. Latest news from there shows that the workers themselves, as a result of experience, are wondering whether it is going to pay and their shrewdest leaders are now asking for a return to the longer day. An interesting review of the situation appears in another column.

Be Sure—Then Go Ahead

"YOU SIMPLY cannot afford to pass up this opportunity," remarked a salesman recently to a prospect, and upon being asked to explain himself in detail, went on to propound reasons why his proposition should be accepted. As it happened he was an advertising salesman, and while his arguments sounded all right to himself, he did not realize how little impression they were making on his prospect who was a specialist in a certain type of business machine. The salesman was trying to convince the specialist that he should sell his equipment to coal mines, and, of course, that he was offering him the best and only medium for such a purpose. Feeling that he had covered the situation quite thoroughly the salesman paused, but was greeted with this question:

"Have you ever been down in a coal mine?"

"Why, no," was the reply in a somewhat astonished tone.

"Because if you had ever visited a coal field you would realize immediately that the arguments you have been giving me do not hold water. I have been at the mines for the past few months trying to sell the very equipment you claim I can dispose of through your medium," continued the specialist, "and I find that their methods of working do not lend themselves to such machines."

Before the salesman left he heard further enlightening truths, but while this happened to an advertising representative, there is a lesson in it for every salesman and manufacturer, irrespective of the product he sells or produces. It is this:

Study your product thoroughly. If you are making the goods ask yourself if they are being manufactured and packed in the best way possible to sell to the trade. If you are selling the product, do not attempt to convince a prospect before you know the details of his business or requirements. Get a walk through his plant if you can, and failing this, discover through other channels, the best manner of approach. Do not step in blindly and tell him he cannot afford to pass up your proposition, for ten chances to one he will make you prove your rather loosely worded statement.

How Much?

THE NEWS from the building fields is discouraging. Though 90 per cent. of all unemployment in Canada is in these trades; though employment in the building industry shows a shrinkage of 42 per cent. against a general shrinking in all industries of only 12 per cent.; though the 1922 outlook for building is for at least 25 per cent. less than last year; labor agitators are still urging and getting the workers to hold out for war-time hourly wages. In some trades, like carpenters, while there is a nominal scale of 90c per hour the real wage is 80c and many are working for less.

Manufacturers generally will support the Building Trades Unions in getting the highest wages the industry will bear —the highest price the public will pay for homes and larger buildings. If workers can get in 300 days at the hourly war wages it would mean busy factories. But manufacturers, judging from experience, feel very sure that the public will not again pay war prices for building, etc. They have dropped their own prices over 50 per cent. in some cases—and every week shows a further decline—in an effort to get orders, but still the demand grows less and more plants shut down.

Manufacturers advise labor leaders to take their mind off the war scales long enough to study general conditions. If they give assurance of steady employment for 1922 and lay solid foundations for succeeding years, then they would be justified in holding out for the present high rates. If they do not, they should quickly reduce and keep on reducing them, as the manufacturers have done with commodities, until they can find the basis on which buyers will come in freely. Then they can increase as the demand warrants. There has been a heavy reduction in salaried incomes all through Canada. It is strenuous conditions not happy ideals we are facing to-day. Some income is better than no income and public charity.

The records for automobile fatalities for Toronto for the eleven months of 1921, as compiled by the Safety League, show a total of 45 such deaths on the streets of Toronto. This figure is a noticeable improvement over 1920 when there were 64. which means a reduction of 30% in fatalities, in spite of an increase of thousands of motor cars registered in 1921. In the months of January to November inclusive, 1919, there were 47 automobile deaths on the streets of Toronto, so 1921 shows a slight improvement there too.

Steel Business Is Picking Up Gradually

No Important Price Changes—Open Weather Helping Steel Trade—Small Tools and Supplies Are Fairly Active—Machine Tools Only Fair—Scrap and Non-Ferrous Metals Weak

STEEL PRODUCTION SHOWS GOOD INCREASE

THE AMOUNT of business being closed on the Canadian steel market can safely be said to range from 50 to 55 per cent. normal, with a slight increase for the better every week. There have been no important price changes so far this week.

The steel market in the States shows an increase in demand, and practically all orders closed are for very prompt shipment. Steel production is now nearly three times the rate of last July, but of course general business is not three times as active. Pig iron, basic, is selling at 25 cents less per ton than last week, this price being on large orders. Sheets are steady, hoops are lower, and the demand for pig iron is somewhat heavier.

Manufacturers are showing more interest in the market these days and some good orders have been secured. The railways have not yet come into the limelight, but are buying only in a small way. One good feature in all markets is the general nature of the demand. The size of the orders is not very large, but is scattered over a variety of industries, this bringing the total up to good proportions. This is a healthy condition, and once manufacturing plants and foundries widen their activities, a good volume of orders for iron, steel, and general metals should result.

Machine tools are spotty; some dealers are securing fairly good business, while others are extremely dull. Aggressive salesmanship is responsible for orders being closed, and those content to sit around are securing no business.

Pig iron in Canada remains at the same level as last week, and the demand is very light. Where large orders are on tap, the regular price is shaded, some sales being closed as low as $26.60, although the average consumer in Toronto may be asked $27.15. The price in other localities varies according to the distance from source of supply.

Shading of prices on many steel goods continues, especially if the orders are large. Generally speaking, however, iron and steel bars are selling at $2.75, and band steel at $3.25. These are Toronto quotations.

Small tools and supplies are holding their own in the Toronto field, but a little added improvement is noted around Montreal. The month just closed will show up better than January, and prices in these lines continue to remain firm.

Scrap and non-ferrous metal prices remain weak, and there is practically no demand. Conditions look dull for some time to come, and no noticeable improvement can be looked for until foundries become more active.

Toronto

March 1.

THE MONTH of February was not so bad as some dealers expected. In fact, when viewed in comparison with January, there was no cause for complaint, as the total about of business closed was better than many anticipated. The small tool and supply market was the best of all sections.

Iron and Steel.—Conditions in the iron and steel market shows an improvement over last week. A few concerns claim they have noticed no added interest, but these are very much in the minority. One dealer mentioned to Canadian Machinery that he secured such a number of enquiries and orders last week, that it took his staff all their time to handle the improved demand. The best feature of all was that this demand was general in character and not confined to merely a few specialized lines.

About a block from this scene of activity, another merchant told Canadian Machinery that he had experienced a rather poor week. In another section of the city a representative of a large steel concern mentioned that the last week was exceptionally good, and that the character of the orders were all that could be desired under present circumstances. The average dealer feels better, and it is the fellow who is content to sit back and wait for business to come to him that is finding the going rather hard. There has been more aggressive salesmanship displayed during the last few months than occurred all during the war period. The chief feature of the increased demand is its wide scope. Usually the orders are for small quantities, being for immediate requirements, but one dealer told Canadian Machinery that the orders he received last week alone, covered thirty branches industry. This is a very healthy sign, and once general business picks up to a greater extent, all iron, steel, and metal markets should benefit. Following are prices on the main iron and steel lines:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Machine Tools.—Business on this market, while not very brisk, seems to be slightly improving as the year advances. Enquiries still continue numerous, but quite often after a much desired order is about to be closed, a hitch occurs which holds up the prospect for another three or four months. It is a common occurrence for a dealer to keep in touch with a prospect for over a year, always hoping something will break. Shading of prices is still existent, and while this may not appear on the surface, it exists nevertheless. Buyers are having their innings, and in many cases are driving very close bargains.

Small Tools and Supplies.—This branch of the market is holding its own locally. One cannot truthfully say there has been any improvement since last week, but conditions are certainly no worse. In the majority of cases the buying is of the hand to mouth variety, with the result that considerable expense is entailed even in the closing of a small order. There is the sending of the enquiry, the submitting of quotations, placing of order, acknowledgment, etc., all this tending toward expense. One dealer actually put on additional help in his stenograph department in order to type quotations and general answers to enquiries, and yet, boiled down to actual business closed, the total doesn't amount to much.

Luckily, there is a seeming trend toward better things, for one dealer told Canadian Machinery that various firms are now realizing the clerical cost at both ends, and are asking for prices over an extended period. If this movement becomes general it will be good for business all around. Lines such as drills, taps, files, reamers, etc., are in fair demand, and general supplies, as required in mining sections are picking up. In fact several dealers are making their new camp up north at present, as they look for good business from the mining locality.

Pig Iron.—The demand for pig iron remains dull. There has been no change in price. Foundries are still inactive, with little hope of immediate opening. Following is the existing price.

Silicon, 2.25% to 2.75%	27 15

Non-Ferrous Metals.—Prices are weak in all non-ferrous metals, and the demand is very light. There has been no change in Toronto prices, although the Montreal figures are shaded slightly. This has made no effect on local quotations as it only amounts to a quarter of a cent a pound, and Montreal may have secured some metals by a more direct route, thus reducing the freight cost slightly. Following are existing quotations.

Lake copper	17 50
Electric copper	17 25
Castings, copper	17 00
Tin	34 50
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	27 00

Scrap Metals.—Demand is very weak in scrap. Prices have not changed since our last report, and until foundries pick up, no move of importance can be expected. Following are Toronto prices:

Copper, light	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 machine composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 00
Ten lead	3 00
Aluminum	10 00

	Gross
Boiler plate	9 00
Heavy melting steel	12 00
Axles (wrought iron)	20 00
Rails (scrap)	12 00
Malleable Scrap	12 00
No. 1 machine cast iron	19 00
No. 1 machine cast iron	19 00
Pipe, wrought	6 00
Car wheel	18 00
Steel axles	18 00
Mach. shop turnings	6 00
Stove plate	16 00
Cast boring	6 00

Miscellaneous.—Other lines, such as oils, greases, steel pipe, waste, belts, etc., remain in fairly good demand. Prices are unchanged in any of the above mentioned lines, and the majority of business closed is for immediate needs only.

Montreal

March 1

FOR the first time in several weeks a general improvement in the local iron and steel business has been noted. The change for the better is not on a large scale but is certainly of a positive nature. At the same time there are some commodities that have not participated in the improved tone. The improving conditions were not altogether unexpected and are somewhat of a seasonable nature. The waterfront is commencing once more to attract attention. Every spring there is a great deal of repair work, improvements, and renovations in this quarter. The steamers that winter here are being carefully surveyed, previous to starting the work of recommissioning them. All the harbor tugs, the lighters, the unloading plants, and other varied port equipment is due for the spring overhauling. The initial orders that this work naturally necessitates, are commencing to come in, which is, in a measure, responsible for the better tone locally. Then, too, the manufacturing plants are coming into the market for certain lines in a way that is more encouraging. As yet the increase in business is not of large proportions, but is of interest as in many cases it is the first orders for certain materials that have been placed by many firms since New Year. These conditions together with the general spirit of optimism that is usually present in the spring, has impregnated the whole situation with a very satisfactory feeling that better times are coming. There is not present any artificial inflation and a genuine demand for materials for immediate consumption is behind the improvement. It is fully appreciated that the general situation is suggestive of a gradual improvement extending over several months. The railways as yet have not come into the market, except in a small way for supplies and equipment which are required immediately. It is known that the policy of these corporations for some time back, has been one of purchasing from hand-to-mouth. For this reason it is expected that in the near future some nice orders in various lines can be expected.

Steel Market—The call for merchant bars has not improved during the week, although some interesting inquiries of fair size have been received. The structural steel sales have not improved to any great extent. The outlook for this particular department is, however, very promising as the local building program is larger this year than it has been for several years past. The largest improvement in the steel products has been in boiler tubes. The marine interests have placed quite a few nice orders lately and inquiries from various sources are numerous. The demand for plates has been somewhat better. The orders received have been from varied sources for a variety of uses in new and repair work. Sheets have been fairly active since the new year but the volume of business has fallen off, of late. This is due to a belief that prices in the States are due for a drop owing to the weakness in British and European markets. Whether this assumption is right or not, remains to be seen. It is generally conceded that present prices are about as low as can be expected when one considers the present production costs. It was fully expected that orders for rails from the railways would have been placed before this. Up to the present there have been no signs of the looked-for orders. It is generally felt that the requirements of the roads will bring further orders at any time now. Quotations have not materially changed in the last week. Local current figures are as follows:—

Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00

Pig Iron:—A slight improvement in pig iron has been noted in the last week. In December the demand for pig iron started to fall off gradually and continued until about the middle of January when the dullest period that had been experienced in years was reached. Practically no orders were booked for several weeks. Not until this week, however, was there noted any improvement in the demand. It was thought that the drop in price of two dollars a ton several weeks ago would have stimulated sales, but such was not the case until recently. No large orders have been received, but there have been a very nice number of car-lot orders booked. Some foundries have come into the market for the first time in months. In fact most of the orders being received to-day are from the small foundries who are experiencing a little spurt in business. The larger consumers of pig are still operating at part time and are purchasing only in small lots on the hand-to mouth plan. No change in price has been made, and from present indications no changes are contemplated.

Machine Tools and Supplies:—The movement of machine tools is slow and there is but little to lead one to believe that the demand will be much better for some time to come. Orders to-day are usually for one tool only and but few instances have been reported where a sale of a large tool has been made. Dealers are contenting themselves with keeping their prospects informed on all the various improvements and price reductions. As there is at present a surplus of machine tools in the country, when the present demand for manufactured articles is considered, it is pretty hard to convince a shop man that he is in need of new equipment. One point cannot be concealed, and that is during the present dull period machine tool manufacturers have used their surplus designing and engineering capacity to more fully develop and improve their product. Thus when at some later time manufacturers do come into the market for machine tools, they will have a very fine line of machines ready for them. As before stated, the sale of new tools is small, but there is a fair demand for second-hand tools. A large number of these tools have been on the market for some time past, but they are gradually being absorbed. In spite of their ever decreasing numbers, a fair volume of business is being done every week.

The supply business is still very satisfactory and at the present time is the mainstay of the businesses of several local dealers. There has been a gradual and healthy improvement in this department for some months past. On one or two occasions a dull period of a few days was noted, but on the whole business has been very satisfactory. In connection with the supply business there has been a very fair demand for miscellaneous material such as pumps, stationary gas engines, farm machinery, contractors' supplies, saw mill equipment, and general manufacturing supplies. Prices of machine shop tools and supplies are gradually being reduced as business increases. An ever increasing variety of tools are being standardized and manufactured in quantities. The field of distribution is also increasing as the service garages are now real prospects for a large number of machine shop supplies and tools. In the portable tool field, which has broadened out largely of late, a large number of real prospects are found in these garages. Reports from various jobbers and machine tool dealers vary. Some claim that January business was better than February business. Others state that February was better and that there is every prospect that March will exceed February.

Non-Ferrous Metals:—The weakness in the non-ferrous metals that has been present for some weeks past is still evident. Copper is down still lower. Tin also has dropped a cent a pound. Very little demand is evident and trading is consequently very light. There have been no outstanding features in the market during the week. Quotations on other metals remain the same, Montreal figures are as follows per 100 lbs.:

Lake copper	17 00
Electric copper	16 75
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	27 00

Scrap Metals:—This department of the metal business has been very dull for some time past and prospects are not any too good for immediate improvement. Some difference of opinion exists as the quantity of scrap available in the country at the present time. Some dealers claim that the low prices prevailing have not warranted the collection of scrap and that for this reason large quantities have not been reclaimed or collected, which would otherwise have been. This is the reason advanced for the shortage claimed. One dealer states that he recently had great difficulty in collecting a car of stove plate scrap iron to fill an order. This condition may exist, but conflicting opinions are evident. The following are the local quotations:—

PER 100 IBS.	
Copper, light	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
PER GROSS TON-	
Boiler plate	9 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	18 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	3 00

Pittsburg

March 1.

PITTSBURG, (Special to Canadian Machinery.)—In most branches of the finished steel trade a further increase in demand is observed this week. As practically all buying is for very prompt shipment, buyers having no occasion to anticipate their wants, the actual production of steel is the best measure of demand, and production has become still heavier, being estimated at 29,000,000 gross tons a year in steel ingots. The rate at the end of December was under 18,000,000 tons, so that the rate has gained by an average of more than a million tons a week since the end of the old year. The rate at the height of last autumn's demand was 23,000,000 tons, in October and November, so that already there is a gain of 25 per cent. yet it cannot be thought that the full force of the spring demand is as yet being felt in actual production.

Steel Production.—Instead of there being compaint about the volume of business, the steel makers regard the improvement as being easily the greatest that could possibly be expected, and in some quarters there is a little note of warning suggesting the possibility that things may be moving a trifle too fast. Some steel producers remark that they "only hope it will keep up" There is room for suspicion that perhaps the condition at the moment is the reverse of the position that plainly existed last summer, when production of steel was far below a rate that would be in keeping with the volume of general business then being done. At that time stocks in the hands of jobbers and manufacturing consumers were being drawn upon. Steel production is now nearly three times the rate of last July, while of course general business is not three times as active. It has merely improved by a moderate amount. Thus it seems barely possible the buyers are now stocking up to a limited extent. In the trade one does not find any statements that this is being done, the common report being that all buying is from hand to mouth and that buyers will not replenish their stocks at all.

Bars, Plates and Shapes.—All finished steel products are not necessarily at bottom as to price, but whatever may be the case with some products, it is quite certain that bars, shapes and plates are very cheap, being quotable now at 1.40c, with a very occasional concession and with some small orders going at 1.45c or 1.50c. It is much more likely that two months hence bars, shapes and plates will be at 1.50c than at 1 30c, and thus there would be good reason for replenishing stocks in a conservative way. The market is at a lower level than buyers themselves expected it to reach, provided there were no reductions in freight rates and no further reductions in wages. While there continues to be much talk about freight rates there is really no definite prospect of their coming down in the discernible future, at least by enough to make much difference in the cost of producing steel, while as to wages there is no talk of reductions.

Sheets Steady.—Sheets continue firm at quotations prevailing for three months past, 2.25c for blue annealed, 3.00c for black and 4.00c for galvanized. The 2.25c base price applies chiefly on the lighter gauges of blue annealed, 12 gauge and heavier often going at plate prices. Incidental evidence that the sheet market really is steady at the quoted prices is furnished by the fact that the American Sheet and Tin Plate Company has opened its order books for second quarter, at the former prices. A little business had already been filled, awaiting the formal opening of books. At the same time the company opened its books for tin plate orders from jobbers for second quarter. To manufacturing consumers books had previously been opened for the half year. The regular price remains $4.75 but on large orders somewhat lower prices are commonly made by independents.

Tubes and Pipe.—No changes in list prices on tubular goods have been made since the reduction of December 15, but shading by independents in standard steel pipe has increased. More often than not in past years the independents have been giving an extra 2½ per cent. in addition to the usual trimmings of the leading interest, and of late there has usually been 2½ and 2½, while in the past week or ten days 2½ and 5 has been given not infrequently. Even this, however, is not sufficient to cause the leading interest to revise its discount card. It is running approximately as well as the independents, about 60 per cent.

Hoop and Band Steel.—Hoops are quotable $2 a ton lower, at 1.80c on orders that are at all attractive. Technically this base price applies to bands also, which were put on the hoop card during the war control, but practically a specification involving bands alone, particularly the wider and heavier, would draw a lower base price. As extras were lowered $4 a ton when bands were transferred from the bar to the hoop card, a continuance of the pre-war practice, with the base price of 1.40c on bars, would mean that bands would be selling at the same net prices as would obtain with the existing card, if the base price were 1.60c instead of 1.80c, and naturally the 1.80c price is shaded somewhat when it comes to bands.

With steel ingots being produced at about 29,000,000 gross tons a year there is represented a production at about 55 per cent. of the entire capacity, the highest rate since January of last year. Considering the different finishing departments separately, their average operation is not as high as 55 per cent., the reason for this apparent discrepancy being that there is always an excess of steel finishing over steel producing capacity. Tin plate mills are operating at about 75 per cent., and sheet mills and pipe mills at about 60 per cent. Bar, shape, plate and rail mills are at less than 50 per cent. but they are all doing better than in December or January.

Pig Iron.—The demand continues very light, while prices appear soft or firm according to viewpoints. Thus the merchant furnaces seem to be standing together more firmly than ever on a quotation of $18, valley, for basic iron, but it is known positively that the last important transaction was at $17.75 or less. A difficulty is that the merchant furnaces are not in control, as there is resale iron in the market as well as iron made by steel works. In Bessemer iron, for instance, the regular furnaces

(Continued on page 68)

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 40
Tank plates, Pittsburgh mill price	1 40
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 00	$17 50
Electric copper	16 75	17 25
Castings, copper	16 75	17 00
Tin	34 00	34 50
Spelter	7 00	7 25
Lead	6 50	6 75
Antimony	6 50	8 00
Aluminum	24 50	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.36	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Dd., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 00	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 50	3 50
Medium brass	**4 50**	**4 50**
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00

	Per Ton	Gross
Boiler plate	$9 00	$9 00
Heavy melting steel	9 00	12 00
Axles (wrought iron)	17 00	20 00
Rails (scrap)	10 00	12 00
Malleable scrap	10 00	12 00
No. 1 machine cast iron	18 00	19 00
Pipe, wrought	7 00	6 00
Car wheel	18 00	18 00
Steel axles	16 00	18 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	16 00
Cast boring	3 00	6 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28.00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 90
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 24½
Solder, guaranteed	0 26
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	**less 50-60**
Taps, hand, under 1"	**less 40-50**
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 50	....
Galvanized sheets, No. 28		5 55
Queen's Head, 28 B.W.G.	7 25	.....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28		....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sixes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	37 50
Black oil, per gal.	21 00
Cylinder oil, Capital	66 50
Petroleum fuel oil. bbls., net	10 40
Pure turp., single bbls. gal	1 35
Linseed oil, raw, single bbls.	1 00
BELTING—No. 1 OAK TANNED	
Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored.13
Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toron
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute).	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

Make Sure Where Your Charity Goes

In View of Numerous Calls Being Made on Canadian Manufacturers and Workers for Famine Contributions at This Time, So Many of Which Are Fraudulent, the Following Articles from The Financial Post Will be Found Interesting and Informing

"WHEN THE DEVIL WAS ILL THE DEVIL A MONK WOULD BE"

We have been under the impression that Lenine and Trotsky were a couple of extremely clever, unscrupulous hypocrites for whom the world was hand-picked by the Germans and certain allies, which they officially admit, and sent to head a movement for which plans had been carefully made, to take Russia out of the war and to place that country's wealth and resources in the hands of the promotion syndicate. By slogans and popular theories of handing the properties of the classes to the masses they made a great hit. They themselves, of course, never believed in any such ideals. They got their rivals and opponents out of the way by a gigantic system of organized murder. They prolonged the war and in that way were responsible for the killing and maiming of thousands of Canadian boys. Since the war they have carried on a persistent campaign for creating discontent in Canada—particularly among the wage earners to prevent their working.

Having looted Russia to the limit they are throwing down their dupes, the Bolshevists, blaming them for the wrecking. They are just like groups of financial highwaymen with which trusting investors here are too familiar. They are asking the world to come in and assist them to re-organize the company, buy more bonds. The first offerings did not meet with success. The public was suspicious of the looters. They called back the proposals and proceeded to sugar-coat them; to put the public in a friendly frame of mind for their reception. Their new propaganda was designed to show that the looters were really very great, kindly, in fact, saintly, men; public benefactors who had suffered from the actions of unscrupulous employees. It is true, Lenine and Trotsky admit, thousands of good Russian men were murdered and many more thousands of gentlewomen and girls raped but that was an error of judgement. They are repentant. They are sorry. They are changing the system. The murder-rape policy is being gradually abandoned. The sugar-coating is the linking up of "Save the Children Famine Fund," with the whitewashing of Lenine-Trotsky. A big-hearted genial Canadian, Colonel Mackie, rancher, contractor, promotor, recently made a flying visit to Russia and has come back full of the saintliness of the reformed Lenine-Trotsky crew of murderous highwaymen and the good things they have done and are going to do for Russia—and the old story of prospects of big buying orders for Canada and Russian concessions for Canadians. Under the auspices of the "Save the Children Fund," the gallant Colonel has set himself the task of correcting Canadian beliefs in the unsavory characters of these men. By keeping their thoughts on the children he has succeeded in getting official recognition of the Prime Minister and of Mr. Meighen, leader of the Opposition, with the result of renewed activities of the Bolshevist agents and newspapers and sympathizers in all parts of Canada.

We would be sorry to misjudge Colonel Mackie, but the fact is that so far all his utterances in interviews are about one-tenth famine relief and nine-tenths rehabilitation of Lenine-Trotsky. It is rather a coincidence that over two months ago a propaganda sheet issued by the Berlin Bolshevik agency told of this plan—boasted of its success in developing the appeal for famine relief into a big campaign for the financing of Soviet Russia by western capital. Now they will boast the Canadian Parliament is giving them moral recognition. Is this fair to Canadians?

FAMINE COLLECTIONS

Canada is being intensively organized and solicited for aid to the starving Russians. The strongest pressure for contributions will be on financial institutions primarily, and then on manufacturers, merchants and business concerns generally. They have, therefore, a very vital interest in the question. We have pretty well all we can do taking care of our own destitute at this time. But we can do that and still have some to spare for less fortunate foreigners and particularly for suffering but deserving Russians.

The fact that these people have been so fearfully exploited by, and are still under control of a group of grafting foreigners, is no reason why we should withhold our aid. We should have no sympathy with those who suggest they should be allowed to suffer. The difficulty is to know how we can get our contributions to the real sufferers. We do know that during the last year or more large sums have been collected in Canada which never went beyond the Soviet propagandists within our own borders. Of the many so-called Russian Relief funds, we know of but two that are perfectly legitimate. So crooked are Soviet conditions that persons in this country desirous of sending money to their families in Russia are advised not to do so as only a small per cent., if any, will get to them even through British and United States official channels. The real Russian Red Cross of the war days, still in existence, advise their British colleagues against supporting any of the Soviet schemes and go so far as to say that internal conditions in Russia are morally as bad as in the worst days.

It is the knowledge of these conditions that has made the always generous Canadians hesitate. It has made the British hold back, and the Americans and the French.

Word now comes that millions are going through the indescribable horrors of famine for whom no relief can ever arrive in time. For this condition the policy of the Lenine-Trotsky group in making famine relief the basis for spreading propaganda for recognition and financial aid from foreign countries is responsible. These men have been refusing all relief for the sufferers excepting through their own channels. Persons who knew them have absolutely refused these terms.

The best authority, because of his proved capacity as an organizer and executive and his unusual experience in this particular work, is Mr. Hoover, U.S. Minister of Trade. He knew the urgent need for help. On his advice the U. S. Government gave an initial grant of $20,000,000 to aid in feeding and clothing the starving millions. Lenine-Trotsky prevented his activities for a long time on the demand that distribution must be done through them. But Hoover thoroughly understood their aims and refused. International opinions forced them to give in, but the Soviet agents in Canada and the States are carrying on a campaign against Hoover and his plans. Even the Canadian Government has been privately warned from the Soviet headquarters in New York to avoid his policy or any co-operation with him.

Canadians want to help, but with these facts before them they are at sea and financiers and business men would be well advised to hold up all contributions until the situation is cleared. As pointed out last week, the Government has been committed, probably under the impulse of the moment without proper enquiry, on the advice of one man, to the endorsement of one particular fund "Save the Children." It may be the best, but it is certainly not being conducted on this side on lines that will create confidence. Its promotors here are giving more attention to the rehabilitation of the Soviet leaders than to the famine. In fact, when it was first put out in Canada last year under other auspices it became necessary to bring pressure to bear to stop it. This "Save the Children Fund" was organized by Lord Weardale, whose wife is Russian, widow of Count Tolstoy, and managed by Nansen, a Norwegian scientist-diplomat.

The Friends' Emergency Committee is another that is raising money here. It is apparently thoroughly reliable with a splendid war record.

Finally, there is our own Canadian Red Cross with its wonderful record in South Africa, in this war and since. It is thoroughly organized with foreign connections. When the famine was looming, it took the matter up with the British Red Cross and on their advice has been co-operating through them with the Russian Famine Relief Fund, the chief organization of its kind in England and under the presidency of the Lord Mayor of London. It seems to us Canadians cannot do better than concentrate on, and work through this thoroughly trustworthy channel of good service, and if contributions are large enough, have them administered in our own name.

Since the above was in type several newspaper clippings have come in which show renewed activities by the Soviet Red Cross in several Canadian centres. Such collections are illegal and no money should be given to such agencies.

LONGER GERMAN WORKING HOURS

When Socialist and other radical leaders in Germany like Helmud von Gerlach and Hugo Lindemann come out for a longer working day than the eight hours established after the revolution their program challenges the attention of all industrial countries.

The reawakening of Germany to the law of economics and of sense that mere wage scales cannot give workers what they want without the production by the workers to back up the wage scales means that other nations will have to face the same fundamental truth whether they like it or not. German productivity or German unproductivity, British, American or any other workers cannot let their own production decline without having their standard of living decline, for the simple reason that they can divide only what there is to divide. The more there is produced the more there is to divide; the less there is produced the less there is to divide.

Germany's output of food, clothes and other necessaries of life is not enough under the eight hour system, the foregoing labor leaders now frankly admit, to enable the people to live as they lived before when more work was done and more of everything was produced. That being true of Germany as to its standard of living, something else must be equally true as to German productivity in relation to general productivity. This is that if the German workers speed up their productivity either other peoples of whom the Germans are trade competitors must speed up their productivity or the Germans will conquer the world industrially where they failed to conquer it by force of arms.

Increased production, with a corresponding lifting of living standards, may not always depend upon the length of the working day. In one country or in one industry where productivity has oozed away through men not staying on the job only more hours of work can solve the problem. In another where men are putting in long enough hours but not hard enough licks more human steam will turn the trick. But whether by longer hours in the one instance or by closer application in the other, the productivity of a nation or of an industry must be prevented from running down or its population must have its bread cut in thinner and fewer slices. There is no possible escape from that.

In this country of all countries where hard work from morning to night built up American industrial power and gave the highest standard of living ever known in the world, labor has been grossly duped by labor union politicians and other demagogues into the idiotic belief that it could get a good living without working for it. It might as well expect stones to turn into fruit for the mere wishing.

Whatever the Germans do or do not do in the way of longer hours to bring them more of the needs and comforts of life, the American people are not going to get back to the living ease which they had won by a century of manful toil until they get back on the job in the old American way, with a square day's work for a square day's pay every workday in the year.

VAUCLAIN ON WORLD OUTLOOK

The manufacturing situation in England is bad and will grow worse as sterling exchange, quoted in terms of the dollar, increases in value, according to Samuel M. Vauclain, president of the Baldwin Locomotive Works, who has just returned from a tour, which included almost every country of Europe. In France some discretion is being exercised in not allowing the dollar value of the French franc to advance too rapidly.

The principal reason for this anomalous situation, Mr. Vauclain explained, is the extreme keenness of German competition. The value of the German mark has declined to such an extent that Germany can offer her goods in the open markets at figures that appear ridiculous. He said a mechanic can be engaged in Germany for 100 marks a day or less than fifty cents. Other countries, where it is hard to obtain mechanics at even fifty cents an hour, are finding it difficult to compete with manufactured goods produced under these conditions.

From Havre to Paris, Mr. Vauclain said, he found better conditions than two years before. In Brussels he was surprised by the reconstruction and the improvement of properties. Business in Brussels is slack, but not so bad as here, he said. A temporary hold-up of business has been occasioned by the intensity of German competition. In Germany he visited the Krupp plant, where he found great activity. The new locomotive shops there, he said, are working well, with twelve to fourteen months' work ahead.

In Stockholm all workshops are busy on Russian work. Russia has ordered 1,000 locomotives in Sweden and every effort is being made to speed up deliveries to one locomotive a day. In Norway, he said, he received terrible reports of the awful conditions existing in the famine-ridden portions of Russia.

Mr. Vauclain said a remarkable advance has been shown in Poland in two years. That country, he declared, had a hard time between Germany and Russia, but this position now is destined to make Poland one of the wealthiest and most substantial States of Europe. The development of Russia, he said, must be conducted through Poland.

Czecho-Slovakia is in fairly good condition, although not so good as Mr. Vauclain expected. Austria's situation he characterized as bad, due largely to the splitting-up process through which other States got the vast hinterland upon which Vienna depended so much for its commercial supremacy. Hungary, he said, is better off, but feels the situation keenly.

France, Mr. Vauclain declared, has nothing to worry about. That country is able to compete with Germany to some degree. In England, the shops are running at only about 20 per cent. of capacity, with few orders. The future of the United States for the next five years, the locomotive builders said, depends entirely upon the ability of manufacturers here to extend credits, which, if liberally given, will result in America getting her full share of the world's trade.

Mr. Vauclain said that he did not go abroad for orders and that he "was able to restrain himself." There is plenty of business available if sufficient credit is extended, he asserted, but the Baldwin Locomotive Works does not desire to extend credits to a point at which its capital may be affected. Already credits have been extended to Poland and Rumania, $7,000,000 in the first instance, and further credits to both are probable. Interest has been paid promptly on the $7,000,000 Polish credit and no payment on the principal is due until next year.

As for the United States, Mr. Vauclain said: "Business is not good here." The remedy, he said, is economy, work and thrift. "You can't maintain a payroll," he declared, "if you have nothing to maintain it with.

"I think we will have good business before long, not so profitable as two years ago, but sufficiently profitable to meet all requirements. Prices, wages and the cost of living must go much lower. If we are to continue to compete against the producers of Europe our dollar must buy more than it has been buying."

News From the Industrial Field

W. C. Smith of Toronto, has been appointed to the position of engineer for the town of Oshawa, Ont.

Standard Steel Construction Co., Welland, is in the market for a second hand locomotive crane of from 7½ to 10 tons capacity.

During the year 1921 Peterboro was successful in securing five new industries. This makes a total of 15 in the past three years.

Scottish Fertilizer, Ltd., has begun to operate its new plant at Welland. About twenty-five men are being employed at the outset.

Camile Laurendair, B. A. Sc., of Montreal, has joined the sales staff of the MacKinnon Steel Co., 404 New Birks Bldg., Montreal.

Hardware merchants who import all the oxygen used in the building trades in Jamaica, solicit prices from Canadian firms, for immediate purchase.

The erection of an office building at the cost of $500,000 on Mountain Street, Montreal, is contemplated by Knights of Columbus and the city council.

Action is expected shortly in connection with the proposed bridge or subway for the elimination of one of the level crossings of the G. T. R. at Stratford.

The Messervy Battery Factory of Brampton, Ont., has been purchased by the Arabol Mfg. Co., of New York. It is stated that the plant will be enlarged.

A Birmingham dealer in motor, aeroplane and coach accessories would be pleased to have particulars of any line in motor parts suitable for importation to England.

Work is expected to start about the end of March on the relaying of rails on approximately 100 miles of the London division of the G. T. R. 100-pound rails will be used

An old established London firm is open to represent as buyers or agents, representative Canadian manufacturers and shippers of lubricating oils, tallows, turpentine, rosin, tar etc.

It is reported that the Page-Hersey tube mill at Welland is now in full operation again with day and night shift, between 250 and 300 men having been added to the staff recently.

An Italian firm would be interested in receiving catalogues and price lists of machine tools in general, in order to form an idea of the kind made in Canada, and to ascertain if business can be put through.

Fire of unknown origin completely destroyed the Thornton Rubber Factory at Oshawa, Ont., on the morning of February 22, causing a loss of something in the neighborhood of $100,000 in building, machinery and stock.

A large Dutch Importer in Gorinchem would like to represent Canadian exporters of agricultural machinery in Holland. Wishes to have catalogues and export price lists.

The third annual commercial fair at Brussels, will be held between the 3rd and 19th of April. The preparations give promise that the fair this year will far exceed any others yet held.

The C. N. R. have acquired a large piece of land on the outskirts of Regina, Sask., and will use this for yard extensions, increased grain handling facilities and the enlargement of shops.

Work will commence early this summer on the construction of the two bridges that will connect St. Anne de Bellevue with Vaudreuil. Plans are now being prepared by V. Denis, engineer, Department of Public Works, Ottawa.

A smelting works located in Bristol is in a position to consider offers of type ashes, tin ashes, solder ashes, pewter ashes, brass ashes, tin ores and tin slags, disused electrical accumulator lead plates and lead peroxide and dross from accumulators.

The National Association of Purchasing Agents of the United States will hold its seventh annual convention and exposition at Exposition Park, Rochester, N. Y:, from May 15 to 20. L. F. Boley, 19 Park Place, New York, is convention secretary.

An old-established firm of metal merchants are anxious to extend their connections with Canada for the trade in all kinds of new or old metals. Would like to hear from both manufacturers and merchants in regard to shipments from or to Canada.

There is no possibility at the present time of a plant being established in Toronto by the Canadian Car and Foundry Co., of Montreal. W. W. Butler, president of the company, stated this emphatically when referring to the report that had been circulated recently that such a move was contemplated.

G. E. Morris, sales manager for the International Business Machines Co., Toronto, told Canadian Machinery a few days ago, that business has improved considerably during the last two months. "In fact we are now doing 50 per cent. more business," continued Mr. Morris, "than we were in the early part of 1921, just before the slump started."

Speaking at a luncheon of the C. M. A. recently, Col. F. M. Gaudet, representative of the Scientific Research Council, stated that: "Canada must arm at once for the wars of commerce. The greatest weapon in this war is knowledge. Knowledge of what you can do and can't do with your raw materials. Knowledge of the best ways of doing everything we do."

A delegation from the Canadian Manufacturers Association, representing all parts of the Dominion, will wait upon the Canadian government in the next day or so to present a memorial upon certain subjects which the Association is interested in.

Speaking with regard to the new technichal schools in the east end of the city of Toronto, Trustee Miller of the Board of Education, stated, "We will have British goods in our schools, if we cannot get Canadian goods." He also stated that a Canadian boiler with a Canadian chain stoker could not be secured in Toronto.

Paul Leclaire has been appointed assistant engineer of the Port of Montreal. For a number of years Mr. Leclaire was engineer in charge of buildings, bridges and water supply to the Harbor Commission. Prior to this he was engaged in engineering work with the C. P. R., and with the Dominion Bridge Co.

In last week's issue appeared an item from the report of C. W. Kirkpatrick, Commissioner of Industries at Hamilton, stating that the Ford Company had established headquarters in that city. This should have read: four other companies have established their headquarters in Hamilton, but had not yet commenced manufacturing.

Prospects for renewed activity in the steel districts of Nova Scotia has been brightened by the announcement that the Nova Scotia Coal Co., are making plans to increase coal banking facilities and resume operations in preparation for opening of navigation. It is anticipated that other metal working activities will commence shortly.

J. W. Horne, one of the pioneers of British Columbia, died last week at his home in Vancouver, at the age of 82. He was born in Toronto in 1840 but settled in Vancouver in 1884. He helped to organize the company that built the first street railway in Vancouver and was president and managing director for a number of years.

The total log production of British Columbia for the first eleven months of 1921, from the official returns of logs scaled, has reached 1,650,759,388 feet. During the past year the months of heavy production were June, July and August. Of the total production 1,283,734,106 feet were scaled on the coast and 667,025,282 feet on inland territory.

M. P. Fennell, Jr., who for the past five years has successfully filled the position of secretary-treasurer of the Montreal Harbor Commission, has been appointed to the newly created office of general manager. Mr. Fennell has made a thorough study of harbor activities as they are carried on in all the leading ports of this continent and Europe, and is well fitted for his new duties.

F. W. Pennock has resigned as vice-president and general manager of Cleaton Co. of Canada, Ltd., and will hereafter be solely connected with the firm of Gelinas & Pennock, Reg'd 207 St. James St., Montreal.

Arthur T. Wilson, for some twenty-six years with the Canadian General Electric Co. and recently sales manager of the Earle Electric Co., has been appointed sales manager of Factory Products Ltd., 220 King St., W., Toronto. Mr. Wilson succeeds Mr. Langmuir who is severing his connection with Factory Products Co., to engage in another line of business.

The Gray-Dort Motors Ltd., Chatham, Ont., are planning to put all their local plants on full production schedule March first, according to an announcement made by vice-president Wm. N. Gray. Mr. Gray is most optimistic over the prospects for the year and believes the tide has turned in industry and that the country will gradually resume normal conditions.

It is reported that the Ford interests are considering the establishment of a plant in the Sudbury district. In view of the fact that the tract of land mentioned in the report forms part of one of the principal iron ore deposits in the province, it is thought the intention is to go into the refining of ore and production of steel commodities used in the manufeature of motor cars.

D. F. Fisher, representative for the Enterprise Foundry Co., and the Charles Fawcett, St. John, N. B., stated that there were eleven stove foundries in New Brunswick and that with these he believed the companies he represented were largely interested in the Western trade. His company also bought pig iron from Hamilton as Sydney found the Maritime market for foundry iron was too small.

During the year 1921, the Trail Smelter handled more than four hundred thousand tons of ore, the greatest aggregate in its history. All of this with the exception of about ten thousand tons, was from the properties of the Consolidated Mining and Smelting Co. Gold accounted in the total for 50,000 ounces; silver for 1,173,000 ounces; copper for 57,000,000 ounces; lead for 53,000,000 pounds, and zinc for 53,000,000 pounds.

A firm of manufacturers' agents in Australia, with excellent banking and other references and a successful experience in handling Canadian goods, is desirous of securing the representation of a Canadian manufacturer of bolts, nuts, etc., of the following kinds and sizes for which a good market exists; coach bolts, cup head, square shank, from ¼ to ⅜-inch diameter and 1 to 4 inches in length; counter-sunk head bolts, same sizes; engine bolts, square and hexagon, same diameter, 1 to 3 inches in length; nuts, square and hexagon, ¼ to ½-inch; iron washers, ⅜ to ⅞-inch; pan head rivets, black mild steel, in sizes from ¼ to ½-inch and up to 1½-inch in length. Quotations should be on f.o.b. steamer basis and in Canadian funds.

A sharp turn has taken place in export demand for Atlantic Sugar Refineries and big orders for England are enabling the plant to produce to the limit of its capacity or about one million pounds daily. A report covering the past twenty months will be issued shortly, but as this will take in the very severe losses of the latter half of 1920 it naturally will be an unfavorable one.

The Canadian Sales Tract Law according to a statement made at Washington, is to be followed by the House Ways and Means Committee in the Soldiers Bonus Bill that is now being prepared. The special committee of the Ways and Means Committee that will draft the financial positions of the bonus measure has decided to construct the Sales Tract proposal upon the same wording as the Canadian Law.

The Dominion Bureau of Statistics have just published a survey of the manufacturing industries of Quebec province. The total capital invested in the province in 1919 amounted to practically a billion dollars which goes to show how the great natural resources of the province combined with cheap labor have attracted the industry. The value of the raw products used by the manufacturer was $517,587,980 as compared with the finished value of over $988,000,000.

Off shore shipments of lumber during the year 1921 from the mainland of British Columbia amounted to 164,000,000 feet. Shipments to China and Japan accounted for 93,000,000 feet; Australia and New Zealand, 27,000,000; United States, 13,500,000; United Kingdom, 9,000,000; other places 21,500,000. In addition 700,000 bundles of shingles were shipped to the United States Atlantic ports, while 24,600 tons of box shooks went to Australia and Singapore.

It was learned on good authority that a prominent business man of Western Ontario was in Oshawa recently looking for a suitable site on which to erect a large hotel. This man, it is understood, is already in the hotel business, and is desirous of locating here. It is understood that a local real estate firm is making arrangements to secure prices on different properties in town. Lack of sufficient hotel accommodation is acknowledged to be one of Oshawa's greatest handicaps, and word to the effect that a new and modern hotel was to be built here would be enthusiastically received by citizens generally.

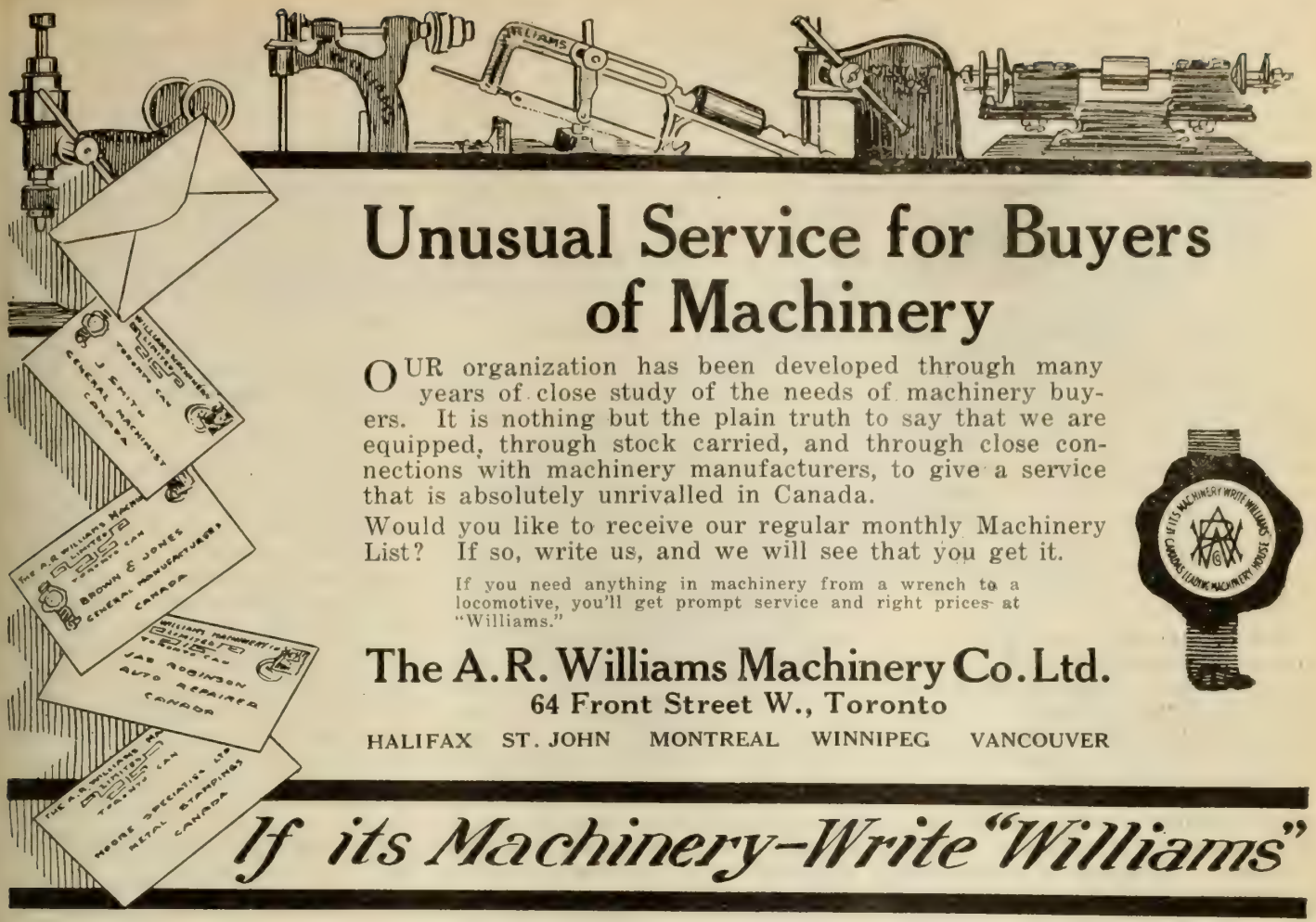
The Canadian Department of Railways and Canals has an exhibit depicting the Trent Canal at the motor-boat show in Grand Central Palace, New York. The exhibit, which is attracting widespread attention, consists of a number of very excellent views of the canal system, and specimens of big fish to be found in the Kewartha Lakes, through which the canal route passes. A working model of the largest hydraulic lift lock in the world, at Peterboro, is also prominently displayed. There is also a continuous moving picture of scenes along the canal, which is proving one of the most popular features of the show.

After a suspension of some 18 months, work will be resumed on the construction of the large ocean pier projected by the C. P. R., at Vancouver. This pier, to be known as Pier B.C., will be situated between pier A. and pier B and will be the largest structure of its kind at Vancouver, being of similar width but somewhat shorter than the Ballantyne Pier now being constructed. It will take approximately 18 months to complete the work. The pier will be 800 feet long, 320 feet wide and will carry four railway tracks to enable freight to be handled expeditiously between ship and cars.

The feature of the leather market at the present is the increase that has been noted latterly in the demand for export. The demand from abroad has shown a remarkable increase and dealers are looking forward to the time when they will be able to dispose of between thirty and forty per cent. output in other countries. As a rule the Canadian tanneries have a capacity which exceeds a domestic market by fully 50 per cent. so that it is obvious that if the position mentioned is reached, the trade of the Dominion will be on a much more satisfactory basis. Much of the current stillness in the local leather trade has been due to a number of failures which, though anticipated, nevertheless have a bad effect upon the market. This influence has now been largely eliminated and the trade is in a position to take advantage of any improvement that may develop.

Soon every village in York county will be equipped with public waterworks and other conveniences. At a recent meeting, Engineer H. A. James presented plans and estimates for a water system, and as a result it is likely that the Council will decide to bore test wells and see if a sufficient quantity of water can be obtained to make the scheme feasible. It is proposed to obtain the water from wells. The system would at first include only the business centre and the main streets of the village, but the plant would be large enough to provide for extensions. The cost of a partial distribution plant, pumping station, standpipe and wells was estimated at between $25,000 and $30,000.

The Wallace Shipyard, Vancouver, has been awarded the contract for alterations and improvements to the American Steamer, Admiral Farragut. This was in direct competition with Seattle, San Francisco and Tacoma. The successful bid was $63,000 in Canadian coin. The difference between the Wallace bid and those from the south ranged as high as $40,000. The British Columbia Lumber industry expects to get back into something like its normal stride this year. Reduction in freight rates, coupled with general improvement in Eastern demand, is an important factor. The Atlantic coast of the United States is buying much lumber from this province, the Boston market alone sending in orders for 250,000 feet almost every week.



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OUR organization has been developed through many years of close study of the needs of machinery buyers. It is nothing but the plain truth to say that we are equipped, through stock carried, and through close connections with machinery manufacturers, to give a service that is absolutely unrivalled in Canada.

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Technical School Men !

With the co-operation of the Departments of Education of the various Provinces, and with the assistance of principals and instructors, we purpose publishing on March 16th a number that will be a perfect mine of information in the development of Technical Schools to date. There will be such an exchange of ideas, such a volume of practical information, that the number will be regarded as a text book and will be preserved indefinitely for reference purposes.

Articles are appearing in CANADIAN MACHINERY every week, that are just what you have been looking for and for a long time. If you want to know what kind of articles these are—write us for a pamphlet explaining fully.

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Citizens of Welland, Ont., are greatly pleased with the news that the Standard Steel Construction Company of that city has secured two large orders. This Welland firm has bid successfully on three swing bridges. One is a hand-power swing bridge, 200 ft. long and is for the Trent Canal at Hamlet, Ont. The other two are 100 ft. power-driven swing bridges for locks numbers one and two on the Welland Canal at Port Dalhousie. These orders will keep 60 men working 10 hours a day for six weeks.

The discount of 3¾ per cent. on Canadian funds in New York, reached this week, is the lowest it has been since sagging of sterling exchange ceased in March 1919. Since that time the discount has gone as high as 17½ per cent., which occurred in February, 1920. The present high value of Canadian funds is influenced by the fact that Canadian foreign trade figures for 1921 showed a favorable balance of about $17,000,000 when most authorities had expected a deficit at the end of the year.

Hon. George Robert Smith, for many years associated with mining activities in Canada, died recently at his home in Thedford Mines, Que. Mr. Smith was born at Newark, New Jersey, February 17, 1860, and came to Canada in connection with the mining industry. He was vice-president and general manager of Bell's Asbestos Company at Thedford Mines, and vice-president and general manager of the Asbestos Manufacturing Company of Montreal. He was one of the founders of the Canadian Mining Institute, and at one time its president.

The greatest danger we have ever faced as business men is to-day, the menace being from United States. In the United States the manufacturing plants are at present over-built with a production capacity of 25 to 40 per cent., greater than the necessities of domestic demands. They have much unemployment there also. We must not stop in this idea now. We must go forward in a larger way and get our merchants to clear their stocks of all but Canadian goods, with perhaps a few necessary exceptions in British lines. "We must nail to the mast the Made-in-Canada sign and work to keep it there. Not only should there be another show next year, but it should be double the size of this."

The estate of the Kaministiquia Pulp and Paper Co., consisting of a fully equipped ground-wood mill and 16 acres of property under a 99-year lease from the corporation of the city of Port Arthur, was sold at public auction for $175,000 to Geo. P. Berkey, vice-president and general manager of the Consolidated Water Power and Paper Co., of Wisconsin Rapids, Wis. The mill was constructed and completed in January, 1921, at an estimated cost of $450,000, and was in operation less than three months. U. M. Waite was president and general manager. The Consolidated Co. is capitalized at $1,600,000, with a surplus of $5,991,000. It is stated to be the intention of the company to open the mill at once.

At the present time the Dominion Government is in for a busy time with Hon. John Oliver, Premier of British Columbia, and a big delegation representing British Columbia Boards of Trade. One topic of discussion is the freight rate from that province east; and another concern is the dry dock at Vancouver and the half built one at Victoria. The work on the dock yard has been practically shut down. Government assistance with these is asked. There are reports in Ottawa that these delegations from British Columbia would like to unload the Pacific and Great Eastern Railways upon the national system. Planned originally to link the Grand Trunk Pacific with Vancouver, this railway never reached within 40 miles of that city. It has already cost some 40 million and perhaps some 30 million more would be required to complete it.

The J. D. Brill Co., of New York, which extended operations into Canada during 1921, and secured enough business to purchase the plant of the Preston Car and Coach Co. of Preston, Ont., has issued a report for the year 1921, which shows a large falling in the output of the company's plant The sales values total $7,647,898, compared with $17,537,000 in 1920 and $14,510,000 in 1919. The report goes on to say "While the company has been doing business in Canada for many years, it seemed that it was necessary to extend operations there, and a new concern was formed, Canadian Drill Co. Limited. The new company has leased, with an option to purchase, a moderate sized plant at Preston, Ont., which was put into operation September 1st, 1921, and now has sufficient work to keep it running at full capacity. There has been great improvement since the first of the year in employees received and in a prospect for business, which should be placed during the current year. The large number of electric railways are considering seriously the purchase of cars which they badly need."

Toronto is to have a large car building plant. The Canada Car and Foundry Co., of Montreal, which has already turned out 200 cars for the Toronto Transportation system, is seriously considering starting a plant in Toronto. Sites on the water-front at the foot of Bathurst Street, Toronto, once the Dominion Shipbuilding plant, and others, have been carefully looked over with a view to purchase or lease for the headquarters of the new Toronto industry. The Canada Car and Foundry Co. have been greatly encouraged by the prospects for business in this city and the province. When this system was taken over the Toronto Commission sent out word that any company locating in Toronto would receive special consideration when orders were given for new equipment, and mention was also made about the heavy repairs which the Commission would have to give out in connection with the operation of the system.

The 45,000 K. V. A. generator, now nearing completion at the plant of the Canadian General Electric Co., at Peterboro, will probably be ready for shipment to the Hydro-Electric Power Commission Power house at Queenston early in April. This unit is stated to be the largest of its kind in the world and will require 25 freight cars for its transportation. It will take several months to install. A twin unit is now under construction at the Peterboro plant.

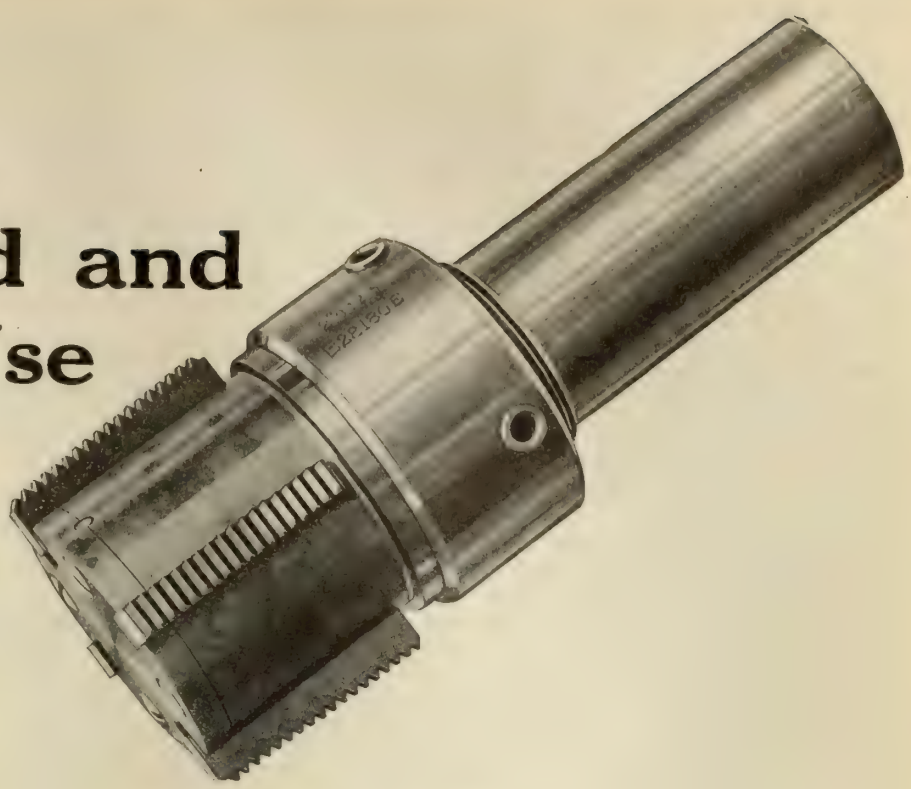
The International Nickel Corp., according to wire information received, disposed of a larger quantity of refined nickel during January 1922 than in any corresponding month in history, and incidentally added to its treasury surplus. The producers are formulating plans for an aggressive campaign to increase the sales of refined nickel and Monel Metal for commercial uses and by economies made, the metal in future will be in keen competition with brass and copper. They also intend to assure its increase for use in the manufacture of steel, which will undoubtedly have to be sold at a lower price than they have been in the habit of receiving, but operation will not likely be impaired as they can cover their maximum production without fear of exhausting their reserve under one hundred years, having millions of tons of ore yet untouched, and millions of tons blocked out and proven by Diamond drilling. The future of the nickel industry in the light of recent scientific readers, now appears brightest.

New Appointment To Harbor Board

The appointment of Dr. W. L. McDougald to the position of chairman of the Harbor Commission of Montreal, has been officially announced. Mr. McDougald is president of the Century Coal Company, a director of the Hollinger Mines, a director of the Dominion Steel Corporation; president of the Sterling Bond Corporation, a director of the Canada Steamship Lines, Ltd.; a director of the British Empire Steel Corporation. He is also president of the Ogdensburg Coal and Towing Company, which organization are the agents for the Dominion of Canada for the Delaware, Lackawanna and Western Coal Company, one of the largest coal companies of the world.

During the war period, Dr. McDougald acted in an unofficial capacity as aid to Mr. C. A. Magrath, when the latter was Controller of Fuel for Canada, and was of much assistance in obtaining an equitable distribution of available supplies. He has travelled extensively, and while doing so has made extensive study of transportation matters and port facilities throughout the world. The new official is the youngest chairman the port of Montreal has yet had. He is but forty years old, and was born in Glengarry, Ont.

A Tap For Both Hand and Machine Use



Geometric Adjustable Non-Collapsible Tap

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A Threading Tool that is "making good" in the reduction of production costs—the Geometric Adjustable Non-Collapsible Tap.
It is especially valuable on machines having no means of closing a Collapsing Tap or for some other reason not permitting the use of a Collapsing Tap.
The Geometric Tap has the advantage of use either as a hand tap or as a machine tap.
The Tap is not equipped with the collapsing device, but has all the other advantages of a Collapsing Tap. Being adjustable, correct size is always maintained.
Chasers are readily removed for regrinding, and when finally necessary to renew the chasers, this can be done at slight cost. A great saving over renewing the entire tap.
Each size tap accommodates chasers for a range of diameters.

Reducing production costs is no new occupation for Geometric Screw Cutting Tools and Machines.

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PITTSBURG MARKETS
(Continued from page 58)

had been holding to $19.50, valley, but the Cambria Steel Company, Johnstown, decided a few weeks ago to make merchant iron and has now sold a lot of several hundred tons to a Pittsburg district consumer at the equivalent of $19, valley. Foundry iron remains quotable at $17.75 to $18, valley.

Probabilities now are that the reduction in Lake Superior iron ore for the 1922 season will be in the neighborhood of a dollar a ton, made up of concessions by producers and by decreases in freight rates, the regular price being at Lake Erie dock, not at mine. Mesabi non-Bessemer last year was $5.55, at Lake Erie dock, there having been a reduction of $1 a ton from the 1920 price, putting the market back to the 1919 level. The actual market price will hardly be developed for two or three months yet. The question is whether the decline in pig iron prices has discounted the prospective decline in ore.

Connellsville coke is holding the advances reported last week but has not stiffened farther. Spot and prompt are quotable at $3.25 to $3.50 for furnace and at $4 to $4.25 for foundry, per ton at ovens.

Don't let your machine cut wind when the boss isn't around.

Don't try to shift the responsibility for any spoiled work, own up like a man.

HAVE MANY ORDERS ON HAND

"WE ARE experiencing very good business. In fact some of our present orders will not be completed for at least three months or more." This was the cheering news which E. M. Jones, sales manager for W. H. Banfield & Sons, gave to Canadian Machinery during an interview a few days ago.

This firm is just completing a large shipment of electrical goods and phonographic parts to New Zealand, and a short time ago sent various of their products to Japan. They are doing quite a bit of export business, having sent material to a number of other foreign countries.

They are developing their range of electrical goods, more extensively and have engaged H. A. Shroder, who has had twelve years experience in that business, to supervise, and develop new lines. In addition to their regular electrical products, they are going to place on the market a levoriler chain socket which breaks at 660 W. They are also going to make keyless sockets, rotary switches, heat switches for stoves, and other lines. Their push switches, and in fact all their lines, are placed under very exacting tests, these being viewed by Canadian Machinery.

They are also selling some of their war time equipment and are re-arranging their other tools in order to have the various departments in the best possible sequence. The work entailed in this move is considerable, but will be worth while when completed. In a later issue we will have more regarding the activities in this plant, touching upon production methods adopted.

In an article dealing wtih the metallurgy of copper, contributed to the Journal of the American Institute of Mining and Metallurgical Engineers, Mr. E. P. Mathewson attracts attention to the importance of the by-products of the smelting operations. Under this head the following may be mentioned:—Sulphuric acid, liquid sulphur dioxide, gold, silver, lead, zinc, zinc oxide, zinc dust, test lead, blue vitriol, litharge, cadmium, bismuth, thallium, selenium, and its compounds, tellurium, arsenic, fungicides, insecticides, phosphate fertiliser, aluminum and its compounds, antimony, lithopone, platinum, palladium, iridium, nickel and its compounds, fire-brick, and common brick.

BUBBLES IN GLASS

Bubbles which are detected in glass in the process of manufacture must of course be eliminated, and the only way would seem to be to stir or otherwise manipulate the materials until they are brought to the surface. A German firm, however, has applied for a British patent for subjecting the glass while in a soft state to a pressure of at least 200 atmospheres so that the imprisoned gases will be absorbed.

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METAL STAMPINGS

Manufacturers of metal specialties are coming more and more to realize the utility and economy of metal stampings over castings and expensively machined parts.

Have you investigated this possibility as applied to **your** manufacturing problems?

Bring your problem to us. With our extensive experience and complete plant for turning out metal specialties of all kinds, we can undoubtedly be of service to you.

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A Perfect Saw for every Purpose

"Finest on Earth"

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You can purchase Atkins products from all distributors in the United States, Canada, Great Britain and France; in fact in all civilized countries. If they do not have in stock the particular saw or machine required, they will get it for you.

If you have difficulty in obtaining Atkins Saws and other products through your regular service, write

E. C. Atkins & Company

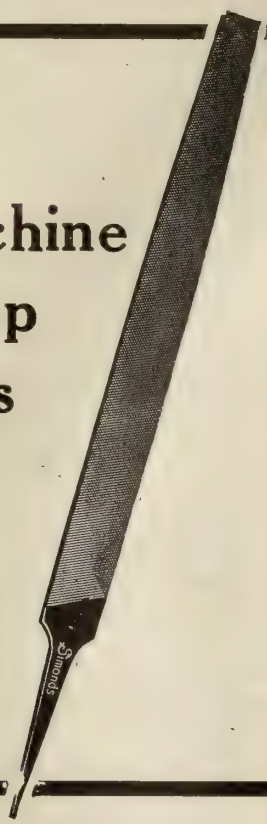
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Machine Shop Files



Highest Quality

Good files are as necessary in a machine shop as any other tool—In fact, files like Simonds are really essential for smooth work. All Simonds Files are made absolutely uniform and hold their cutting edge longer.

Mechanics should try Simonds Machine Shop Files.

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St. John, N. B. Vancouver, B. C.

Colgates & Co., soap manufacturers of New York and Jersey City, have purchased a modern building at 72 St. Ambrose Street, Montreal, where they will be able to increase their Canadian production and speed up delivery. The Colgate business is one of the oldest industrial firms in the United States. It was established 115 years ago and there are now 3,000 employees in the main plant.

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Machine Springs, Valve Springs, Automobile Cushion Springs, etc., of a quality that defies competition. Tell us your requirements. Send sample or specification for price.

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Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.

Brantford Oven & Rack Co. Ltd.

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"Maple Leaf" BRAND

Stitched Cotton Duck Belting

"Maple Leaf" brand costs less than leather, rubber and balata; has a positive grip on the pulley and is true running.



Have us send you samples and see just why "Maple Leaf" sets the standard in economy, strength and durability.

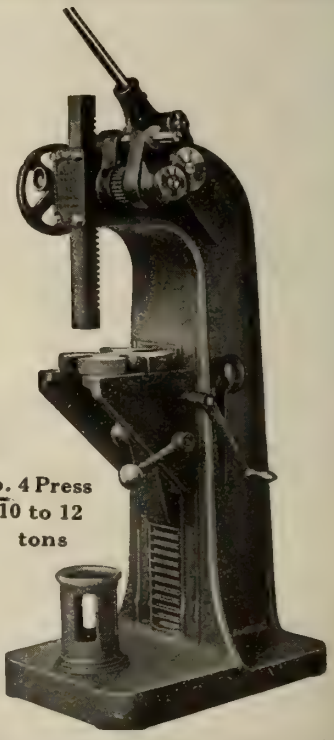
Dominion Belting Co. Ltd.

Hamilton, Canada

Quebec Branch: 51 Duluth Bldg., Montreal

A new safety code for the use, care and protection of abrasive wheels has recently been approved by the American Engineering Standards Committee and released for publication, the date of approval being February 11, 1922. This code has been in the process of preparation for about two years, and the announcement of its official approval will be gladly received by a large number of individuals and organizations who have been waiting for an authoritative publication on this subject, as well as by the many societies, associations and individuals who had a hand in its preparation.

The code was prepared under the rules of procedure of the American Engineering Standards Committee and has as its sponsors the International Association of Industrial Accident Boards and Commissions and the Grinding Wheel Manufacturers of the United States and Canada. The new code is a distinct improvement over the codes previously issued by the grinding wheel manufacturers, and contains much information not found in any other publication. The size and scope of representation of the organizations sponsoring and endorsing the code give it an air of authority which cannot but commend it to the careful consideration of everyone interested in any way in grinding wheels. The code is now in the hands of the printer and will be ready for general distribution about the middle of March, 1922.



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Kalamazoo, Mich., U.S.A.

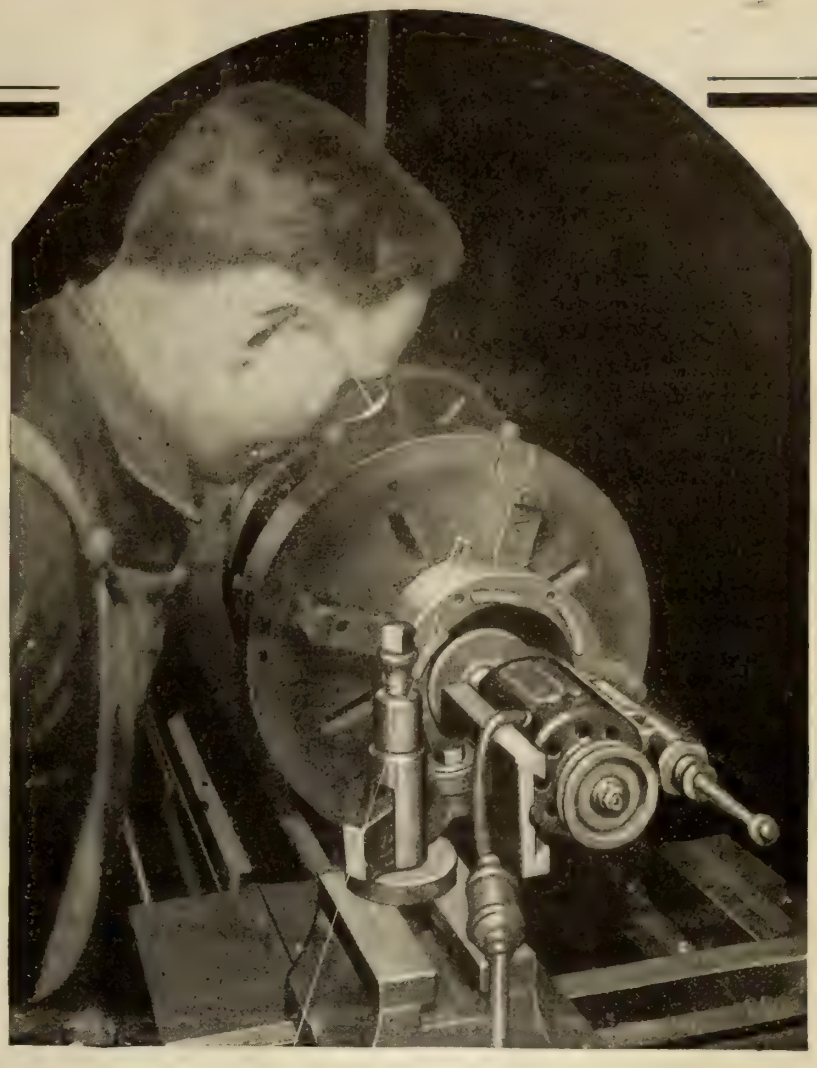
Canadian Representatives:

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Durably built in six useful styles and sizes, these compact high-speed grinders have long ago become indispensable in many varied industries. DUMORE grinders combine perfect running balance with correct cutting speed and work with a total lack of end play and absence of vibration—insuring speed and accuracy on the most delicate jobs.



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Let the DUMORE solve **your** grinding problems. Ask your dealer about them or write us for descriptive literature, and learn how DUMORE economy saves time and money. Write **to-day.**

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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

REGO WELDING and CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies

Carter Welding Co. of Toronto, Limited

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BRASS, BRONZE, ALUMINUM Trolley Wheels, Closet Seat Hinges, Bronze Gears, etc. Jobbing Brass, Bronze and Aluminum Founders.

The Langley & Austin Brass Foundry

GALT, ONTARIO.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

ATTENTION CANADIAN MANUFACTURERS!

Will license or sell outright basic patents covering a product and process for making same, which is used in practically all mechanisms for power transmission, including automobiles, trucks, tractors, agricultural machinery, machine tools, etc. Is better article and cost is reduced 50% by this process. Ford is using them in cars in the States. A wonderful opportunity to fill up your drop forge plant and machine and license others if patents are required. Address: H.N.A., Box 36, Lakewood, Ohio.

(C.9M.)

SITUATIONS WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

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MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W.H. Sumbling Machinery Co., Toronto. (etfm)

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CAFETERIA EQUIPMENT — RANGE, STEAM table, glass shelving, urns, Cash register, etc. Must be in first class condition. Give description and prices. State where may be inspected. Box No. 801L, Canadian Machinery.

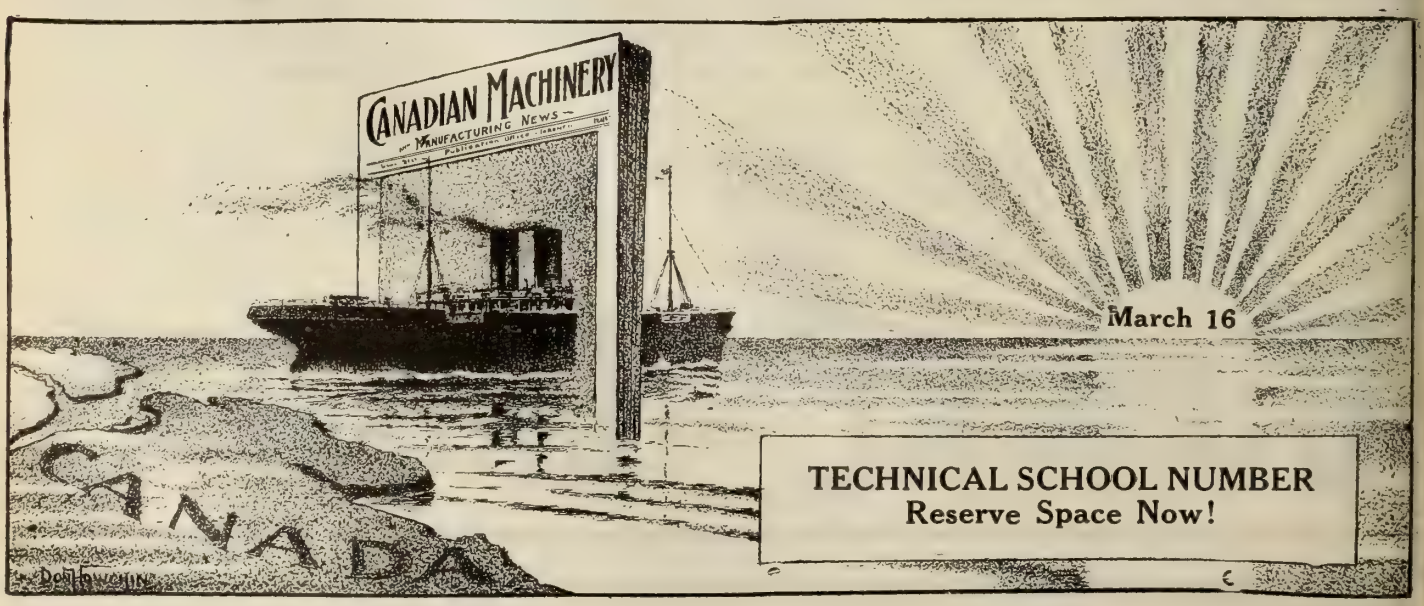
WANTED TO BUY—A SECOND HAND LOcomotive crane in first-class condition 7½ or 10 ton capacity. Address Standard Steel Construction Co., Welland, Ontario. (C.9.M.)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.

ASK US.

THE KATIE FOUNDRY, GALT, ONT.



MACHINERY FOR SALE

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1—26" x 12' Pond Lathe, S.B.G., C.R., P.C.F.
1—24" x 12' New Haven Lathe, D.B.G., S-Q.C.G., C.R.
1—24" x 12' Can. Mach. Lathe, S.B.G., C.R., P.C.F.
1—21" x 10' London Lathe, S.B.G., C.R., P.C.F.
4—20" x 8' C.M.C. Lathes, D.B.G., S-Q.C.G., C.R.
1—18" x 8' C.M.C. Lathes, D.B.G., Q.C.G., C.R.
1—21" x 10' Butler Lathe, D.B.G., Q.C.G., C.R.
1—16" x 6' McDougall Lathe, S.B.G., S-Q.C.G., C.R.
1—18" x 8' C.M.C. Lathes, D.B.G., Q.C.G., C.R.

Shapers

1—24" Rockford Shaper.
1—12" Port Hope Shaper.
1—16" Hendey Friction Geared Shaper.

Drills

1—No. D-1 H.D. Colburn Drill.
2—No 24 H.D. Foote Burt Drills.
1—28" Barnes Drill, B.G., P.F.
1—22" Barnes Drill, B.G., P.F.
2—16" Back-geared Drill, lever feed only

Miscellaneous

2—2" x 26" Pratt & Whitney Turrets.
1—No. 2 Gardner Disc Grinder.
1—3" Acme Bolt Cutter.
—No.54PerkinsSprue Cur.
1—No. 320 Brown-Boggs Pess.
1—10"x24" Plain Landis Grinder, self-contained.
Union Triplex Hydraulic Pump, 1¼"x"4

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HALE STREET
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CLEARING SALE
Of Steel Tubing
At Less Than Mill Cost From Stock

SEAMLESS DRAWN STEEL TUBES
100 lbs. 3-16" O.D. x 20 Ga.
400 lbs. ¼" O.D. x 20 Ga.
500 lbs. 5-16" O.D. x 20 Ga.
1,500 lbs. 1" O. D. x 10 Ga.
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1,600 lbs. 1⅛" O.D. x 14 Ga.
1,000 lbs. 1⅛" O.D. x 10 Ga.
3,000 lbs. 1¼" O.D. x 10 Ga.
10,000 lbs. 1⅝" O.D. x 5-32 W.

WELDED STEEL TUBING
500 lbs. ⅜" O. D. x 15 Ga.
3,000 lbs. ½" O. D. x 15 Ga.
1,300 lbs. ¾" O.D. x 15 Ga.
6,200 lbs. 2⅜" O.D. x 3-16 Ga.
1,200 lbs. 2⅝" O.D. x 13-16 Ga.
1,000 lbs. 4" O.D. x Ga.

BRAZED STEEL TUBING
700 lbs. 1½" O.D. x 16 Ga.
250 lbs. 2" O.D. x 14 Ga.

BUTT JOINT STEEL TUBING
23,000' ⅜" O.D. x 20 Ga.C.R.
13,000' ½" O.D. x 20 Ga. C.R.
3,000' ⅞" O.D. x 18 Ga. H.R.

WELDED STEEL TUBING
4,500' 7-16" O.D. x 20 Ga. cold rolled.
2,400' ½" O. D. x 20 Ga. cold rolled.
13,000' ⅞" O. D. x 20 Ga. hot rolled.
6,000' 1¼" O.D. x 20 Ga. cold rolled.
1,500' ½" O.D. x 20 Ga. cold rolled.
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Phone Parkdale 5200

Elimination of waste effort is the secret of complete efficiency--in a filing job as elsewhere.

A file that has lost its keenness wastes a workman's effort and time, and so costs more than a new file.

Keep a new file handy to replace the worn one, and for long-lasting efficiency specify one of these brands:

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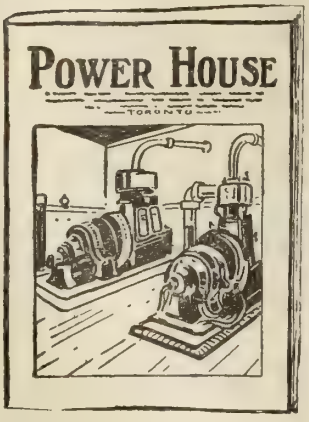
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POWER HOUSE—published semi-monthly. It serves steam, electrical, water and gas power plants and refrigeration plants throughout the Dominion. It reaches plant owners, their purchasing agents and stationary engineers and firemen. It goes into the power houses of all general manufacturing plants, pumping stations, mining industries and railroads.



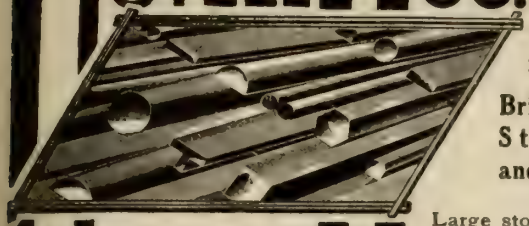
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Good distribution of your product is desirable—good salesmanship is essential. Our proposition possesses possibilities that will be sure to interest you. Full information on request.

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Large stock of all sizes.

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Means Better Work



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and work gloves give complete hand **protection** plus hand **comfort.** The same reinforcement (small steel ribbons over strips of tough leather) that protects the hand also gives so much extra wear that these mittens and gloves last almost indefinitely. Sewed closed with steel thread, they are absolutely rip-proof. The steel reinforcement does not interfere with flexibility. Your workmen equipped with Steel-Grips will dig in with a will.

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NORTHERN MADE IN CANADA CRANES & HOISTS



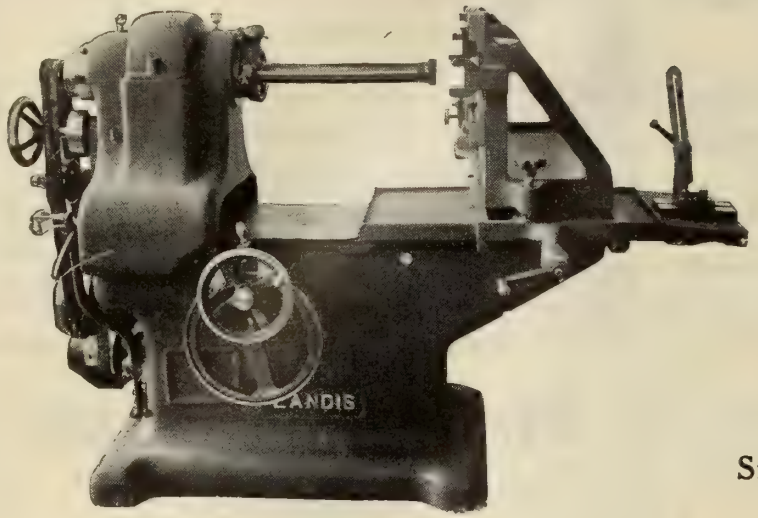


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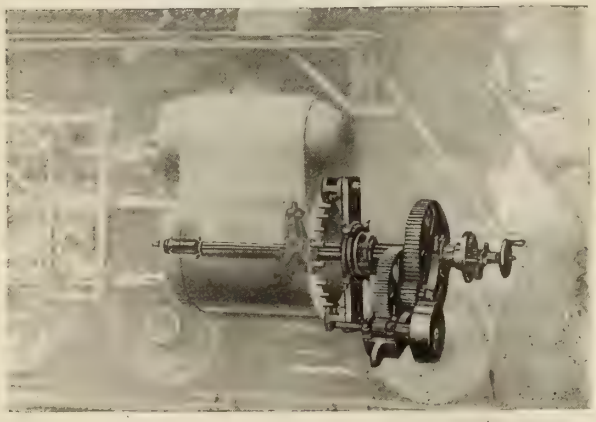
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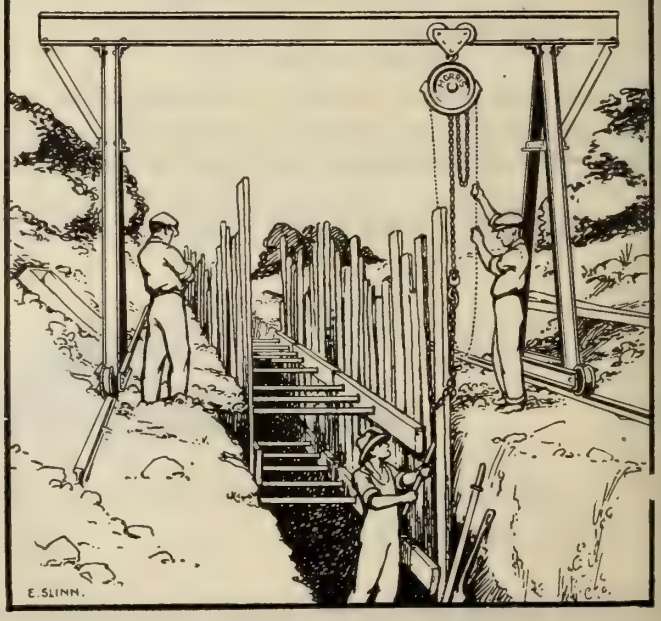
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are popular among contractors because with all their qualities of speed, ease and safety, they are also rugged enough for rough handling.

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Parker Vises take in 70 sizes and a style for every trade or shop. For small repair shops and garages—for the engine room—for experimental departments—and for great machine and railroad shops using hundreds of vises, there is a "Parker."

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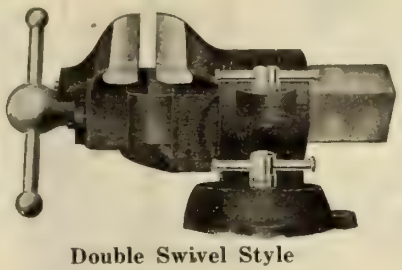


They "Grip Like a Grizzly"

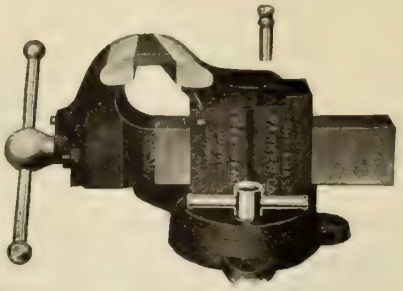
THE CHARLES PARKER CO., *Master Vise Makers*
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Single Swivel Vise



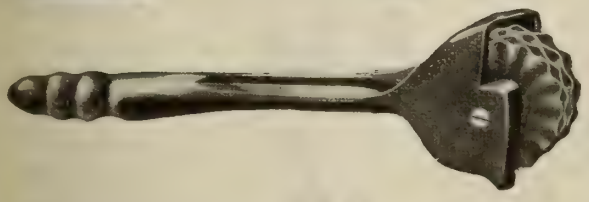
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THREE OF THE "70"



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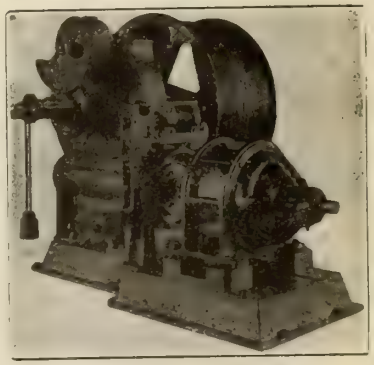
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Roelofson Elevators

Reduce Freight Handling Costs



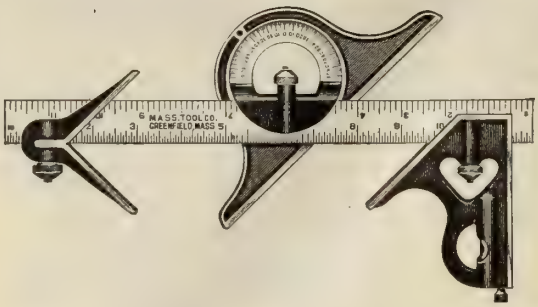
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They keep costs down low by running smooth, safe and noiseless. Brake is self-adjusting. Gears are strongly made of phosphor bronze. Worms cut from solid steel forging. Construction is self-oiling and dust-proof. Capacity 1,000 lbs. to 10,000 lbs. A complete line of Electric, Hydraulic and Hand-Power Elevators.

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GOODELL-PRATT

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Why buy precision tools blindly on reputation? Why not test each tool yourself before you buy it?

If it's a Square you want, test it out with another and make sure you get a light-tight fit.

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Goodell-Pratt Precision Tools welcome any test you want to make, because every one is made with good old-fashioned honesty and care. We don't ask you to take our word for it; all we ask is that you give Goodell-Pratt Tools a fair test.

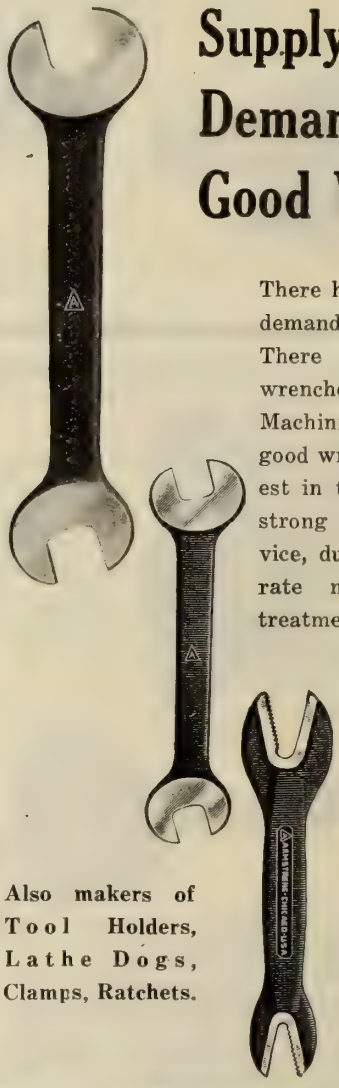
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Goodell-Pratt Company

Toolsmiths

Greenfield Mass., U.S.A.





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There has always been a big demand for **good** wrenches. There always will; good wrenches are hard to make. Machinists who know that good wrenches are the cheapest in the end find in Armstrong products longer service, due to best steel, accurate machining and heat treatment.

In addition expert designing of a wide range of styles insures prompt satisfaction on your order — no matter what it may call for.

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Production At Lower Cost

AN instance of how Acme Forging Machines are employed to give increased output at a lower cost is seen in the forging of auto pinion shafts.

Upsetting is completed in three operations, the stock used is $1\frac{1}{8}$" steel. The cold end of each shaft is placed against stop, then heated end in the die. A step on treadle completes first operation. This being a two-operation die the work is next placed in its lower section, the treadle again stepped on, and the second operation completed. After a quantity of work has piled up the dies changed and a single operation at opposite end of shaft completes the part.

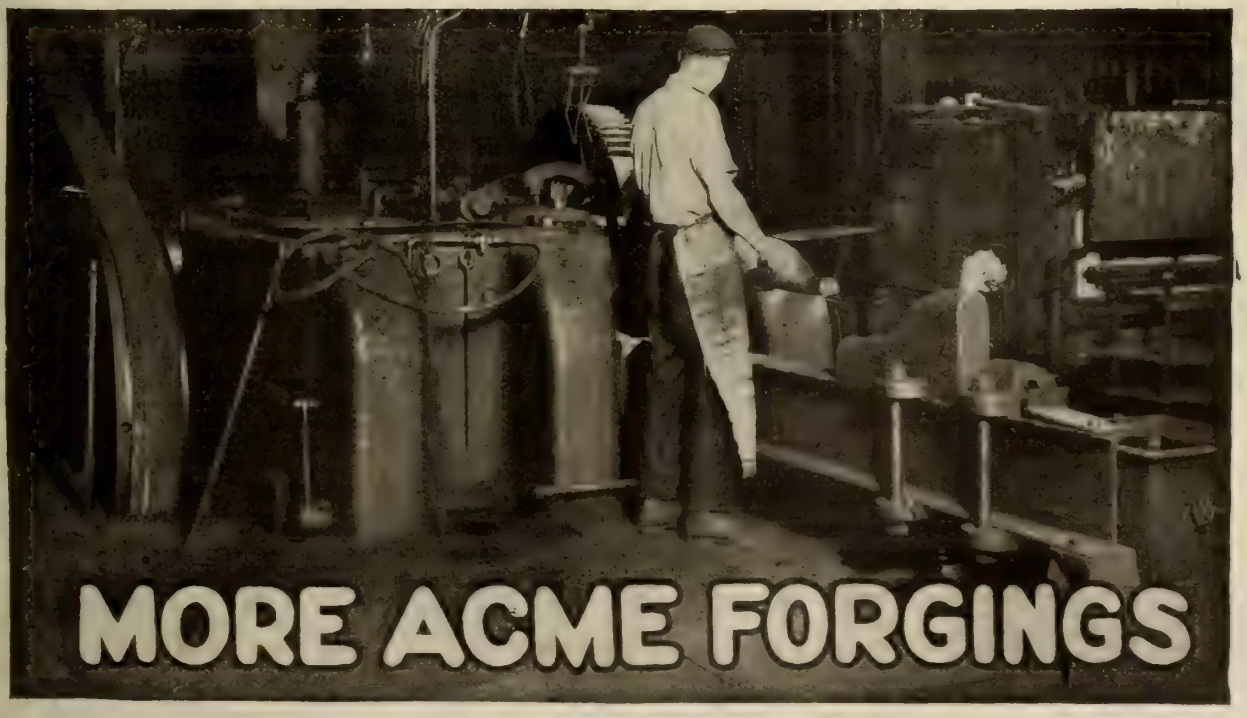
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Canadian Agents:

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PRESSES

HYDRAULIC SCREW AND FILTER

Hydraulic Wheel Press



Made in Canada

WILLIAM R. PERRIN, LIMITED
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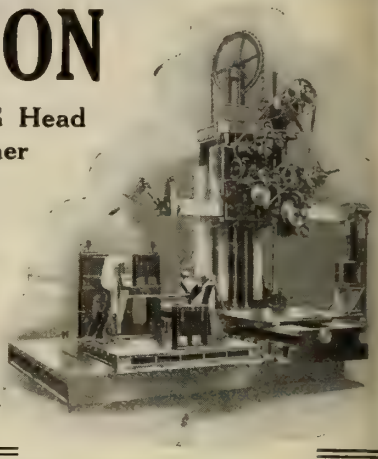
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Reliable because it's Morton made.

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SPRING SHACKLE BOLTS



"D"

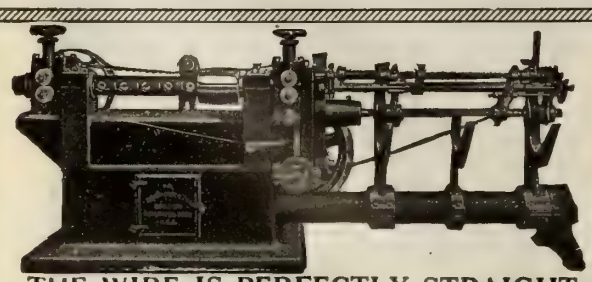
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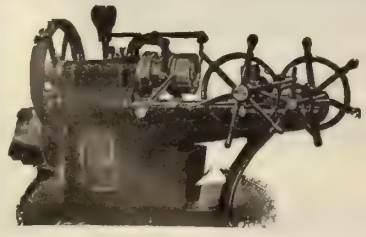
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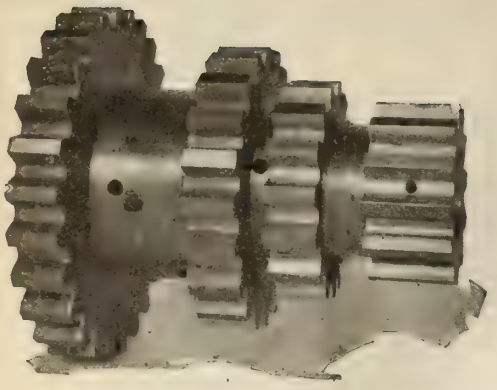


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Discharging End
Conveyor is adapted to the characteristics of the individual piece

Interesting data on improved methods, with an outline of the factors governing the intelligent selection of equipment and fuel, are given in Bulletin 240T.

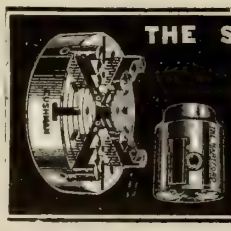
Typical heating and handling problems are considered, with illustrations of stationary and continuous furnaces and a variety of handling equipment.

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50 Church St., (Hudson Terminal Building) New York.
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COAL—OIL—GAS—ELECTRICITY
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SMITH'S FALLS MALLEABLE CASTINGS LTD
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"CUSHMAN" CHUCKS 1862
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YOUR DEALER WILL FURNISH THEM



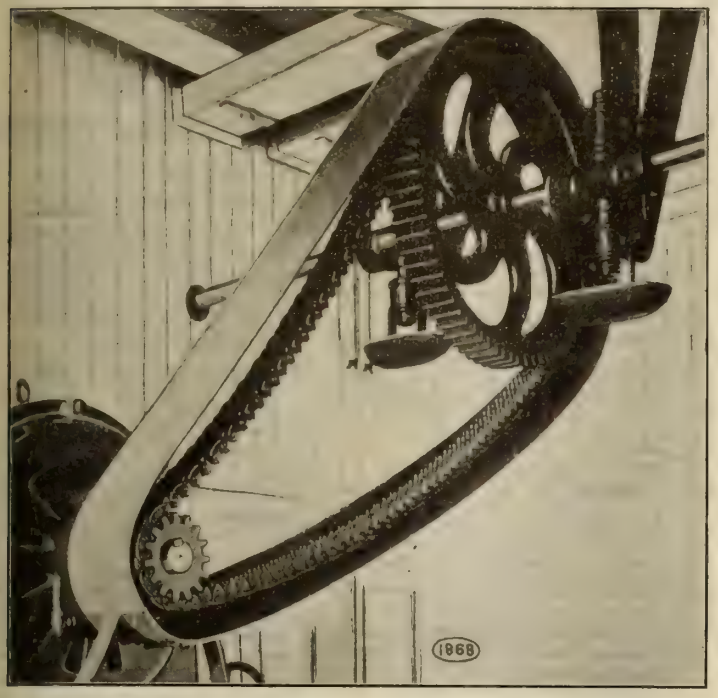
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ROCKFORD, ILLINOIS, U. S. A.

THE

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Do Your Castings Cost Too Much?

A rearrangement of your patterns might cut their cost 25 per cent.; a different method of molding them might double your production at no increase in molding cost. We can advise you and we have expert metal and wood patternmakers who are able to make any changes that may commend themselves to you.

If you need some new Patterns

send us a sample, blueprint or sketch, and ask for our advice. It won't cost you anything. If our advice is good and commends itself to you, it is only fair to assume that our work will be equally satisfactory, and we need the work as badly as you need the patterns.

We are in a position to do turning, boring, drilling or other semi-finishing operations on castings supplied by us. Ask us.

We have for our and your requirements, a large stock of assorted White Iron Stars, suitable for light agricultural to medium weight machinery castings, while they last, at 8 cents per lb. F. O. B. Galt.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Acetylene, Dissolved
National Electro Products Co., Ltd.,
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
S[illegible] of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Attachments, Tapping
William I. Procunier, Chicago, Ill.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.

Babbitt Metal
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Fittings, Ltd., Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pilew
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Ltd., Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Belting, Fabric
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont.

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Grey Iron
Fittings Ltd., Oshawa, Ont.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Hanna & Co., M. A., Cleveland, Ohio
Hepburn Ltd., John T., Toronto, Ont
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que.
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Boardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks,
Chicago Watchman's Clock Co., Chicago, Ill.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Can. Mathews Gravity Carrier Co., Port Hope, Ont.
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and certz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Preston & Schwartz, Galt, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machines, Bench
Burke Machine Tool Co., Conneau Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drill Press Sleeves.

BUYERS' DIRECTORY

Drills, Center

Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Combination Centre

Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist

Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet

Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat

Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings

Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment

Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments

Bristol Co., Waterbury, Conn.

Electrical Supplies

Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices

Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)

Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors

Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety

Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan

Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical

Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube

Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust

Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating

Can Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre

Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps

Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines

Williams Machinery & Supply Co., A. R., Montreal, Que

Filler, Iron (See Cements, Iron)

Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes

Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers

Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe

International Malleable Iron Co., Guelph, Ont
Fittings Ltd., Oshawa, Ont.

Flexible Shafts

Aikenhead Hardware Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery

Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop

Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer

British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment

Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies

Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid

Can. Steel Foundries, Montreal, Que.

Furnaces, Electric

Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal

Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas

Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.

Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing

Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric

Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording

Bristol Co., Waterbury, Conn
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Gages, Standard

Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread

Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing

Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed

L'Air Liquide Society, Toronto, Ont.

Gas, Compressed

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets

Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure

Taylor Instrument Co., Toronto, Ont.

Gear Blanks

Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters

Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiten Machine Co., D. E., New London, Conn.

Gear Testing Machines

Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast

Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut

Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Ford-Smith Machine Co., Hamilton, Ont
Gardner & Son, Robt., Montreal, Que
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited Montreal, Que.

Gears, Dressed

Kennedy & Sons, Wm., Owen Sound, Ont

Gears, Forged

Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone

Hamilton Gear & Machine Co., Toronto Ont.

Gears, Rawhide (See Gears, Cut)

Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto Ontario.

Gear, Silent Chain

Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal Quebec

Gears, Worm

Dom Steel Products Co., Brantford, Ont
Hamilton Gear & Machine Co., Toronto Ontario.

Generators, Acetylene

L'Air Liquide Society, Toronto, Ont

Generators, Electric

Northern Electric Co., Montreal Que

Gloves, Protective

Industrial Glove Co., Toronto, Ont

Goggles, Safety

Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets

Can. Link-Belt Co., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O

Gravity Carriers

Mathews Gravity Carrier Co., Port Hope Ont.

Grease Cups, Pressed Steel and Brass

Can. Winkley Co., Ltd., Windsor, Ont

Greases, Lubricating

Canadian SKF Co., Toronto, Ont

Grinding Machines

Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt

Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench

Aikenhead Hardware Ltd., Toronto, Ont
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center

U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Cutter and Reamer

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

Grinding Machines, Die

National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc

Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill

Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont
Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face

Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool

Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario
Petrie, Ltd., H. W., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.

Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable

Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel

Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging

Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post

Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal

Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.

Grinding Wheels

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel

Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery

Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power

Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping

Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Company, Wallace, Hamilton
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Gardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal, Q

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefsen Machine & Tool Co., Toronto
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Belt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Patterns, Wood and Metal
Crescent Machine Co., Ltd Montreal, Q
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Commercial Camera Co., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa.

BUYERS' DIRECTORY

Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rebuster Co., F. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Ltd., Montreal.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Leg
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que

Screws, Wood and Machine
Steel Co. of Canada, Ltd., Hamilton, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelofson Machine & Tool Co., Toronto,
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas Ont

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwartz, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwarts, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
National Machine Tool Co., Racine, Wis
Preston & Schwarts, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Rice Lewis & Son, Ltd., Toronto, Ont

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Mon

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont

Valves
Can. Fairbanks-Morse Ltd. Montreal, Q
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

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Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wiping Cloths
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Canada Metal Co., Ltd., Toronto, Ont.
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Greening Wire Co., B., Hamilton, Ont.

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Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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A. R. Williams Machinery Co., Toronto, Ont.

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Use Starrett Tools

42-284

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVII. No. 10 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | March 9, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page



42 302

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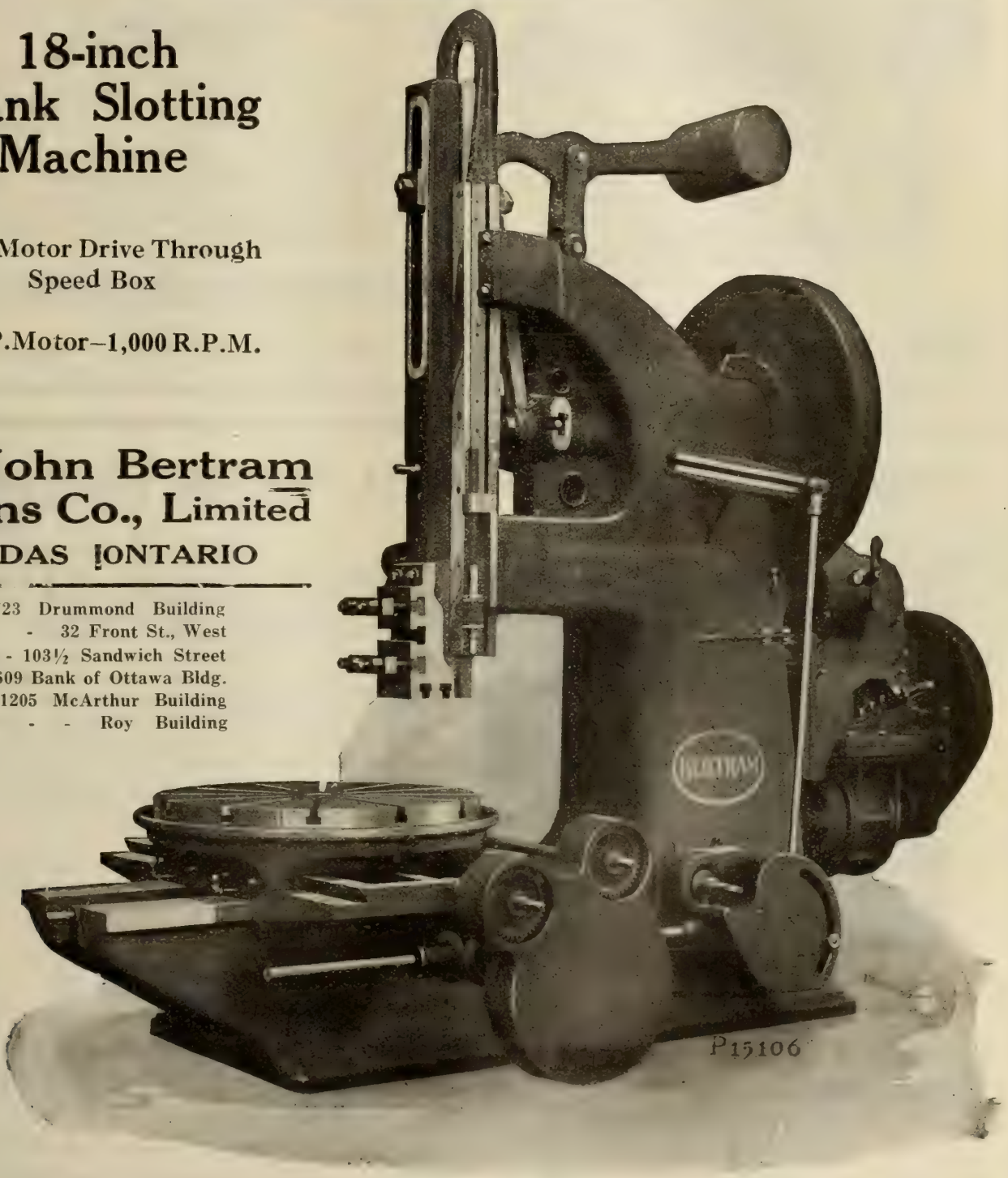
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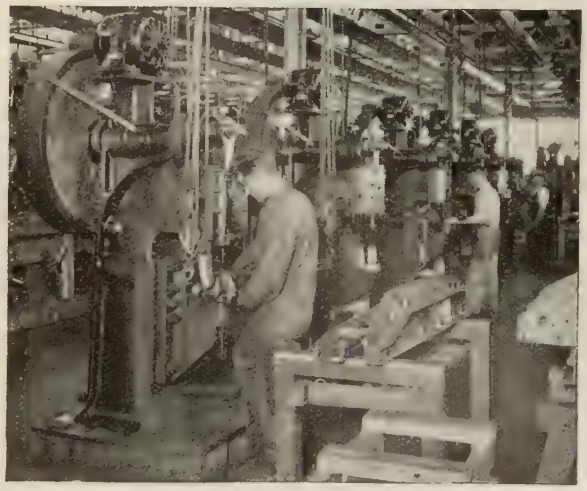
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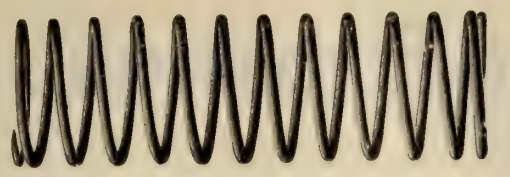
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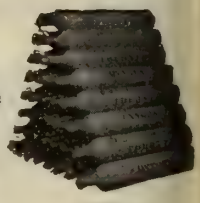
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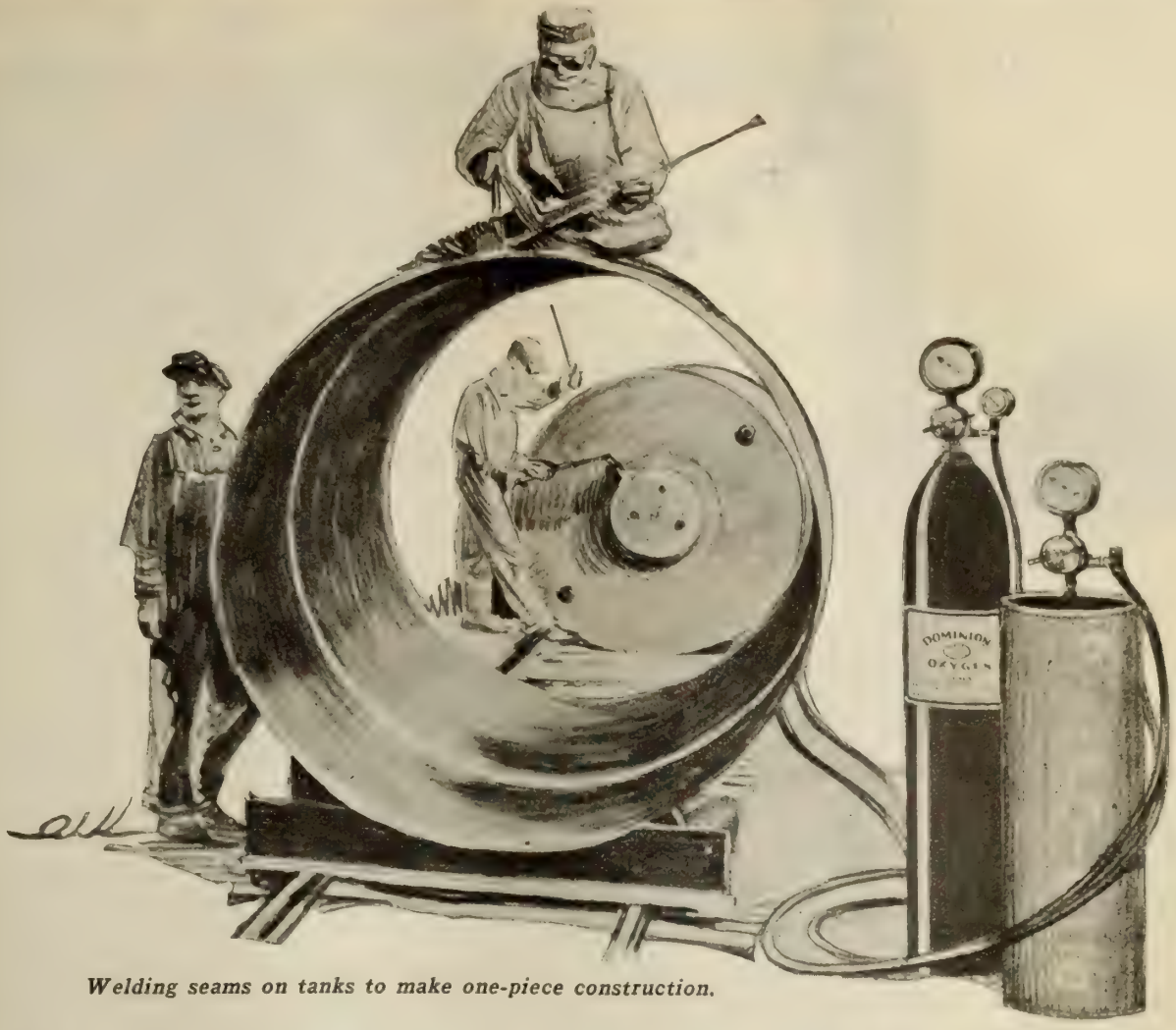




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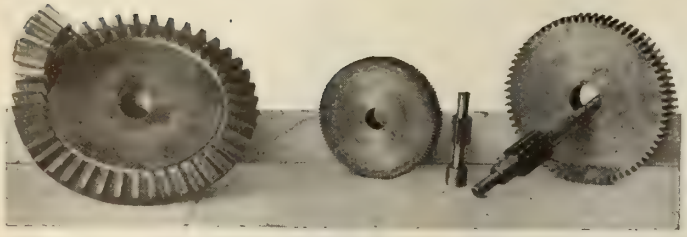
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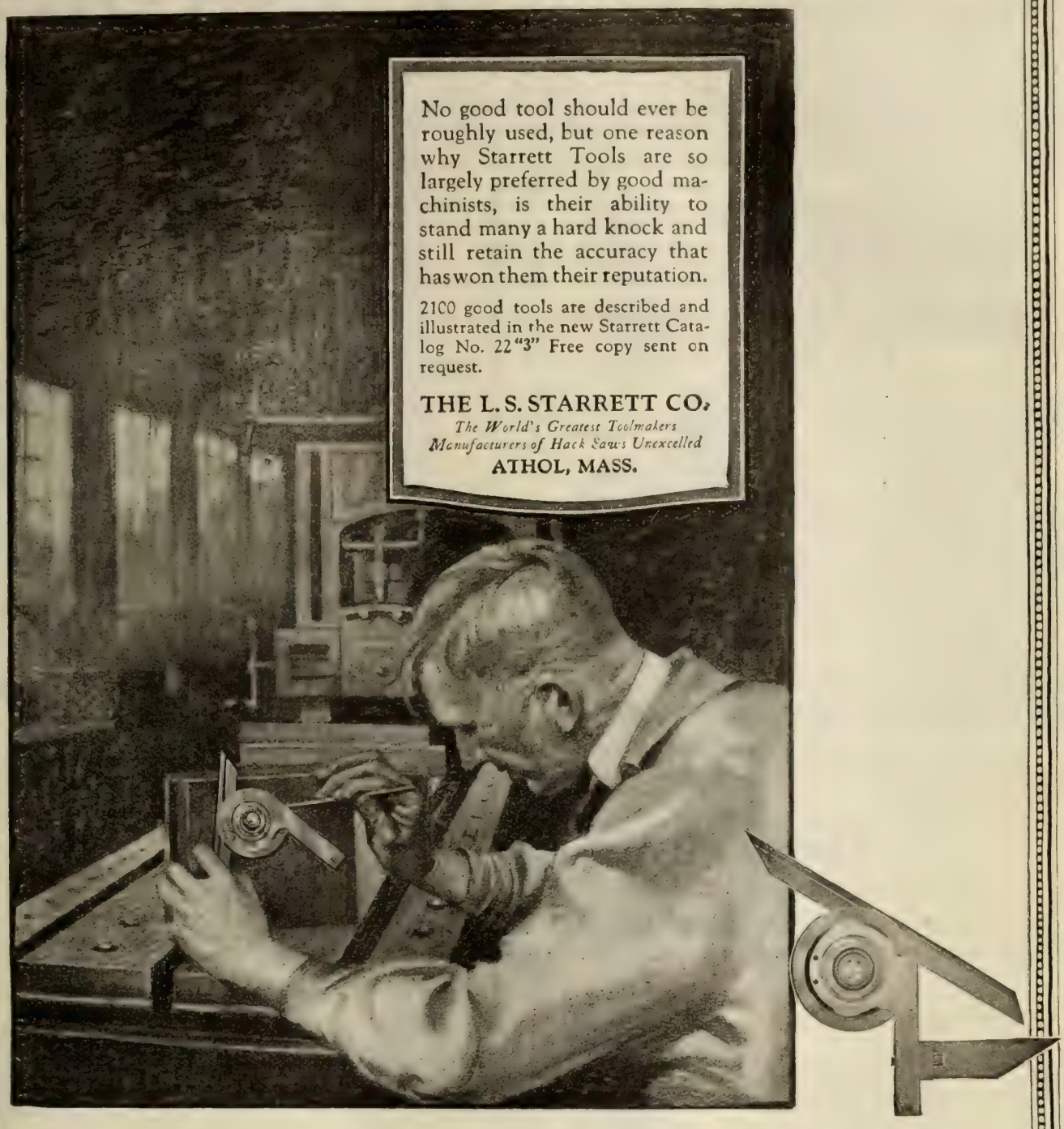
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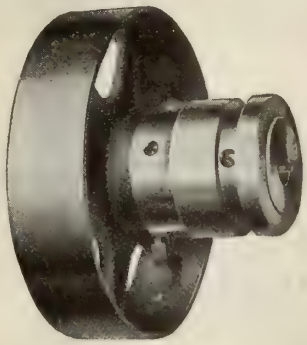
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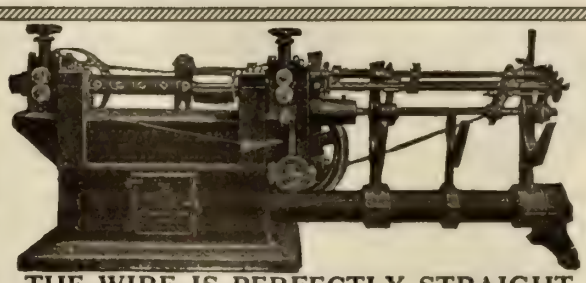
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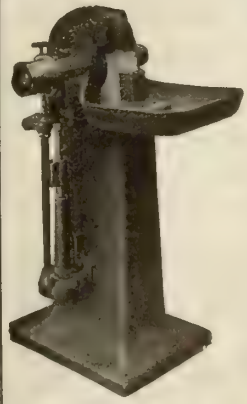


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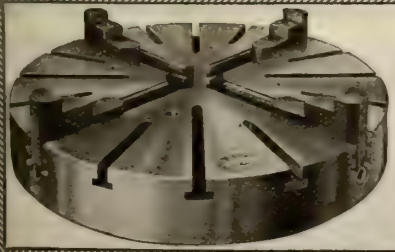


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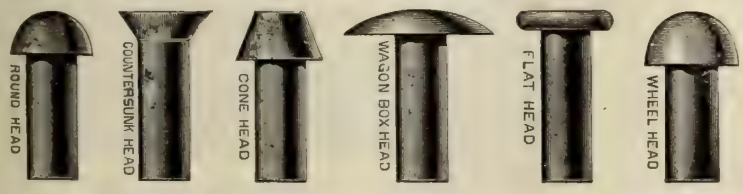


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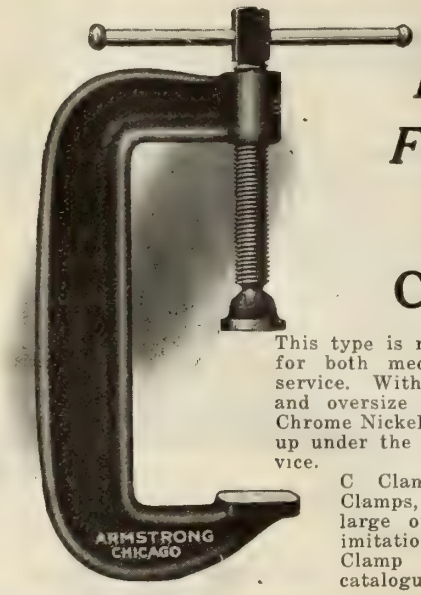
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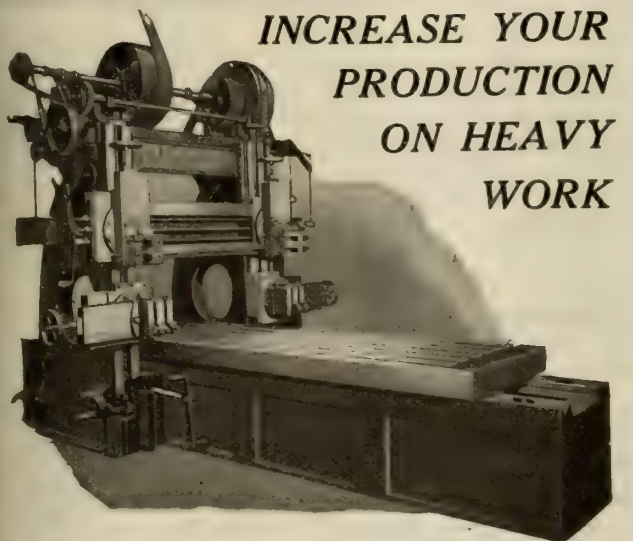
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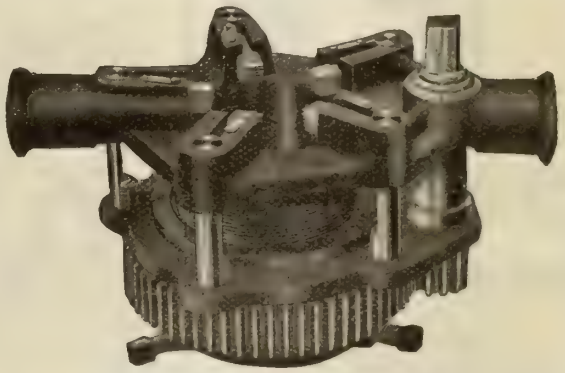
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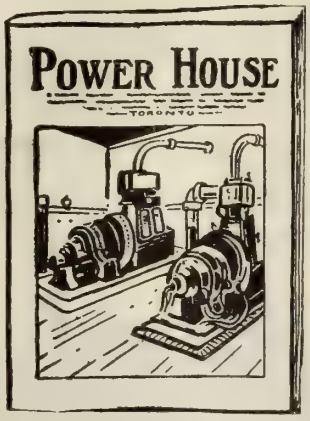
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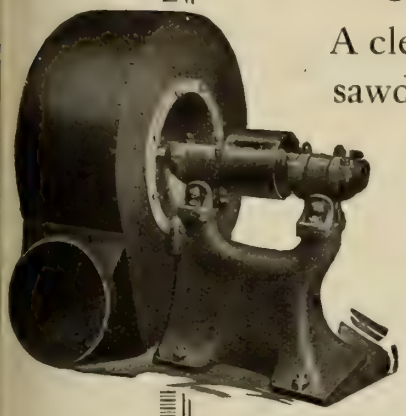
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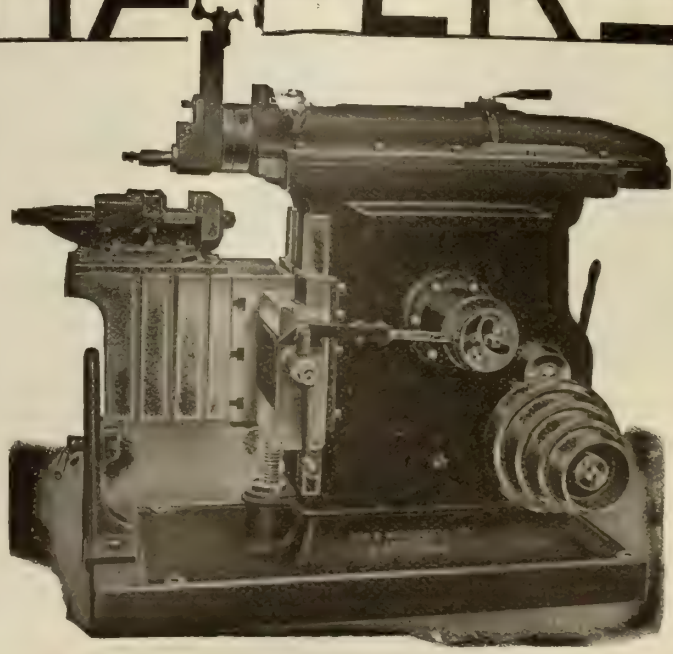
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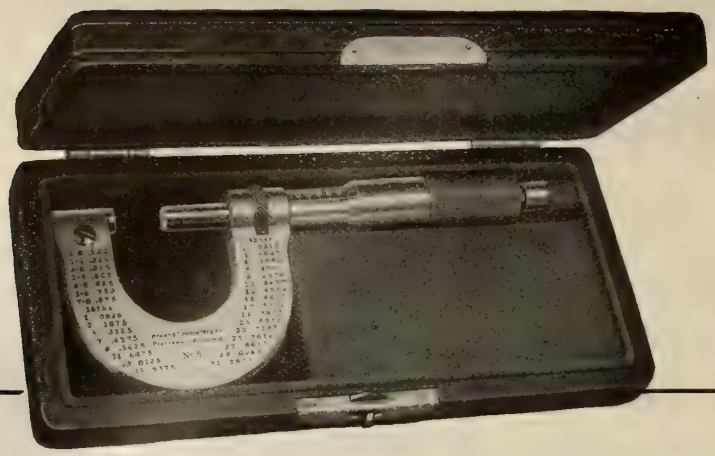
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VOL. XXVII. NO. 10 MARCH 9, 1922

Reduce Your Costs by Better Trucking Methods

Profitable Expenditure—Keep Machines Supplied With Work—Tracing Cause of Delays—Design Body to Suit Requirements—Mechanically Operated Trucks Facilitate Handling of Material

By J. H. MOORE

CAN you save money, by spending money? This sounds like a foolish question at first, but it is one that every executive should be interested in, especially at the present time when elimination of needless expense is so necessary. There are many ways in which an executive can spend money wisely on new equipment, saving expense in the long run, through the improvement in production, quality of work, and so on. Such saving is not confined to equipment, but to cover all sources of expense leak in one article is impossible, so that in the present material we will touch upon only one method of reducing factory expense.

A well managed plant always has a steady stream of material arriving at the various machines and benches. Whenever a tie-up occurs, it means a loss of actual cost to the plant owner, for wages, overhead, etc., must go on just the same. Tracing the cause of delays, through material not arriving at machines in time, it is generally found that inter-shop transportation methods are at fault. In other words, either the wrong type of truck is used for the purpose, or worse still, insufficient trucking equipment is installed. Either condition makes for lower profits.

The cost of handling a product has always been a vexatious one to executives. They often find, upon investigation, that more time is taken up in handling, than in the actual machinery operation. This of course should not be, and the remedy should be applied at once.

If you have not considered the matter of handling costs in this light before, it is not too late to do so. Proper handling of work is an ever increasing problem, so that one can truthfully say that the value of inter-shop trucks to a business largely depends upon the extent to which executives make use of this aid. Properly used, trucks can reduce production costs, and increase the efficiency of the workers. So many different types of trucks are obtainable, that executives have a very wide choice. Not only that, but they can secure definite data from the firms making such trucks regarding the savings effected. These figures generally come from the managers and superintendents of plants who have used trucks with success so that they can be thoroughly relied upon.

The Question of Cost

First cost is a minor consideration when viewed in comparison with future savings. That is to say, do not always purchase the cheapest equipment you can find, unless you feel sure it is the best for your purpose. For example:—

Suppose you were contemplating purchasing some equipment which would cost you from 35 to 40 per cent of your estimated savings. On the face of it, this looks like a mighty good proposition, but suppose we consider a second case. Another type of equipment can be purchased at 60 to 70 per cent. of estimated savings, later reducing handling costs 100 per cent. Which is the better proposition? Naturally the last mentioned, so that it pays to study more than the first expense only.

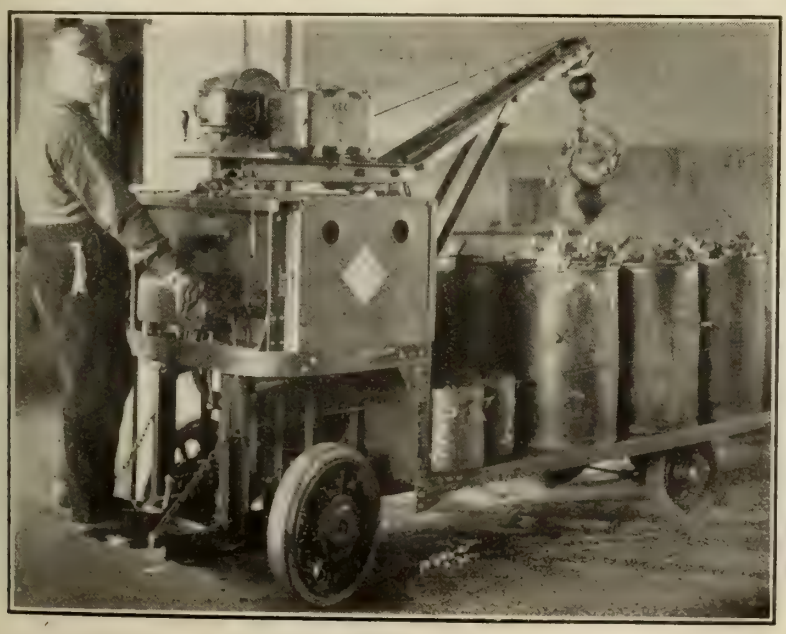


Fig. 1.—Type of truck used in Ford plant.

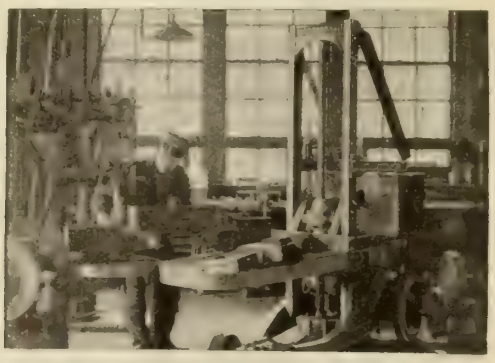


Fig. 2.—Showing use of lifting truck in machine shop.

We know of a case where the saving in handling per year amounted to $750,000, through the use of proper trucks. Suppose first expense had been considered as the chief point in this case, the equipment purchased might not have given such favorable results. True, this was a large concern which effected such an enormous saving, but smaller shops can benefit in like proportion.

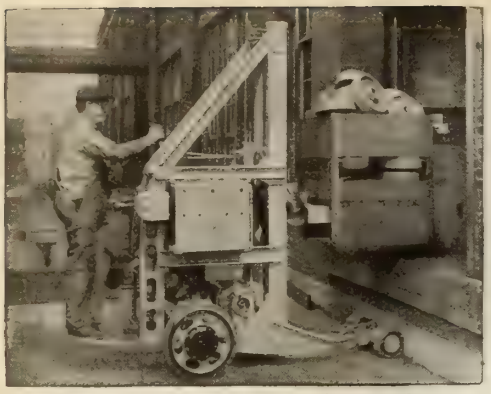


Fig. 3.—Showing use at various levels.

First, we have the hand-operated truck. These vary in character, but the principle is the same, viz., the human element does the necessary pushing or pulling. Usually the higher grade trucks are equipped with ball bearings, this reducing to a large extent the energy required for their operation. A ball-bearing truck, even though loaded to capacity, is not a difficult thing to move. Thus, the workman's strength is not overtaxed.

The type of platform, top, or rack, should be studied carefully. Figure on the work which has to be trucked, how it can best be loaded and unloaded, and, in many cases, it may be found wise to make a special shaped body to suit the nature of the work. A little extra expense on the body will more than pay for itself in the end.

Then we have the electric type of truck, such as shown in the various illustrations in this article. These trucks get their motive power from batteries, these being charged at regular intervals. A large number of firms throughout Canada have found this style of truck to speed up production and handling time in a wonderful manner. There is no need to comment on the method of operation, and the simplicity of steering is one of the chief assets of this type of inter-shop truck.

Savings Secured

The truck can be arranged to draw small trailer cars, taking raw materials from one section of the plant to another and so on, we have figures on file which show that in a certain automobile factory the trucking gang was reduced by 64 men by the first installation of eight trucks of different types, these varying with the class of work being handled. The average load was not over 1,000 pounds, and since the installation of the system we speak of, there has been less damage and breakage of parts, and practically no congestion as formerly. Of course a large cash saving also resulted. Rather than quote further actual examples of saving, we will discuss how electrically driven trucks, fitted to suitable bodies, can be used to advantage in the shop.

Take for example Fig. 1. The type of truck shown is equipped with suitable crane, and is used in the Ford Motor plant with good success. Others of like nature speed up and down the factory, taking parts from one machine or department to another. Note the varied collection of castings handled; one can readily understand how much quicker this method is than the hand-trucking way.

Fig. 2 shows another type of electric truck, which has a lifting device, this allowing the operator to bring the platform up to any desired height within the capacity of the framework. As will be seen from the cut, the drill operator has no trouble getting his casting on to the table. Not only does this save time, but it increases efficiency, as the workman is not straining himself lifting all day long.

Fig. 3 shows another use for this style of truck. Here we find that the operator has lifted up his platform to suit the door sill level. Many factories have yards such as shown, and if ordinary trucks are used it means waste of time and double handling. With the

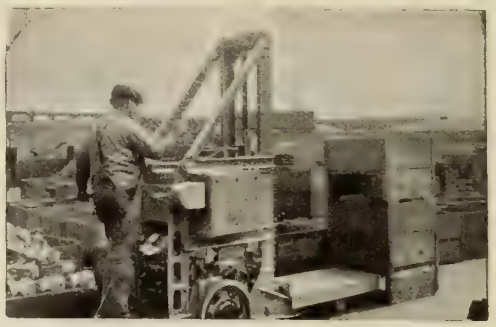


Fig. 4.—Note type of construction at bottom of holding racks.

method shown, the material is soon landed into the other department.

Fig. 4 shows another use for the lifting platform type of truck. In Figs. 3 and 4, it will be noted that the bottom part of material-rack is shaped to suit the entry of platform. This is most important, and speeds up handling considerably. It proves the former point mentioned, viz., that it pays, not only to study the truck, but the style of storing and piling used in conjunction with the truck.

Then there is the electric locomotive shown at Fig. 5. This style of hauling aid has proved of great value in taking heavy or light castings to and fro, especially in the larger-sized plants. It can handle very heavy loads, allowing many cars to be hauled at one time.

We have only scratched the surface of trucking possibilities in this short article, but sufficient has been shown to prove that trucks are very necessary and valuable to a well conducted business and the extent of their value depends almost entirely on their wise application to the work on hand.

AUTOMATIC FURNACE CONTROL

The furnace may be said to be almost the first industrial appliance ever produced, since it is in furnaces of some sort that metals are melted. And the beginning and the end of the art of the furnace lies in controlling temperature. During recent years, especially since the development of electric furnaces, there has been remarkable progress in the accuracy of this control, and the summit appears to have been reached in the appliance recently displayed at a scientific exhibition in London, England. The instrument is intended not only to keep a furnace at a certain temperature, but to raise or lower the temperature in accordance with any pre-arranged programme. In general appearance it is similar to a recording barometer, the pen tracing out a curve which rises and falls according to the temperature. A metal plate cut to a certain shape is laid over the chart, and if the temperature falls too low the pen comes into contact with the metal and completes an electrical circuit which operates mechanism arranged to raise the temperature of the furnace. Contrariwise, when the temperature gets too high the pen comes into contact with another part of the metal actuating mechanism for reducing the temperature. The curves of the metal thus determine the fluctuation in the furnace temperature.



Fig. 5.—Transportation truck with trailers.

Increasing Man Power Through Management

Placing of Employees According to Ability—Importance of Definite Instructions—Temperament Must be Reckoned With—Foreman Should Take Time to Plan Work—Leaders, Not Drivers, Make Best Executives

By L. W. OLSON

Factory Manager Ohio Brass Co.

WE ALL recognize that one of the most important functions of an executive is the management of his men. I have not tried to form any estimate of the proportion of his time to be so applied, but I know of estimates others have made placing this as high as 70 per cent. However, we are not concerned particularly with any mathematically correct proportion, which after all must vary with different lines of activity. Of the supreme importance of the task we are all agreed.

Distinguished by their methods, there are two types of executives:—Drivers and Leaders. The former class was perhaps more prevalent years ago than it is now, and it is certainly encouraging to believe that this is so, for it is a distinct mark of progress and advancement in industry. It is my conviction that plants managed by Drivers have higher production costs than those managed by Leaders. It is certainly not necessary to argue as to which method is the more desirable; for aside from the pleasure that comes from contact with a contented and co-operating force of men—there is that wonderful efficiency and economy that comes from loyal and contented people which no one can definitely measure, but which we all know exists.

It has been said that Leaders like poets, are born and not made. This is undoubtedly true to a large extent. We all know of glaring examples of individuals who are brilliant mentally, strong physically, clever, skillful and educated, who are wonderful in individual accomplishment, but who cannot manage other people. Even with a limited contact they always seem to rub everyone the wrong way. Then there is another type—pleasant, amiable, and well liked, but who, upon being given any authority over others seem to feel their importance to such an extent that they become unbearable. This is the type that are afraid others will not recognize them as boss, and think they must periodically do something that shows conclusively that they are vested with authority.

Real leaders need no special badge of authority, but naturally in an organization it becomes necessary to prescribe bounds and limitations, and to designate functions. Leaders are undoubtedly possessed of a natural inherent talent, which when developed to a high degree makes for prominent and distinct leadership. However, others may have less natural endowment but by persistent and intelligent application may so develop themselves that they succeed as leaders in a large measure.

Author delivered this talk to the foreman of factory he is connected with.

Development Necessary

Comparatively few people, if any, are so generously endowed by nature that no further development on their part is necessary, and many wonderfully gifted people have never made use of their talents nor would they work for their development, but their ambitions were satisfied with a proportionately small accomplishment. Not all of us have the ability of leadership given us in the same degree, but perhaps by careful scrutiny of ourselves, by attention to certain fundamentals, and by a persistent effort along certain lines, we may be able to improve the talent we have and develop it to its limit. No such development as I have in mind can come without hard work; but after all the harder the task and the more intense the application, the greater is the satisfaction that comes when accomplishment is complete.

I have set down the following as some of the cardinal principles involved in the management of men, and shall discuss each one separately.

Place each man according to his ability. Give careful, correct and precise instructions. Manage the individual according to his temperament. Delegate and supervise properly. Compensate fairly and proportionately. Set a good example. Maintain discipline.

Cultivate an unselfish desire to help your men. Develop your personal character. This is not perhaps a complete list, nor is the sequence perhaps according to exact relative importance, but it will serve my purpose.

In human management it is of utmost importance that each man be placed at the kind of work he is best fitted for. This means that you must carefully study the abilities and capabilities of all your people. Unless this is done misfits of all kinds will occur and you will suffer handicaps from the very beginning that will influence all subsequent management.

Careful and Precise Instructions

A great deal of misunderstanding and discontent is caused by a lack of proper attention to this factor. Nothing is quite so unsatisfactory to one who is anxious to carry out instructions as to have only a vague idea of what is wanted. On the part of someone who is looking for an excuse for his failure to accomplish a result nothing can more quickly result in an argument than ambiguous or insufficient instructions. If it is a piece rate task, or if the operator is really anxious to make a showing, he becomes discouraged and often leaves. If he is not conscientious it may make a very poor and indifferent worker of him. In the case of executives and their immediate subordinates, it may result in a woeful loss of time for the one, and discouragement for the other.

The executive cannot expect to be able to delegate work to a subordinate, and have him grow in ability to take assignments if that executive is not willing and able to instruct properly, nor would that executive have developed much himself if those whom he had been under had been negligent in this regard. If you are in the habit of giving insufficient and unsatisfactory instructions, don't be surprised if some day you get results that reflect rather markedly your lack of attention to this factor and which may react as a boomerang on your advancement and prospects.

We are all so different in our make-ups that we do not respond alike to the same influences. To some people praise is as necessary as food and periodically it must be supplied; others are absolutely indifferent to praise; while others are easily spoiled by too much of it; sharp reprimands are necessary in some cases and mild ones in others. While different circumstances call for different procedures, at no time is it necessary to become profane or abusive. The English language is flexible enough to express your mildest sentiments or your severest criticism. Above all things be considerate. It is far better to leave something unsaid than to be sorry for some spoken word, for even a subsequent apology does not take away all the sting.

Delegate and Supervise Properly

I have known executives of all stations who were extremely industrious, but who accomplished little. They were so busy doing things, they had no time to talk to anyone, nor to give any attention to their subordinates, except perhaps a favored few. They lacked personal balance.

I have known foremen who would set up every job; who would go to the tool room and get all the tools; who would go out of their way to make combinations and make-shifts, and yet their department would not be efficient. They would spend so much time getting a job started right, they would have no time to see it after that. They had no time to go over their orders, but would pick

them out haphazardly or they would be picked out for them of necessity. They had no time to plan their work, to judge their men, or to watch their product, yet they would work themselves into nervous exhaustion and fail in health.

They were so busy doing little details that they lost sight of the larger and more important things. They were so occupied that they had no time for conferences or interviews. They fooled themselves into thinking that the details they were doing could not possibly be done by someone else. One of the hardest things I have had to learn is—when to cease doing a detail and delegating it to someone, and I am still struggling with this problem. This is especially difficult when it involves things that I feel I can do exceptionally well myself, or things that I am fond of doing.

Principle of Balanced Application

To give to each of your tasks and duties just the right amount of time and attention, that its importance deserves is what might be called a balanced application. The man who expects to grow in executive ability must learn that his function is not to perform details, but to teach others, and then allow them to do them, giving just enough supervision to know that the work is being satisfactorily accomplished. The rapidity with which we can climb to higher positions or the speed with which we can make our present positions more important, depends almost entirely on our ability to master fully our present tasks; train others to do correctly and rapidly some of the less important things we are now doing and then to equip ourselves to lie in line for more important things that may be delegated to us from time to time, as our superiors go through the same process.

Many men are excellent delegators but very poor supervisors. They are quick to assign duties and tasks to their subordinates but have not learned to properly check after the assignment has been made. They supervise either too much, or too little. Sometimes they interfere unnecessarily. This robs the subordinate of his opportunity for initiative and only loads the executive with unnecessary detail. Such interference will stunt the development of the subordinate, and discourage him. I have in mind in a general way, relations existing between superiors and subordinates where initiative is to be developed. Obviously various kinds of assignments require different kinds of supervision and instruction; as for instance tasks in repetition production, should be very carefully and methodically planned and supervised. Even here too much, or interfering supervision may become irksome, and distasteful.

You may have been in the habit of doing a certain thing in a certain way. Don't for that reason alone, insist on others doing it the same way if satisfactory results are obtained by some other method, for some day someone will do it much better and more rapidly than you ever did, and it might be humiliating to you. We oftimes hear this: "I might as well do it myself as to try to tell someone else how and it will not be any harder for me, and it will be accomplished sooner, and to my entire satisfaction." Such an individual will always be doing it himself, and really confesses a lack of executive ability. Human natures and human abilities vary over such a wide range that there will always be some things which we cannot delegate without actual loss of efficiency and value and the problem for each individual to solve is what duties he should delegate and what duties he must preform himself.

Effective supervision demands on the part of the executive a thorough and complete knowledge of methods and results. Too often a subordinate is allowed to proceed without supervision until he has finished his task or until he has accumulated results of a considerable amount. You will find the results are not to your liking and you censure him for not having requested supervision when you yourself are at fault for not having furnished it. I do not mean to say that you cannot often judge by the results you are getting. In fact it becomes necessary sometimes to limit supervision to a judgment of results.

I wish to emphasize, however, that when you elect to supervise in this way you yourself take a risk and your criticisms of the result if adverse must be made in a spirit of suggestion and to be solely a guide for future procedure, and not as a criticism which might cause disappointment and discouragement, for you are responsible for the manner in which you elected to apply your supervision.

Compensate Fairly

If I should try to name the most important factor in making loyal and contented employees I should say a square deal in compensation. This does not necessarily imply the highest wages nor the easiest tasks, nor even a combination of the two. It does imply that all people get a reward commensurate with their worth or as near to this as is humanly possible. You will often find plants where compensation in the form of piece rates or day rates are exceptionally high in some or many instances, or where the average of all compensation is equal to or above th eaverage in other shops; nevertheless, on account of large and flagrant discrepancies in piece rates and day rates, there is a general feeling of dissatisfaction and uncertainty that makes for lower efficiency. Those enjoying the higher rates are fearful lest their seeming advantage be lost and those required to take lower compensation feel that they are not getting fair treatment.

On the other hand there are plants where perhaps through force of necessity the average compensation may be even slightly below the average of the community, but by painstaking diligence in pursuing a policy of fairness to all a higher degree of relative fairness in compensation is maintained and a much larger degree of general satisfaction and stability results. This particular phase of human psychology is a very sensitive one. Men naturally resent discrepancies in compensation that they feel are not justified and more trouble can come from inequalities in pay than from most any other one thing. In this connection two factors come to my mind:—An unbiased judgment based upon facts and prompt action to reward merit and eliminate discrepancies.

It is no easy matter to judge values and interpret them into terms of compensation. It is least difficult where all are doing the same class of work on the same product but becomes increasingly difficult where the number of classes increase and where the character of the work becomes widely different. It is no easy matter to judge as between different kinds of skill; between skill and physical strength; between intense application in a repetitive operation and painstaking care in delicate manipulation; between executive responsibility and the application of a highly trained mind to more or less intangible problems. No rules can be laid down for procedure or even guidance, so we can only use our best judgment. One thing is certain, he who can best satisfy the largest number of different individuals of different accomplishments excels in the application of this factor.

Be Consistent in Rewarding

The second phase of this factor is to take the initative in rewarding merit. Do not confine increases in compensation to those who are most insistent and pester you. Know their worth and value in the organization, and take steps that will secure for those who deserve it a just and prompt recognition in the form of increased compensation whenever you have such adjustments to make. Get in touch with that branch of your organization having jurisdiction over such and if conditions do not justify it at the time you would desire to secure action, you can at least discuss your desired recommendations and perhaps obtain authorization that will enable you to go back to the man, commend him for his performance and make him a promise that he can look forward to. The management of this company has never retracted on promises made by foremen, to their men, or by other executives to subordinates where there was shown an honest attempt to judge fairly. Remember that a small increase voluntarily given is more effective and gives more lasting and better satisfaction than a larger increase secured by threats or coercion, to say nothing of your own feeling in the matter, and the effect it will have on your own peace of mind.

If at all times you carry with you a real desire to help, you will quickly see many rough places made smooth. This is not only true of your department, but of life in general. A wise man once said: "I will try to point the way of success to others and by showing it to them, I

(Continued on page 29)

Machine Wear Affects Quality of Product

Machines Must be Properly Installed and Accurately Aligned—Shocks Should be Minimized—Sag of Parts—Selection of Materials—Effect of Twist in Bed—Strains Caused by Cutting Tools

By FRED HORNER

THE detrimental effects resulting from wear are more serious in the case of machine tools than they are in the majority of prime movers, and mechanisms such as pumps, cranes, etc. A certain degree of looseness in these is sometimes of no consequence, beyond the noise produced, and a slight want of alignment or concentricity means no more than increased friction. The precise testing and re-adjustment of a great many of such mechanisms is therefore not attended to in the same way that corrections of machine tools are, the chief aim being to secure free and quiet working. But a machine tool may work with the greatest ease, and quietness, and yet be almost useless for performing its proper functions. This is because it is a reproducer of shapes in most instances, and the accuracy of alignments, of planes, of parallelisms, of angular settings, etc., vitally affects the work produced. Hence, the means for preventing, restricting, or minutely compensating for wear is of first importance, and the methods of accomplishing this often differ essentially from the compensating devices adopted in ordinary mechanisms. What makes the matter so difficult is the variance of movements, such as the lengths of strokes or sliding actions, which are frequently lengthened or shortened according to demands; therefore, the wear is not uniform from end to end, say, of a slide-way, and this brings in annoying difficulties. The directions of cutting pressures also vary in different machines, and on different kinds of cuts in the same machines, and the means for combating effects of wear have to be designed accordingly. The features of design and the best selection of suitable materials of construction also have an immense influence on the degree of wear that develops.

Wear, when it is legitimate and unavoidable, can nevertheless be controlled and arranged in such a manner that the machine continues to evolve a product within the limits of inaccuracy desired. The wear proceeds on well-known lines, and is kept within control in such a fashion that either no corrections are required for long periods, or these are effected in a simple way by provisions incorporated in the construction.

The first thing that determines the lasting accuracy of some kinds of machine tools is the nature of the foundations. Tables and beds, especially the larger ones, wear according to the way in which they are supported; that is, if an apparently rigid casting is supported on the twist, or the foundations alter (and are not put right) and produce the same result after a short time, the wear of the super-imposed slide or table takes place accordingly (across corners) and gradually the sliding motion partakes of a helical path, more or less accentuated as the load varies. Further settlements in the foundation may improve this fault, or increase it; but usually corrective measures are difficult after a period of running on a twisted bed and the only remedy is refacing the slide surface. A long bed that sags likewise develops uneven wear, the dropping portion giving difficulty in maintaining a true plane of movement, and in setting up gib strips effectively. The overdoing of wedging-up may bring another trouble, that of humpiness at one or more spots, which will cause bad sliding, and uneven wear. When practicable, the principle of the three-point support ought to be followed, so as to let the plane surfaces remain unchanged even though the floor is not true, or becomes altered.

Strength of Framings

The next important feature governing wear is the relative strength and rigidity of frames. Weak sections, insufficient thicknesses, and lack of proper staying and ribbing allow flexure to arise, in varying quantities according to the bulk of the work, or the severity of cuts. While a frame is thus in a state of flexure the slideways and the spindles do not stand in the same relations that they occupy while the machine stands idle, consequently the wear on the moving parts is indeterminate in direction and amount. This difficulty is especially marked in the case of machines which carry heavy overhanging loads (such as shapers and column-and-knee millers) the cantilever action of the load (which may include heavy vises or fixtures) being such as to flex a frame and bulge it, unless there is plenty of inherent strength in the casting. Weak framings further induce another trouble—vibration—which, apart from its ill effects upon the cutting processes, usually increases wear unnecessarily, and produces a peening action under certain circumstances, an action that gradually deforms machine parts, and makes them wear in strange fashions.

Weak Tables

A secondary slide that is unduly weak will give rise to trouble from flexure and shake, but a main work table (or a tool saddle) suffers further difficulty, from the load imposed directly on it. The problem is most strenuous in regard to tables which sustain massive castings, or heavy jigs or fixtures. Two things may happen if the table is thin, or improperly stayed. One is that it may sag towards the extremes of movement, the other that it will assume a deformed outline when heavy objects are bolted on it. Such conditions can happen in respect of planer, milling machine, or boring machine tables. The question of sag is however partly dependent upon the support afforded by the bed below.

Proportions of Slideways

In some machines—lathes for example—no question of end overhang from the supporting slide-way arises, but it does in the types of tools mentioned in the preceding paragraph. Hence the problem of sag is brought in, and also the question of local wear, due to incorrect proportioning of the supporting way in relation to the superimposed table. Good practice in planing machines is to make the bed about 1¾ times the planing length in the smaller machines, and about double the planing length on large sizes. The over-run on a small machine might therefore be about that represented in the diagram, Fig. 1. Yet the resistance to sag, and truth of wear depend largely on the inherent strength of the table casting, and practice of late years has tended towards the adoption of box tables, strongly ribbed, where hitherto tables open underneath and ribbed only were employed.

The proportions of slide-ways as they

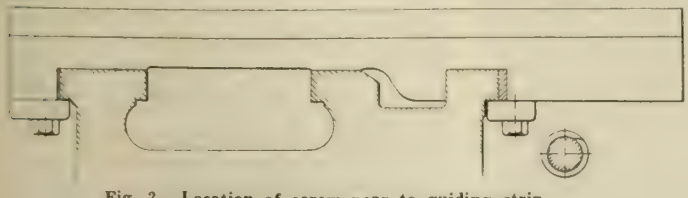


Fig. 2.—Location of screw near to guiding strip.

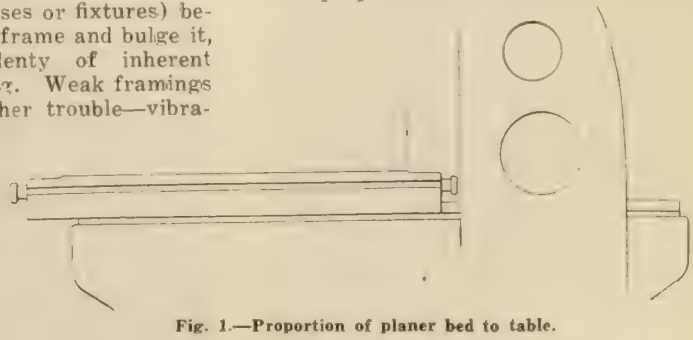


Fig. 1.—Proportion of planer bed to table.

affect tool-rams concern the flexure of the rams at extreme points, and the evenness or otherwise of the guideways. Some rams are wholly supported at all parts of the stroke, others are unavoidably projected quite a distance in order to reach over the work, and the quality of the wear varies at different parts of the stroke, being much more severe and localised at the extreme overhang point than when working well within limits. A shaper ram, as a case in point, wears more rapidly at the front of its bearings than elsewhere, and the side pressure is very severe. Therefore, a single long taper invariably is not suited for taking up wear in cases such as this, a gib with several screws set up according to needs being often preferable. In certain instances overhang of rams is lessened by the inclusion of supplementary slides, that can be adjusted to sustain the ram as close as possible to the work; this is done in some slotting machines, and besides lessening the springs, helps to reduce wear, especially localised wear.

Auxiliary Sliding Ways

When it happens that the excessive loads on a slide are only infrequent or its movement is very brief or occasional, there may be no necessity for the employment of full length or full width ways. The practice in these examples is often to sustain the overhang of the slide upon auxiliary guide faces (or perhaps rollers) using the normal width bed for ordinary guidance, a method common in some boring machines, and planers. Or the design is arranged differently, using a prop or stay mith narrow slide surface, or roller.

Wear Across Corners

In addition to the circumstances already noticed which induce irregular and localised wear, another condition has to be observed, namely, the effect of the twist imposed by the propelling medium of the slide—whether screw, rack, chain, or lever. Some lever actions produce an uneven thrust which may make a ram or slide go harder at certain locations. And nominally direct pulls or thrusts with screws, racks, or chains may not be really satisfactory, because of their distance from the spot where the resistance (tool or work) lies.

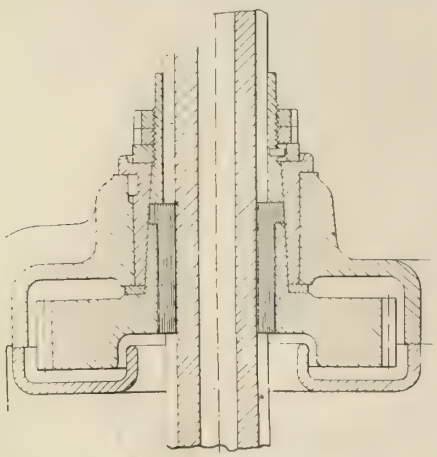


Fig. 3.—Bush to relieve side pressure from spindle.

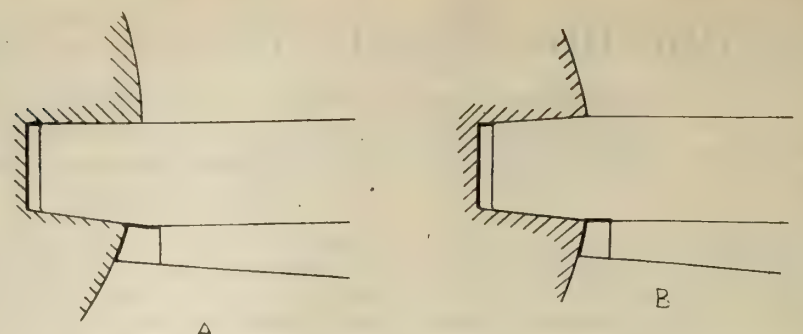


Fig. 4.—(A) Good type of index bolt. (B) Type that wears badly.

What happens in this latter event is that part of the slide nearest the screw or rack starts off, and the remainder follows reluctantly, as its movement is opposed by the cut. An incessant strain becomes imposed on the slide, which twists, and besides working stiffly, wears across corners. The "narrow guide" principle has done much to lessen this trouble in many types of machine tools, since the control of the slide movement is brought within narrow limits, and these lie close to the propelling medium, such as illustrated in Fig. 2. Some specimens of slide motions cannot be actuated with a single screw, owing to their unavoidable spreading of guiding ways, and the screws or racks need to be duplicated, and kept in adjustment to work in unison.

Local Wear on Long Slides

This is always a source of difficulty in machines that must undertake work of varying dimensions, the lathe carriage being the most prominent example. In general work, as distinct from lathes always employed on long sliding or screw-cutting movements, there is more wear near the headstock, affecting the carriage ways, and the screw. This entails inevitable difficulties soon or later, from loss of alignment of the slide movement, and irregular working of the screw. The trouble is enhanced if unsuitable materials are employed in construction, say a harder carriage than bed. The correct way is to have harder surfaces on the bed than on its sliding element, throwing the wear on the latter, and preserving the truth of the bed as long as possible, a dictum which is reflected in the use of semi-steel castings in some instances, and in chilled or densened guide ways in others. The employment of nuts softer than their steel screws also acts beneficially.

Increase of Wearing Surface

A factor that has had to be revised from time to time in machine tool design is the proportioning of wearing surfaces, alike in slides and rotating elements. The small areas of contact that sufficed in the early machines, and which were suitable because the work was light, and the labor of preparing the meeting surfaces also suited the primitive means then available, needed to be increased as the power of cutting developed. And then, when rapid-cutting steels altered practice so radically, considerable enhancements of slide areas and of spindle diameters and lengths were inevitable. Even lately the regular vees of the American type of lathe have been found wanting in durability and sustaining power, and several modifications exist where the front vee is enlarged, or altered in profile, or is supplemented by flat edges to assist its controlling and wearing capacities.

The policy of placing additional bearings to support shafts that were formerly allowed to overhang at one end accounts for the prevention of unnecessary wear, not merely on the shafts but also to pinions subject to irregular wear on the teeth when not kept well in mesh. The "whipping" of shafts and spindles is also eliminated by extra bearings, the chief function of which consists in the preservation of alignment. A similar idea is adopted when long lead or feed screws are in use; these, if not sustained at appropriate locations, would sag, and the consequent wear would be uneven as the nut had to take out the sag in its passage along the screw. Cut-away bearings or tumbler bearings are of necessity fitted, so that the central axis always remains in the same plane.

Another specimen of improved bearing design is that seen in types of drives where a spindle has to slide through a pulley or gear, and the side pressure due to the drive is best relieved from the spindle to prevent its premature looseness in the bearings, as well as to render the sliding action free. The pulley or gear sometimes runs on an extension of the frame, or in a bush fitted therein (Fig. 3); or mayhap an internal bore is utilised to journal the hub of the pulley within, using either plain surfaces, or ball or roller-bearings.

The Effects of Shock

Several classes of shock are met with in machines of one sort and another, the results of which include premature wear to slides, bearings, gears, belts, clutches, etc. One of the ordinary occurrences is that of intermittent cutting, on lathes and planers, the tool cutting metal and wind alternately, with bad consequences to the slides, the feed arrangements, the belts and the gears. A careful selection of tools most suitable for the job is essential, so that the edges shall not plunge into the cut with too much avidity and leave it with a violent jerk. Sometimes it is also feasible to arrange two pieces of work or two gangs in such fashion that the operation of a pair of tools is staggered, and the lathe drive or the table drive suffers no strong shocks, one tool being engaged when the other is missing.

Reduction of shock at the moment of reversal is likewise an imperative necessity, and is sought in planers, gear cutters, etc., in the form of spring buffers, or air-cushions. What occurs when the tool enters and leaves the cut is a matter dependent in some degree on the actuating mechanism in the case of shapers, and certain types of mechanism possess the merit of a gradual start and gradual termination of the stroke, which lengthens the life of the tool as well as reducing wear on the machine parts from shock.

An especially vital part of some machines is indexing mechanism, which may or may not be subject to shocks, a question which depends on speeds, mass, and the proper design of the parts. Nominally, in turrets there ought not to be shock as the index-bolt catches into place each time, but it all depends on the speed of operation, the working condition of the parts, and in hand-operated machines on the human factor. In order to gain a more powerful control of the index action, the index ring should be as large as practicable, an advantage which persists during the cut by keeping the tool steady with less strain and wear on the mechanism. In simple index-bolts for turrets the best procedure is not to form the bolt end with a double taper (with the idea of exact positioning) but to make one side straight so that the turret is swung round the straight side of the bolt will come slap against the index notch. The turret can then advance no further round, and the bolt slides home quietly, Fig. 4, A. On the contrary, with the double taper bolts, B, the turret may swing too far, the taper then has the duty of forcing it back a part of a revolution before home is reached, a duty that does not tend to do the parts any good.

Some turret index recesses are made in the form of bushed holes for pegs, instead of notches. This mode of construction offers a certain advantage, that is, when the bushes are worn out of accuracy, they can be replaced, and the original state of the holes in the turret not being affected ensures accurate pitching of the new bushes.

Wear of Screw Threads

Threads are usually subjected to severe frictional pressure, or to strong pull which deforms the sectional shape. Vee threads get thinner, or they assume a buttress shape, and square threads become narrowed. Local wear creates a difficulty in any case, for the nut cannot bear equally on the worn and the good parts. Hence it is better to wear the nut more rapidly than the screw. A useful practice in regard to heavy end pressures is to anticipate events and cut a buttress thread instead of a vee, so that the lateral pressure will occur against the vertical face, side thrusts will be prevented and the sectional area of the thread will be well sustained by the slope of the buttress. Unfortunately, it is in many instances necessary to be able to feed both ways with equal facility, and the buttress is therefore barred.

There are two or three methods of reducing unnecessary wear on threads, one useful device being applied to threaded parts which have to be removed and replaced often. Pilot or plain sections are used as extensions before or beyond the thread (or both) and serve to steady it in alignment while the screwing up or unscrewing is done. This likewise applies in some kinds of short screws, which are not separated—as chucks and face-plates are—but which nevertheless have to withstand hard service. The employment of counterweights also in the balancing of heavy masses which slide up and down columns greatly lessens the wear of screws, especially those in use for feeds, such as in vertical planers.

Avoidance of Unnecessary Wear

Since the introduction of gear drives and feeds greater attention has had to be paid to the restriction of unnecessary wear, from the multiplicity of parts that are involved. It is an expense to keep numerous bearings constantly running and supplied with oil, a fact that also refers to loose wheels, and to the teeth of gears. Noise develops more rapidly with wear in the last-named case, and the policy should be to have only those shafts, clutches, and gears revolving that are essential to the drive or feed in use. And on high speeds the fewer gears in action the better.

Some part of this problem is a question of the best selection of machines for specific functions, and a large works may be in a better position to purchase machines exactly fitted for certain operations, and thus avoid the complications of a wide range of movements needed for more general purposes. An interesting example of this matter is that of high-speed light drilling machines, particularly those of extended radial type. Years ago it was usual to do the small holes on an ordinary radial of gear-drive type, the high speeds (though not high enough for the size of drills) being attained at the expense of great clatter and noise of the gears. Then the sense of the abolition of gears altogether for this class of drilling was evident, and a special light class of radial sensitive rapidly developed. A similar kind of change is taking place in regard to certain other machines possessing specialised functions, and embodying simplified designs with the minimum of gears and bearings.

Trouble With Thin Sections

A special class of trouble from wear is encountered in regard to thin sections of metal, such as those in collets and other shell-like objects. These with constant use are liable to suffer deformation, especially if not designed with correct proportioning of metal in the various portions. The shape slowly becomes modified, the fitting instead of wearing regularly is affected by the deformation, and gets out of true concentrically and longitudinally. Sometimes the fault arises from too great disparity between jaw parts and the tube part, or from over-strain in trying to grip too hard for the capacity of the collet. Or it may proceed from lack of efficient support in the contractile element, which allows the collet to warp and spring each time it is used.

The split bands of friction clutches are similarly liable to change of shape, gradually getting out of the original form imparted to them. This makes trouble by reason of the high spots rubbing in or on the friction surfaces, and causing noise, or tending to let the clutch engage when it ought to be free. The sensitiveness of the engagement is naturally interfered with, and the lever movement may have to be extended to get the band well out of contact. Th fault either arises from poor design, that is thinness, or incorrect proportioning of the parts, or from too severe service imposed.

Application of Hardened Parts

Apart from the employment of steel castings, or semi-steel, or of chilled ways, there is an immense range of fitments where the wear is only local, and not along broad or long extended areas. The choice in these has to be made between case-hardened and full hardened parts, the one being sometimes suitable, the other maybe imperative. Case-hardening does not always satisfy requirements, partially because it is only good for a limited amount of wear, and because also it will not withstand deformatory action well, being compressed into the softer metal beneath too easily under hard pressures or blows. But a measure of economy is available in many instances by screwing or riveting or welding on hard steel facings or tips to articles subject to shocks, and so also allowing for convenient renewal from time to time.

Importance of Clean Surfaces

Many a good slide or bearing has suffered damage through carelessness in lubrication, or from access of grit that ought to have been excluded. The danger is naturally more likely in the faster movements (such as shafts) where a few specks of grit may immediately produce scoring seizure, and possibly ruin a journal and brasses, than it is in a slow-moving slide. After all possible care in the selection and the filtering of lubricating oil, and the adoption of dust guards, felt pads, etc., there remains a possibility of accidental creeping in of grit. Therefore, bearings, and if possible, slides, ought to be constructed with provision for the escape of foreign substances into catching grooves or corner spaces, where they remain undisturbed until the time comes to take the elements apart.

Difficulties of Efficient Lubrication

In some kinds of machine tools there is great pressure imposed on bearings or slide-ways, from the weight of work, or the thrust of the cut, or both combined, and it is essential that a film of oil shall remain between the rubbing surfaces. Otherwise wear is bound to occur rapidly, and perhaps to the early

(Continued on page 29)

Designing Screw Threads for Bolts and Nuts

Bending Stresses—Stripping of Threads—Failure Due to Shear—Effect of Vibration—Locking Devices—Size of Lock Nuts—Axial and Radial Thrust—Opposing Forces

By L. T. RUTLEDGE

IN the issue of Feb. 23, consideration was given to the design of machine screws and bolts, and this feature of tool construction is continued in this issue.

For small screws and bolts, the above stresses depend pretty much upon the judgment of the mechanic and it is quite useless to attempt any accurate calculations. Every mechanic knows how easily the head can be twisted off a cap screw, so it is apparent the stresses set up in this manner are of considerable importance and must not be neglected where great accuracy of design is involved.

(b) Stresses due to external forces:—As a general rule, external loads may produce either of two direct stresses, namely, tension or shear. An example of a load producing tension was given in lesson 4 on "Eccentric Loading" in the analysis of stress in the holding down bolts of a radial drill.

Assuming that a certain steady load "P" produces a direct tensile stress in the bolt or screw and as the section at the root of the thread is the minimum section, then it is evident that the area at the root of the thread must be the one considered and it must be such that the stress does not exceed the permissible value set forth in the working specifications. If d_1 is the root diameter, then the following equation applies:

$$d_1 = \sqrt{\frac{4P}{\pi S_t}} \quad ---(38)$$

Should the bolt be subjected to a shearing stress instead of a tensile one, then a similar formula applies with Ss substituted for St.

(c) Stress due to Shock Loads:—In some classes of machinery the bolts have to be designed to resist shock loads. The stress induced by a suddenly applied load is at least twice as great as that produced by a steady load. The energy of a suddenly applied load must be absorbed by the bolt. The measure of the energy is the product of the induced stress and the total elongation of the bolt. As far as the mathematics is concerned, it is obvious, that the product may be constant and yet the factors giving it may be varied. This very feature is made use of in creating a condition under which the bolt will be less liable to fracture under a shock load. If the elongation is permitted to increase then the stress must diminish. It is understood that failure occurs when the stress reaches a certain value. There are two simple ways of accomplishing this design, namely, making it possible for an increased elongation without a decrease in strength as follows:

1. Turn down the body of the bolt to the same diameter as the root of the thread which is quite permissible, because, as stated above, failure under stress will take place at the smallest section.

2. Instead of turning down the body of the bolt, its cross-sectional area may be reduced to the area at the root of the thread by drilling a hole up the centre of the bolt from the head end to a point quite close to the end of the thread.

Fig. 30 illustrates the two methods suggested. Actual cases are on record showing how failure was prevented by either of the above methods. Let this point be emphasized, namely, the one bolt is just as strong as the others, since each has the same minimum section but the lighter bolt will stretch more than the heavier one under the same shock load and be less liable to fracture.

(d) Failure due to Thread Stripping:—As previously suggested, a bolt may fail by breaking off at the root of the thread where the sudden change in the cross-section occurs.

$$W = \frac{\pi d_1^2}{4} S_t \quad ---(a)$$

Where w=the external load and d_1= the root diameter.

2. A bolt may fail by the threads stripping on the bolt or in the nut. The stresses on the threads are bending and shear. A section of a thread is shown in Fig. 31. Assume the load w to be uniformly distributed over the surface of the thread. Let

N=number of threads in the nut.

B=total length of thread in the nut being the circumference of 1 turn, it being considered as a circle.

The thread partakes of the characteristics of a cantilever beam. The maximum bending moment for a beam of this type, fixed at one end and uniformly loaded is

$$\frac{WL}{2} \quad ---(b)$$

The resisting moment, by the flexure formula for beams equals

$$M = S_b \times \frac{I}{C} = S_b \frac{bh^2}{6} = \frac{S_b h^2 \pi d_1 N}{6} \quad ---(c)$$

where S_b is the flexure or bending stress.

For equilibrium the resisting moment equals the bending moment then equation (b) equals (c) or

$$\frac{Wl}{2} = \frac{S_b h^2 \pi d_1 N}{6}$$

$$\text{or } W = \frac{S_b h^2 \pi d_1 N}{3l} \quad (d)$$

Equating equations (a) and (d)

$$\frac{\pi d_1^2}{4} S_t = \frac{S_b h^2 \pi d_1 N}{3l}$$

$$\text{therefore } N = \frac{S_t}{S_b} \times \frac{3l d_1}{4h^2} \quad (e)$$

If St be taken equal to Sb then

$$N = \frac{.75 l d_1}{h^2} \quad (39)$$

which is a general formula for the number of threads necessary so that stripping will not take place.

For U. S. standard threads, h=⅞ p and l=0.65 p, where p=pitch.

Then by substitution in (39)

$$N = \frac{.75 \times .65\, p d_1}{(.875\, p)^2} = \frac{.638 d_1}{p} \quad (40)$$

Next, consider failure due to stripping from the standpoint of shear.

$$\text{Area in shear} = \pi d_1 h N$$

$$W = \pi d_1 N \left(\frac{7}{8} p\right) S_s$$

Equating the equation immediately above with equation (a) we have

$$\frac{\pi d_1^2}{4} S_t = \frac{7}{8} \pi d_1 N p S_s$$

$$\text{therefore } N = \frac{S_t}{S_s} \times \frac{d_1}{p} \times \frac{2}{7}$$

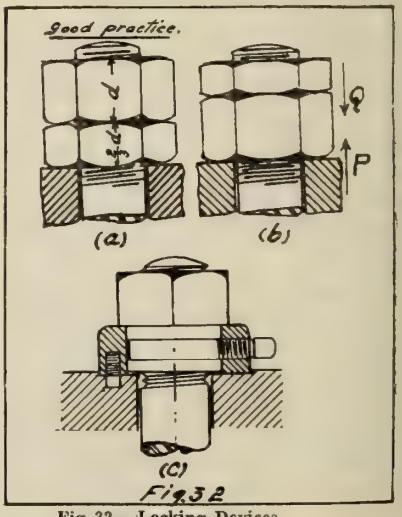


Fig 32.—Locking Devices.

The author is Professor of Mechanical Engineering at Queen's University, Kingston, Ont., and should any reader wish help in any problem on mechanical matters, write us, and we will see that Mr. Rutledge supplies you with the desired information.

and if St be assumed equal to Ss then

$$N = \frac{.357 d_1}{p} \quad (41)$$

Comparing equations (40) and (41) it is apparent that the thread is $\frac{}{.357}$ or 1.78 times stronger in shear than bending. So that in designing against stripping only bending needs to be considered. Where accurate calculations are required equation (1) above should be used in preference to (40). In practice, however, almost twice as many threads are put in the standard nuts as are theoretically required.

Locking Devices

Even though bolts are fastenings that admit of dis-assembling with comparative ease, nevertheless the bolt must be a rigid fastening under service. The next must remain in position without coming loose. In machines where vibration exists, it is almost an impossibility to keep a nut on the bolt without some extra device. This appliance which secures or locks the nut, is called a locking device. The more common locking fixtures in use are the lock or jamb nut, collar nut, castellated nut, split nut, spring wire lock, spring washer, copper washer, set screw and other devices.

Automobile manufacturers use the spring washer and castellated nut with a split pin more than anything else. In high class construction the collar nut as shown in Fig. 32 is used. A headless set screw makes an excellent locking device if it is placed in a position parallel to the axis of the bolt and located half in the bolt and half in the nut. In assembling, it is best to thread the nut on its bolt up tight in its final position. Then drill, if necessary, with an electric drill, a hole in the thread as suggested. The best results may be obtained if the set screw is unhardened, because then the line between the set screw and the other members may be centre-punched which affords extra resistance.

The oldest design of locking device is the use of a lock or jamb nut. This method is also the commonest and cheapest one. In most cases the locking nut is smaller than the regular nut which is supposed to take the axial load put upon the bolt. A question might here be asked: "Should the small nut be placed under or on top of the main nut?" Many arguments over this very detail have taken place in machine shops. The following analysis, due to Weisback, shows that conditions may arise when the first arrangement would answer, while, for other conditions, the second arrangement would be the proper one to use.

In the analysis we assume that the lower nut is screwed down tightly against its bearing surface and that the upper nut is threaded down against the lower nut so tightly as the size of the stud or bolt will permit. As shown in Fig. 32, let the pressure between the

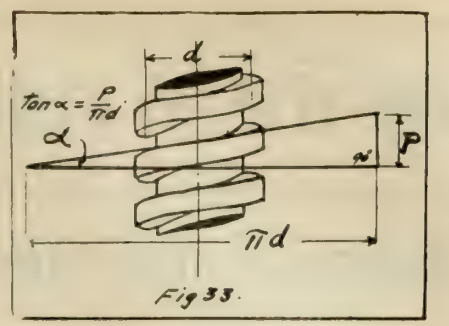


Fig 33.

Square Thread Data

machine surface and the lower nut be P and the pressure between the two nuts be Q. In 32 (b) where the jamb nut is the smaller one, and is on top let us consider the forces acting. It is apparent that the force Q acts downward whereas P acts upward and the resultant force is (P-Q) in magnitude and it acts upon the threads of the stud. If P is greater than Q, the resultant acts upward. This means that the upper surfaces of the threads in the lower nut come into compression against the lower surfaces of the threads on the stud. From this it follows that where P is greater than Q, the lower nut must be of standard thickness as shown in 32 (b), since it alone must support the axial load on the stud which is extra, of course, to the pressures P and Q.

Now considering the case where Q is greater than P, it is obvious, the resultant force on the threads of the stud is downward, thus making the lower surfaces of the thread in the lower nut bear on the upper surfaces of the thread on the stud: hence the upper nut must be taking the axial load and for that reason should be of greater thickness, that is, it should be of standard thickness. Now if P were exactly equal to Q, the resultant would be zero. In that case, no bearing pressure due to tightening of the nuts would exist. The axial load alone has to be withstood by the nuts. For this condition, a little consideration will show that the nut of standard thickness should be on top as illustrated in 32 (a). It will be required to withstand the axial load.

In ordinary practice the quantities P and Q are unknown. If the designer has to select either of the two arrangements, the probability is that the one shown in 32 (a) would suit the conditions. General practice is to put the nut of standard thickness on the top. Instead of having the small nut half the thickness of the larger one, it is better practice to have it two-thirds the thickness. Nevertheless, though the arrangement of 32 (b) is theoretically incorrect, it is practically convenient. Very often the two nuts become so sealed together that a great force is necessary to separate them. When the smaller nut is on the outside less force is necessary to effect a separation.

Efficiency of a Screw

The screw is a simple application of the inclined plane, the thread on the screw fulfilling the same functions as a plane on the same angle. Consider a square threaded screw as illustrated in Fig. 33. The mean diameter of the thread is d, the pitch is p which is the axial distance that the nut rises in one revolution. The inclined plane equivalent to one turn of the thread is shown superimposed on the elevation of the thread. The horizontal length of the plane is

$$\pi d,$$

being one circumference of a circle of diameter d. Let

$$\alpha (alpha)$$

be the angle of slope of the plane.

$$\frac{p}{\pi d} \qquad \phi (phi)$$

Is the trigonometric tangent of this angle.

In the actual case, friction between the thread of the screw and the thread of the nut exists. This opposing force is equivalent as far as work is concerned in increasing the slope of the inclined plane. The additional angle is usually denoted by the Greek letter

$$\phi$$

so that including friction the condition is the same as if the angle were

$$(\alpha + \phi)$$

the tangent is the coefficient of friction denoted by the symbol

$$\mu (mu) \qquad \mu$$

Values of pi for different combinations of substances are given in the handbooks.

Let W be the weight lifted by the screw as would be the case with a screw jack. The useful work done per revolution of the nut without friction is force multiplied by distance equals

$$Wp = W\pi d \tan \alpha \quad (41)$$

With friction, the force to be applied at the mean radius of the thread to raise the nut is (say)

$$Q = W \tan (\alpha + \phi)$$

The total work done in turning the nut through one complete revolution is again force x distance equals

$$Q\pi d = W\pi d \tan (\alpha + \phi)$$

Then the efficiency when raising the weight—useful work divided by total work done

$$\frac{W\pi d \tan \alpha}{W\pi d \tan (\alpha + \phi)} = \frac{\tan \alpha}{\tan (\alpha + \phi)} \quad (41)$$

Formula (41) is the expression for the efficiency of an inclined plane or wedge. Any textbook on elementary

(Continued on Page 29)

News From the Welding Field

Welding Non-Ferrous and Dissimilar Metals

Use of Puddling Hook—Avoid Over-Heating—Distribution of Flame—Proper Fusing of Added Metal—Increasing Tenacity of Copper Weld—Critical Temperatures of Nickel—Resisting Properties of Monel Metal

By FRED. E. ROGERS

METHODS of welding cast and malleable iron were dealt with in a previous issue and non-ferrous metals and dissimilar metals will be discussed in this article.

Welding of Aluminum

The oxy-acetylene torch provides the most practical means of uniting aluminum parts. Because of the avidity of aluminum for oxygen it is practically impossible to solder it or, if soldered, to insure non-separation of the soldered joints when exposed to corrosion. Numerous aluminum solders have been exploited and while some are fairly successful, it is recognized that soldering is not generally a dependable process, and it is not recommended when feasible to weld. A welded aluminum joint is dependable and when correctly made is as strong as the original section. It might be said that gas welding is the one method to be used for repairing broken aluminum and for jointing parts in manufacturing.

An aluminum casting and a rolled aluminum sheet differ in physical structure the same as cast iron and steel. Cast aluminum up to ¼ inch thickness or even more is generally welded without beveling the joint, using an iron puddling hook and spoon to break down the molten metal and to eliminate the oxide. As before stated, a slightly carbonizing flame should be employed when welding aluminum to reduce as much as possible the oxidizing action of the atmosphere. Cast aluminum sticks of special composition free from foundry sand and other foreign substances only should be used when welding cast aluminum, the puddling hook providing means for eliminating oxide and securing a sound weld, but D-B Matchless aluminum flux may be used to good advantage, and is recommended. It reduces the oxide and makes the use of the puddling hook unnecessary or reduces it to a minimum. A smoother joint will result when using an approved flux than when puddled, and this is important in many cases.

Weld from right to left when working on unprepared joints and using the puddling hook. Care must be taken to prevent overheating the puddling hook as iron oxide will be dissolved into the aluminum with consequent weakening effect.

Heavy aluminum castings should be grooved or beveled the same as cast iron, and then welding should proceed from left to right. The use of flux on prepared aluminum joints is urgently recommended. Better conditions will be obtained both in the structure of the weld and in the external appearance. Aluminum melts at about 1,200° degrees F. and welders are cautioned in preheating to avoid overheating a casting and causing a collapse. The temperature should never exceed 700 or 800 degrees; the proper temperature can generally be determined by rapping the casting with a stick while being preheated. A cold aluminum casting should give forth a metallic sound when struck as it becomes hot the metallic sound becomes less and less and when the safe preheating temperature has been reached or exceeded it will no longer resound when hit. Another test is the use of a pine stick. Heat no more than required to char or ignite a piece of fat pine stick brought into contact. Preheating is essential to avoid severe expansion and contraction stresses and also to conserve gases. The metal conducts heat rapidly, and unless preheated the welder may experience difficulty in maintaining the requisite welding heat although the metal melts at a comparatively low temperature.

It is advisable in the case of motor car crankcase castings which are thin and often of complex shapes to support the casting beneath the crack with sheet iron bent to fit the interior and covered with sheet asbestos. The sheet iron in turn may be blocked up with a brick to provide the needed support when the metal is hot.

Rolled aluminum, especially the thinner gauges are prepared for welding, preferably by flanging the edges to an angle of 90 degrees, the flanges having a height of 3/32 to ¼ inch, varying of course with the thickness of the metal. The flanges are fused together using Neapolitan flux to elimate oxide. Exercise care to avoid breaking down the metal and fusing holes through thin sheets. The effort should be to melt down the flanges making a perfect union and to pile up the metal at the joint. The joint is then finished with a planishing hammer, being beaten until of the same thickness as the sheet. In this type of welding no adding material is required but when butt welding aluminum sheets, drawn aluminum or wire adding material and flux should be used.

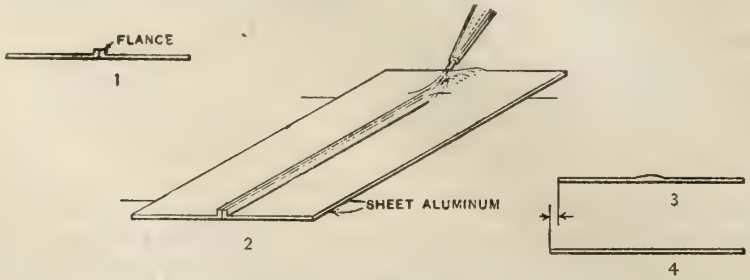
Aluminum Container Welding

Aluminum containers such as canteens, teapots and household articles are welded with the torch, using aluminum flux. The parts are drawn and formed with lips or flanges about 1/16 inch wide which furnish the filler material required in the weld. In the case of the canteen shown, the halves are held together in a revolving jig while being welded.

The speed of rotation and stopping and starting are controlled by a foot pedal. The edges of the part are dipped in Neapolitan flux preparatory to welding. Women operators are readily trained to do such light welding.

Welding Copper

Flame adjustment for welding copper should be the same as for steel but a larger tip and flame must be employed



Welding thin aluminum sheets.

for copper than for steel of the same thickness, owing to the greater radiating property of the copper. For instance, the No. 6 tip recommended for welding steel of 5/16 inch to ⅜ inch thickness should be used on ¼ inch copper or, putting it in another way, use tips of from one to two sizes larger on copper than on steel of equivalent thickness.

The torch should be manipulated the same as when welding steel except that it should not be held so close to the metal. Copper melts at a temperature of about 1,900 degrees F. and not so great concentration of heat is required. The aim of the welder should be to distribute the heat over a larger area, holding the point of the flame away from the metal.

Only pure copper rods should be used for adding material and D-B Anaconda rods are recommended for all copper welding, being the purest copper obtainable. The adding material should be fused by the heat of the puddle and the radiated heat of the flame, and care must be taken to secure penetration. On account of using a larger flame and a broader distribution of heat the welder may experience some difficulty at first in breaking down the side walls and localizing the puddle because of the larger areas affected. The principle of welding, however, is the same in all metals and it is a matter of some experience and practice only to secure sound work in copper.

Preheating is necessary when welding large copper sections, and is desirable in most cases in order to save gas and reduce the time necessary for welding. Preheated copper parts should be covered with Vulcanite asbestos and the welded seam should be protected with the same material from drafts and rapid cooling.

A welded copper joint is composed of cast copper and therefore has the strength only of cast copper but its tenacity may be increased by hammering where permissible. If the joint is to be hammered after welding it should, of course, be made somewhat thicker than otherwise would be required in order to provide sufficient metal for hammering flush with the remainder of the sheet.

Brass and Bronze

Brass is an alloy chiefly of copper and zinc while bronze is composed principally of copper and tin. There are many of these brass and bronze alloys containing variable proportions of the principal metals and percentages of other metals such as lead, antimony, etc. No rigid rule can be laid down for welding them except that the welder must exercise caution to avoid overheating and burning out the metals of low melting temperature. It is especially important to avoid overheating brass, as the zinc content burns out at a comparatively low heat. The burning of zinc in brass is betrayed by dense white fumes which are poisonous. Breathing them should be avoided.

Adjust the flame with the cone the same as when welding aluminum and keep the point of the cone away from the metal to distribute the heat more than when welding steel. Form a puddle of molten metal and add Marvel welding rod to the puddle, using flux to prevent oxidation. It will be necessary on account of the radiating capacity of these metals to use a larger tip than required for an equal thickness of steel, the same as when welding copper.

When white fumes rise from the joint the welder should reduce the heat as this is an indication that zinc is being volatilized and the joint metal weakened.

The welder should study every job and if in some cases it appears that the parts can be brazed satisfactorily he should have no hesitation in brazing in preference to welding. Brazed joints can be made with less heat than required for welding. On thick metal it may not be feasible to braze in which case the job must be beveled and treated the same as steel or cast iron.

Preheating large brass and bronze sections is desirable and often necessary to prevent serious internal stresses that might cause cracks or failure in service. Preheating also reduces the amount of gas required for the actual welding and while cooling off.

Naval Bronze

Certain bronzes, including the so-called Naval bronze can hardly be welded with the oxy-acetylene torch by the average operator without producing numerous blowholes in the point. Blowholes are not permissible, of course, where strength and tightness of joint are required. The trouble can be overcome by reducing the heat, holding the flame further away than when welding iron, and using steel puddling hook or spoon to work out the oxide, the same as when welding aluminum. Briefly, these difficult bronzes may be welded at a temperature but little above the fusion point and by mechanical manipulation which works the metal into the joint and removes the oxides produced.

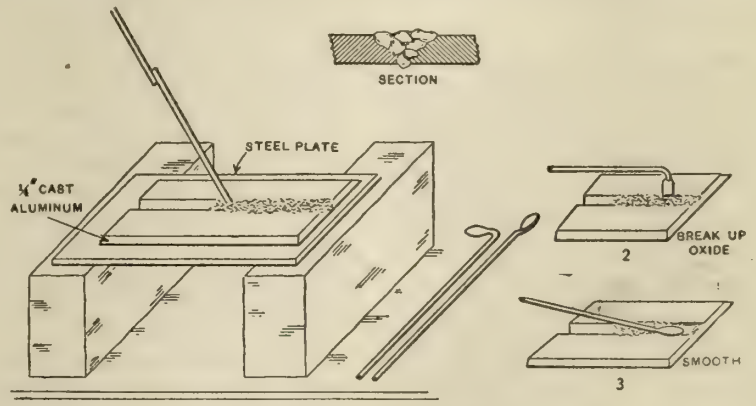
Welds can be made in bronzes by the puddling process free of oxide and blowholes that offer tensile resistance up to 90 per cent or more of the full strength of the unwelded section. In fact, experts have been able to produce nearly 100 per cent. strength joints in this manner.

Galvanized Sheet Steel

Welding of galvanized sheets is not in general advisable. The heat necessary to fuse the metal burns the zinc and the resulting weld is affected by the absorbed metal. Moreover, the protective coating is destroyed and the welded joint will be subject to corrosion. Soldering with a lead-tin mixture is recommended for containers under light pressure and hard soldering for seams required to withstand considerable stress. A brazed joint is very strong; brazing amalgamates with the zinc and forms a union which resists corrosion well.

Nickel

Nickel conducts heat rapidly and requires a larger tip for welding than steel at the same gauge. It should be treated about the same as copper in this respect; use nickel filling rod. Having attraction for oxygen when fused it is desirable to employ a slightly carbonizing flame when welding nickel and alloys high in nickel content. The strength of nickel drops off greatly at certain temperatures considerably above normal, there being two well defined critical points in the temperature range at which the metal is quite brittle. These critical points are about 850 and 1,750 degrees F. Under some conditions the welded seam will crack, especially if under strain as it cools down. This trouble may be averted by reducing contraction stresses to a minimum. When the metal is cold the seam is still likely to be brittle until mechanically worked in compression. Then it may be heated and annealed. A welded joint should not be annealed before being worked mechanically as it is quite likely to crack in the process. But when the physical characteristics of rolled metal are imparted to a weld by mechanical treatment a welded sheet may then be safely subjected to annealing, drawing, rolling or other process required in fabrication.



Welding aluminum sheets.

Monel Metal

Monel metal is a natural alloy of nickel and copper having a silvery appearance similar to nickel and polished steel. It is very strong and highly resistant to most acids and alkalis. Because of its resistant properties and high tensile strength especially when hot it is be-

ing used more and more in chemical apparatus, steam turbines and other machinery. Monel is readily welded with the oxy-acetylene torch using a slightly reducing or carbonizing flame. The method of welding is the same as employed for other metals, the joint being beveled and monel welding rod used for filler.

The nickel in monel has a strong attraction for oxygen and in some cases it may be advisable to use Marvel flux to reduce the oxidation and to eliminate the oxide formed. Preheating of monel should be done only with charcoal or other fuel free from sulphur as this element is freely absorbed by the metal when hot with consequent injury. If oil burners are used the oil should be as free from sulphur as can be obtained. Acetylene must also be free from sulphur, and the best results will be secured with acetylene purchased compressed in cylinders which when furnished by the leading manufacturers is carefully purified to eliminate sulphuretted hydrogen and other injurious gases. If generated acetylene be used special provision should be made to purify the gas. Some grades of monel wire contain considerable iron and these should be avoided as the best results are obtained with monel welding rods free from iron and sulphur.

Welding Monel Sheets

Thin monel sheets requiring splicing may be welded by clamping together between two steel bars, allowing about ⅛ inch to project for welding. The edges are fused with the flame, generally without using flux or adding material. The No. 0 or No. 1 tip will generally serve the purpose.

When welding has been finished the sheets are opened like the leaves of a book and pressed down on a flat surface, hammering on top of the weld with a wooden mallet or block to bend the sheets to right angles with the weld flange. Usually the flange or weld is allowed to project at right angles to the sheet.

The same procedure may be followed of course when welding any thin sheet metal or metal cloth, especially when no bending brake is available for turning flanges.

Manganese Steel

Steel containing certain percentages of manganese and heat-treated is very tough and wear-resisting. It is used for railway frogs, crossings, guard rails, for dredger bucket lips and for other purposes where the ordinary grades of steel would be quickly worn out. Manganese steel castings may be welded with the oxy-acetylene torch using special managanese steel welding rods. No flux is required as the manganese content acts as a deoxidizer.

Preheating is necessary to secure the best results and care must be taken to secure thorough penetration. Inasmuch as manganese steel cannot be cut with ordinary cutting tools beveling must be accomplished by grinding or with the cutting torch. Manganese steel should be heat-treated after welding to restore toughness. Quenching when hot softens and toughens the metal instead of hardening it as with carbon steels.

Welding Dissimilar Metals

Dissimilar metals such as cast iron and steel, etc., may be welded successfully. A rule to be observed in the welding of dissimilar metals is to concentrate the flame on the metal of the higher fusing temperature and to use adding material of the same physical and chemical characteristics, corresponding to the metal of the lower melting temperature. For example, when welding cast iron and steel, use cast iron adding material.

Cast Iron to Steel

To weld cast iron to steel use Atlas cast iron welding sticks and Atlas scaling powder. The steel must be fused first because the cast iron melts at a lower temperature. The manipulation of the torch should be such that the heat is mostly distributed to the steel which requires the higher temperature for fusing. Comparatively little scaling powder is needed.

Copper to Steel

Fuse the steel and bring the copper into contact and let the heat of the steel melt the copper and blend with it. Use little Marvel flux. It is not feasible to weld long copper and steel joints except in spots because of the difference in expansion and contraction of the two metals, but it is sound practice to weld copper bonds to steel rails as a perfect and enduring electrical joint can thus be made quickly. Reinforcement, if desired, may be made by using Anaconda copper rod but in all cases the heat of the steel must fuse the copper as otherwise a perfect joint will not be obtained.

High-Speed Steel to Machinery Steel

High-speed steel bit may be welded to machinery steel shanks with the torch and thereby produce large lathe and planer tools at low cast as compared to the cost of making the whole tool of high-speed steel. The procedure recommended is "tinning" the high-speed steel bit with D-B special welding rod applying welding rod until sufficient adding material has been deposited to permit the piece to be welded to the machinery steel shank in the usual manner.

Another method of welding high carbon and high-speed steel to low carbon steel shanks is successfully employed for lengthening drill shanks, known as compression welding. To carry out this work a special holder or jig is required to hold the drill and shank in line while being heated with the torch flame. When both are heated to the fusing temperature the drill is struck with a wooden mallet and driven against the shank thus producing a compression weld. The resulting flash collar is ground off.

Welding Dissimilar Metals

Almost any combination of dissimilar metals can be welded without serious difficulty by timing the part of higher fusing temperature with adding material of lower melting point that is suitable for welding the metal of the lower fusing heat. When sufficient adding material has been deposited and fused to the part the two pieces are then ready for welding in the usual manner. Care must be taken when starting to weld to direct the flame upon the metal and adding material of the lower fusing temperature only. Consider the tinned part as finished; any attempt to reinforce this part of the weld is likely to result in failure of the job.

Nickel to Iron and Steel

Nickel may be welded to mild steel readily the same as another piece of steel. Requiring a somewhat higher temperature than steel, the flame may be directed against the nickel more than the steel. Steel adding material should be used. The attempt to weld long seams in nickel and steel should not be made though without special precaution on account of the difference in expansion. The expansion coefficient of nickel is about 20 per cent. higher than that of steel. Nickel is used successfully for filling in scratches and score marks in cast iron gas engine cylinders, uniting readily with the iron and making a dependable wearing surface.

Welding Smokestacks

Steel smokestacks corrode in the seams and require replacement every few years. The combination of rain and snow on the outside and the hot gases inside works havoc on riveted joints. A welded smokestack lasts much longer than the riveted stack and is much stronger in resisting wind stresses. There being no crevices nor rivets in which moisture may collect or products of combustion lodge, there are no points at which corrosion is likely to be more acute than at others. The wasting away of the stack by the elements and the gases, therefore, must proceed fairly uniformly throughout and the stack will remain in serviceable condition for a long time. A welded stack is like the famous one-horse shay; when it fails, it goes to pieces all over.

Wire Cloth

Woven wire screens used in chemical plants and by other industries may be repaired with the torch to great advantage. Often a hole will appear in a screen when the remainder is still in good condition. The hole can be filled in a few moments, and the life extended several weeks or months. Of course, the welded portion will no longer act as a screen but usually this will not matter.

Bending with Aid of Torch

Repair men using welding torches soon learn to apply them when bending and straightening shafts, bars and structural parts. A workman who understands heating in just the right spots can quickly straighten a badly bent piece with the expenditure of very little gas and manual exertion.

(To be Continued)

(Continued from page 20)

INCREASING MAN POWER

will find myself." There is something delightfully strange about this thing of helping others, for in some mysterious way we always help ourselves. This law is as old as Human History, yet as young as Modern Business, for it is the real foundation of all successful industries to-day.

Set a Good Example

You must at all times remember that your men have a right to follow the example you set. It is impossible for a leader to disregard a proper observance of the rules he asks his subordinates to follow. It must be embarrassing indeed, for one to reprimand a man for breaking a rule that he himself breaks.

Setting an example implies a proper dignity. People expect to see in their leaders a dignity befitting their particular stations. I do not mean snobbish aloofness, nor a superior attitude: A leader should never be forbidding nor haughty, neither should he be "One of the boys" in the old sense of the phrase. He can be decidedly friendly and approachable, without being too chummy. Character has a dignity of its own, and it would be hard to imagine a man utterly devoid of character who could have any dignity whatever, except such as might be supplied by clothes and appearance. Dignity and character go hand in hand, in giving to a leader the marks that stamp him and instill in his followers the respect and admiration so essential to a continuance of that relation.

In this connection I wish to speak of the matter of personal appearance. By this I do not mean that foremen and executives should wear good clothes or dress up to any standard, but I do mean that no leader who has any respect for himself can expect any respect from his subordinates if he persists in slovenly appearance. You don't have to wear new clothes to be neat and clean. It is far better to have on a clean suit of faded overalls, a clean shirt and clean shave, than an old suit, dirty and shabby, and several days of beard glistening in the sun. A satisfactory personal appearance can be maintained without spending much except time and care. While clothes do not make the man, still the way in which he wears them proclaims a good deal about his habits.

Maintain Discipline

In walking through the plant, I sometime observe men who are either loafing or not applying themselves properly. If they chance to see me they usually hustle around and try in various ways to make it appear they are very busy. In fact I have seen whole departments take on an air of increased activity as soon as my presence was known even though the foreman had been there all the time. The foreman of such a department certainly is not maintaining the right kind of discipline. His discipline is all a farce and to be used only in cases of dress parade or inspection.

Discipline that results in effective work cannot be maintained by rules and regulations alone. There is required a sort of mutual interest on the part of the foreman and his men that only real leadership can secure.

I do not believe most people attach as much importance to this factor as they should. In my opinion it might well stand at the head of the list because it so closely touches and influences the other factors. The whole structure of human relations rests so firmly on confidence that you cannot get far if you disregard the influence of your personal character. Character is not something of clothes; it is not acquired over night; it takes time to build it and we never quite finish the task. Watch out for the little slips that cause deficiencies, for these may result in a streak—a yellow streak.

You may think it amounts to little, but some day you are called upon perhaps to stand out for inspection and the streak is noticeable. Then you fall short of a complete influence. Men will have confidence in you if you have built up a reputation for fairness, justice, sympathy, integrity and all the other virtues that go to build character. Clean living, clean thinking and clean speech with a whole hearted and active effort to acquire those characteristics and human traits that you admire in other leaders will develop in you the character so necessary to all those who aspire to be Managers of Men.

MACHINE WEAR AFFECTS QUALITY OF PRODUCTS

(Continued from page 23)

destruction of the necessary accuracy Of late years forced lubrication has had to be practised more and more, especially for those types of bearings subject to continued pressure in one direction, or for slides which are covered for good portions of the cutting time, and hence do not gain an opportunity of relief and access of fresh lubricant by long traverses over the rest of the ways. Ample grooving supplies the means of ensuring the presence of plenty of cool oil in these cases, and the pressure system guarantees a continuous flow irrespective of the mechanical action of the rubbing surfaces in producing distribution—an uncertain and variable matter. Some kinds of bearings require the oil to be delivered at the spot or line of greatest pressure, which may be at the top in some classes, at the bottom in others. Freedom of running, and regularity of wear are consequently made sure of according to the special needs of each bearing; even on the same type of machine, such as a lathe, for example, the pressure may be quite different, if one lathe is employed chiefly on a distinctive class of cutting from another. The utilisation of double tools, set opposite, also alters the state of affairs, so also may simultaneous operations, as turning and boring, or boring and facing, etc.

DESIGNING THE SCREW THREADS

(Continued from Page 25)

mechanics contains the derivation of the above formula for the inclined plane.

In the case of the V-thread, the normal pressure on the nut is greater than with the square thread according to a ratio that depends on the cosine of half the angle of the thread. So that for a 60 degree thread we have the efficiency equals.

$$\frac{\tan \alpha}{\tan (\alpha + 1.14\,\phi)} \quad (42)$$

In many cases, in addition to the thread friction, there is a collar thrust friction which may have to be considered. If the thrust collar is the same diameter as the screw thread then the combined efficiency is

$$\frac{\tan \alpha}{\tan (\alpha + 2\phi)}$$

Any extra friction would be treated in the same way.

The expression

$$\phi \quad \phi \quad \tan (\alpha + \phi)$$

may be written in another form because of a trigonometric relationship, thus

$$\tan(\alpha + \phi) = \frac{\tan \alpha + \tan \phi}{1 - \tan \alpha \tan \phi}$$

Very often this expression admits of direct substitution to give the required result.

Example:—A square threaded screw 2 inches in mean diameter has two threads per inch of length. The coefficient of friction between the screw and the nut is .02. Determine the horizontal force applied at the circumference of the screw that will be required to lift a weight of 3 tons. Find the efficiency of the screw. The pitch equals ½ equals P, mean dia. equals d, equals 2"; Tangent of angle of inclination of the thread.

$$\tan \alpha = \frac{p}{\pi d} = \frac{.5}{3.14 \times 2} = .0794$$

$$\mu = .02 \text{ so that } \tan \phi = .02$$

Let Q equal the force in tons necessary to do what is required. Q equals the force applied at the mean radius of the thread to lift the weight

$$= W \tan (\alpha + \phi) \quad \text{or}$$

$$Q = 3 \times \tan (\alpha + \phi)$$

$$\text{or } Q = 3 \times \frac{\tan \alpha + \tan \alpha}{1 - \tan \alpha \tan \phi}$$

$$\text{equals } 3 \times \frac{.0794 + .02}{1. - .0794 \times .02} \text{ equals } 3 \times .09956$$

equals .2987 tons.

Also the efficiency equals.

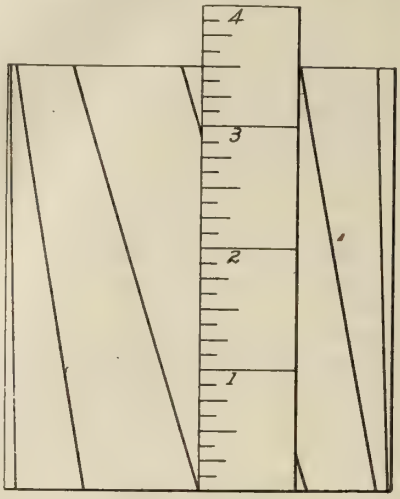
$$\frac{\tan \alpha}{\tan (\alpha + \phi)}$$

Practical Ideas for Shop Executives

A LITTLE knowledge is often a dangerous thing." This is particularly true respecting the lubrication of machinery. Many men think efficient lubrication means "plenty of oil." But the proper definition should be "enough for the particular purpose." This applies both to quality and quantity.

One place where the use of oil is often abused is on the feed screws of machines, particularly lathes and shapers. It is, of course, necessary to lubricate these units but not profusely, as too much oil causes the dust and cuttings to adhere to the thread and when drawn into the nut, results in excessive wear. Especially is this true in the case of cross feed screws on lathes where no cover is provided and cuttings revolve with and adhere to the thread as the tool is advanced or withdrawn from the work. Wherever possible these screws should be protected from the falling dirt and cuttings. Where parts, such as gears, worms, thrust bearings, etc., are completely enclosed, a generous supply of oil is often advisable, but in no instance should more oil be used than will adequately answer the purpose.

Undue waste of oil often occurs in the lubrication of counter shaft and main shaft bearings, and this duty should always be under the supervision of a man with a full knowledge of the requirements and the most suitable oil for the purpose. I have in mind a large industrial plant where an old man had this work to do and more oil was wasted each trip than that placed in the bearings. He would climb the ladder and invert the oil can before he located the oil hole, with the result that more oil found its resting place on the outside of the bearing box than that going into the oil well. His trail could usually be traced by a small pool of oil on the floor beneath each bearing. Proper care on the part of the executives and the man in charge of this work would result in a profitable saving of oil.



Lead of spiral cutter.

LEAD OF SPIRAL CUTTER

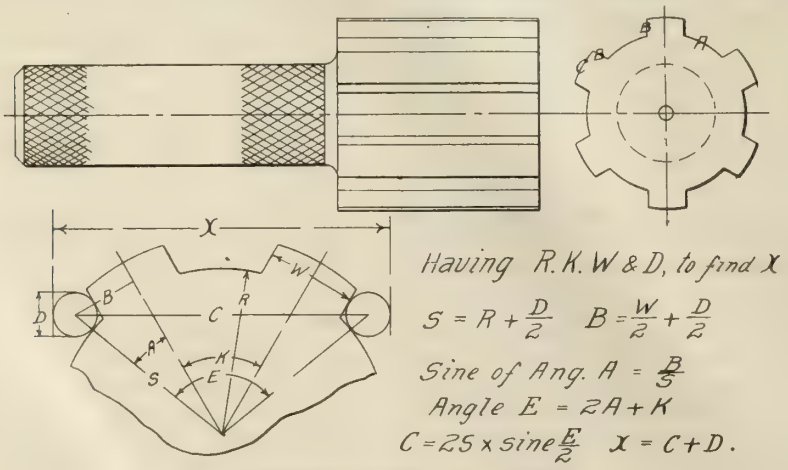
By J. Davies

In answer to the tool room problem in Feb. 16 issue: "How to find the lead of a spiral milling cutter from the cutter itself," I submit the following. Place the cutter on the marking-off table or surface plate and apply an ordinary scale as shown in the sketch. Place the scale at end of one tooth and note the distance where the edge of the scale cuts the line of the next tooth. Multiply this distance by the number of teeth and it will be very close to the lead. The sketch shows a lead of 30 in., 3 inches for one tooth with a ten tooth spiral.

MALE SPLINE GAUGES

By Geo. R. Brooks

The accompanying cut illustrates the method adopted in grinding and gauging male spline gauges for inspecting splined holes in automobile differential slide gears. As it is very difficult to make an indexing fixture that will be accurate to .0002 of an inch, the splines must be ground another way. The ordinary index centres for the surface grinder can be used with two screws opposite each other for clamping the tail of the dog, instead of the usual method of one screw. This allows of closer adjustment. The centres are then checked for alignment. The first operation is to grind the bottom A of the spline, to correct diameter and concentricity. The second operation is to grind two opposite sides B central, and correct thickness. The accompanying formula is used to determine the location of the other splines. Extreme care must be exercised in making the splines the exact thickness, or the last spline ground will be unequally spaced. The gauge is then finished by grinding the outside diameter C to size. A careful gauge maker can grind this gauge to an accuracy of .0002 of an inch.



Grinding and sizing spline gauges.

ELECTROPLATING AND MACHINE REPAIRS

The loss of even a small fraction of an ounce of metal from some part by wear often makes it necessary to purchase a complete new part or, if this be unobtainable, to lay up the whole machine as an alternative to working it under very unsatisfactory conditions. In many cases, however, worn parts can be restored to their original dimensions by depositing on them electrically a film of metal—nickel is good on account of its hardness—of the requisite thickness, wtih a little to spare if subsequent turning or grinding be necessary. The part is thoroughly cleaned and dipped into melted wax. When the film of wax has cooled, says a writer in the British Trade Review, it is scraped away from the surfaces which require treatment, and part immersed in the plating bath. As the metal is deposited very slowly it is easy to work to very close limits; yet, if sufficient time be allowed, the deposit may attain a thickness of 1/10 in. or more.

If the operation be properly carried out, the nickel adheres to its foundation very tenaciously, and is quite continuous and of even thickness throughout. In this way expensive and heavy items, such as crankshafts, cylinders, and pistons, can be made serviceable again at a cost far smaller than that of a new part. At the other end of the scale very slight wear in delicate machinery, in which close adjustment is essential, may be put right by the deposition of a film of the exact thickness required.

MACHINE UNIT ATTACHMENT METHODS USED TO AVOID MACHINE WORK

By F. H. MAYOH

TWO CLASSES of work which give a good deal of trouble and often run up a costly manufacturing bill, are attachments which have to be put on machines already in use, and special work too large to be handled on the tools that are available to do the machine work. The reason for this is usually obvious because of the large amount of hand work necessitated thereby. The group of illustrations shown herewith are of designs used to obviate to some extent manufacturing trouble under such conditions.

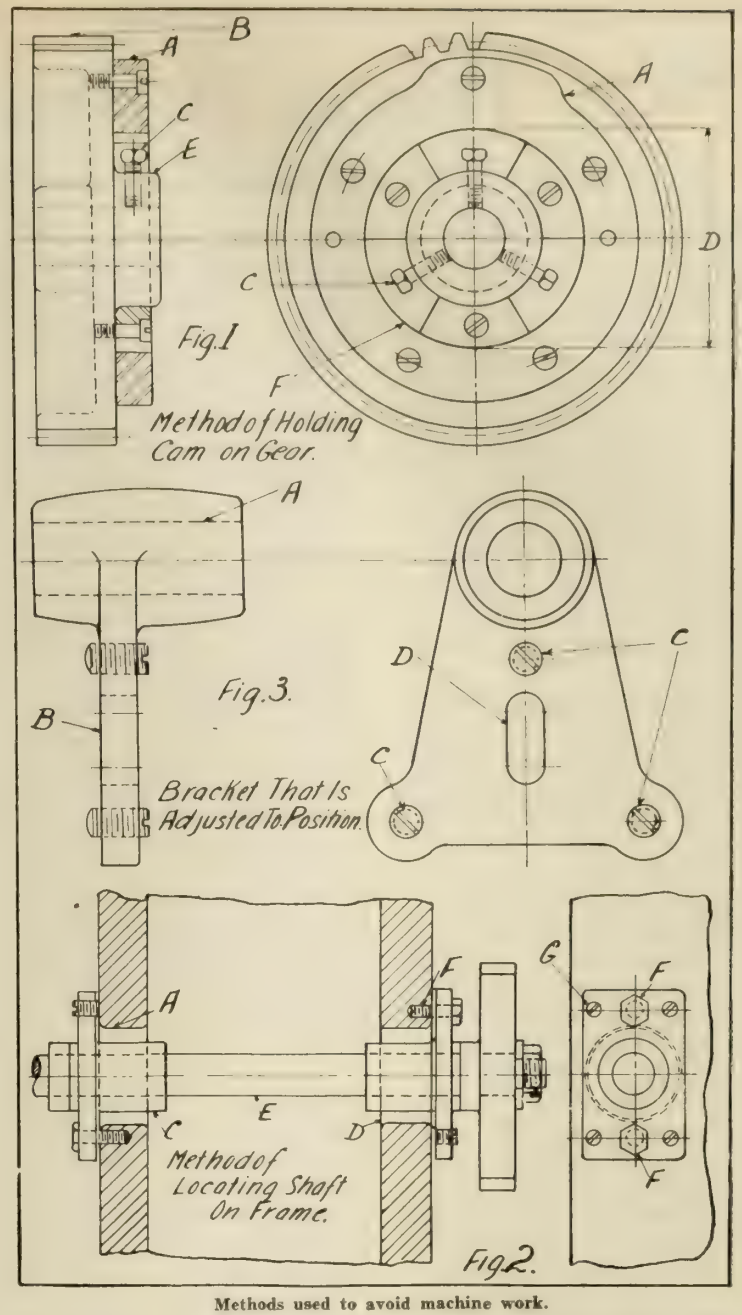
Securing Cam to Gear

Figure 1, shows a cam that was attached to the side of a gear, the cam being indicated as "A" and the gear as "B;" to attach the gear on the shaft upon which it was mounted three set screws "C" were employed. As it was desired to avoid the expense of removing these screws and using some other means of attaching the gear to the shaft, a hole was bored in the cam of a diameter equal to "D." A ring was also made having an outside diameter to fit this inside diameter "D" and a hole to fit the hub of the gear at "E." This ring was cut into six sections and three of the pieces "F" were interposed between the gear hub and cam while screws held them in place, thereby centralizing the cam on the gear. The cam is held in position by screws and dowels and as there were two of these gears with cams attached all of the six pieces "F" cut from one ring were used. The saving in this instance consists of having to do no machine work on the gear and the arrangement as shown permitted of revolving the cam on the pieces "F" until the rise of the cam was in the proper location, in time with the other operating units of the machine.

Adjustable Bearing

Figure 2 shows a method sometimes used to locate a shaft in the base of a machine where the base is too large to go on any of the boring machines available or it might be used to attach a shaft to a machine already set up and upon which additional mechanism is to be assembled. In this instance the two large holes "A" and "B" are cast in the machine or cut out by using hand equipment depending, of course, on the circumstances. These openings are made large enough to permit of adjusting the bearings "C" and "D" which carry the shaft "E" until both ends of the shaft are in line and the center distance correctly located with reference to the other parts of the machine. After this the screw holes are drilled and tapped as indicated at "F" for the purpose of holding the bearings in place, each of the bearings having a large flange cast integral therewith for this purpose.

As shown in this example two holding screws "F" are employed and in each of the four corners of bearing at "G" are placed headless adjusting screws. These are adjusted to line the bearing up on the rough surpace of the casting and after the shaft runs properly, in the correct location, tightening screws "F" securely holds the bearing in place. The bearings can then be doweled in position, or if desired babbitt, or lead may be poured between the bearing flange and the machine thus holding the bearing securely in place and preventing them from getting out of alignment when in use.



Methods used to avoid machine work.

End Support For Shaft

A form of bracket used in somewhat the same manner is shown by Fig. 3 except that this bracket is part of the regular construction of a commercial machine. It is used to support the end of a shaft that has two fixed bearings in the machine proper. The shaft end overhangs considerable and this bracket is slipped over the shaft at "A," the surface "B" is then pushed up against the rough side of the machine and the three screws "C" are adjusted until th come in contact with the side of the machine and permit the shaft to revolve properly. A screw passing through the slot "D" then clamps the brackets securely in position for the purpose of supporting the shaft.

The principle involved in the last two illustrations will be found quite a convenience in building first models where the factory is not properly equipped to manufacture, and in fact on some types of machines most of the heavy machine work can be eliminated in some such manner if it is not convenient to do the same, although it will be understood that these methods are somewhat of a makeshift and should not be employed in good high class commercial machine construction where important functions are to be performed.

New Things in Shop Equipment

PORTABLE ELECTRIC DRILL

A portable electric drill has recently been placed on the market under the trade name of "Willey." It is made in three sizes, 3/16-inch, ¼-inch, and 5/16-inch, these sizes weighing 6½, 7 and 7¾ pounds respectively. The drill is constructed in three units, namely: a motor body, drill spindle, gears, and the handle. The handle is provided with a mechanism for controlling the motor switch. This mechanism is actuated by the fingers of the operator in grasping the handle. Thus the drill automatically stops rotating when the pressure of the hand is released from the switch mechanism. All electrical connections and attachments are contained in the motor body.

The tool is designed for use with high speed drills only when drilling in steel or iron. It is intended that carbon steel drills be used for the softer metals and wood. The drill is manufactured by the James Clark, Jr., Electric Co., Inc. of Louisville, Ky.

OIL CUP FOR LOOSE PULLEYS

An oil cup has recently been designed to efficiently and economically lubricate loose pulleys. It is claimed that the oil cup will keep the pulley shaft well oiled while the pulley is revolving and at the same time does not allow oil to empty from the cup and leak along the shaft when the pulley is stationary and the oil cup is above the shaft centre. The method of mounting is rather simple. An oil hole is drilled through the hub of the loose pulley, to the bore. The outer end of the hole is tapped to receive a special cast iron elbow. One end of this elbow is slightly longer than the other. The long end is used to carry the oil cup away from, and clear of, the hub. The oil cup is screwed into the elbow. It is of simply a reservoir design with a neck on the end. The central line through the oil chamber is set at 45 degrees to the central line through the neck connection. When screwed in place the reservoir should incline toward the pulley hub. The only unusual part of the construction is a small round rod in the neck connection. This rod acts as a valve and keeps the passage way unobstructed, the pin or rod only moving when the pulley is stopped or started. This rod or pin serves to regulate the flow of oil. The top of the reservoir unscrews to permit of filling with oil. The oil cup is manufactured by Charles Kay of 5,073 Burns Ave., Detroit, Mich.

NEW TYPE OF REAMER

A new type of reamer having three right hand spiral flutes, rugged cutting lands, and milled with a generous hook or undercut has been recently placed on the market and for which some unusual results are claimed. The taper pin type of reamer is sharpened so that two of the lands are relieved clear up to the cutting edge, while the third land is only relieved for about two-thirds of its width, leaving the balance of a circular section to act as a steady rest and prevent the right hand spiral and undercut from drawing the tool into the work. Contrary to usual experience, this type of taper reamer gives best results when operated by power. When cutting steel, the cuttings resemble a bunch of steel wool. The taper reamer it is claimed, will not draw into the work, cannot chatter, cuts like a drill and works best when power driven.

The same idea of design has been applied successfully to a chucking or hand reamer for straight or parallel holes. In this case the reamer is made with three equally spaced and fully relieved cutting lands, while midway between two of these is a narrow unrelieved land which acts as a steady rest to keep the reamer from drawing in or chattering. It also serves, in connection with one of the cutting edges, to furnish a place to measure the diameter of the reamer. These reamers are manufactured by the Bickford-Switzer Co., of Greenfield, Mass.

AUTOMATIC DRILLING MACHINE

There has recently been placed on the market an automatic horizontal multiple spindle drilling machine of the station type. This drill press has two horizontal heads, each of which contains a multiple number of drilling spindles. The machine has been tried out on a varied class of work in light drilling. A piece of work in a jig is placed on the work-holding fixture in the middle of the bed. The two heads are fed toward, and away from, the jig at the same time, the operation of the machine in this respect being automatic and continuous. The duty of the operator is to change the work at the front station of the work-holding fixture and index this fixture through the stationary jig. An indexing occurs each time the drill heads are withdrawn from the jig.

The drill spindles are provided with radial and thrust ball bearings and all spindles are run at the correct speeds for the diameters of drills they are driving. The feed of drills is reduced as they enter and break through the work. Quick returns are provided for the heads. Various heads can be used on the slides, very little time being consumed in changing. The saddle, or work-holding fixture, is so designed that a wide range of work can be accommodated. The machine is about ten feet long and weighs approximately 5,000 pounds.

PNEUMATIC RIVETING MACHINES

A line of pneumatic riveting machines, made in various capacities from 10 to 150 tons, is now being built. Movement is given the die, in these machines, through a toggle action which causes the die to advance to the rivet rapidly at first, but at a decreasing rate of speed and an increasing tonnage. After the die reaches the rivet, uniform speed and pressure, sufficient to drive the rivet tight, is provided, thus drawing the plates together, and following up the shrinkage of the rivet with full pressure. It is not desirable, nor is it necessary, to drive the rivet at the end of the die travel or piston stroke. Thus it has been intended that when the die is set for any run of work, that the rivet will be headed when the piston has moved through about three quarters of its stroke. This leaves a sufficient die travel at full pressure on either side of this position to take care of variations in the length of rivets, thickness of plates, dimensions of holes, etc., without it being necessary to make further adjustments of the die screw. The first inch of piston stroke results in a die travel of 1¾ in. Four-sevenths of the power is developed at the die during the movement. Thus a five-ton pressure exerted by the piston results in only 2.85 tons pressure being exerted on the die. In the second inch of piston stroke, the rivet die advances 7/16 in., exerting a pressure of 11.4 tons. The third inch of piston stroke advances the rivet die 5/16 in., with a die pressure of about 16 tons. For the ninth and each succeeding inch of piston stroke the die advances 1/12 in. and exerts a pressure of 60 tons on the rivet die, this maximum pressure being maintained for ½ in. of die travel.

The operating valve is of the plain sliding type having a simple wick packing on the stem, and a removable valve seat which permits of easy regrinding. The machine is provided with means for using line pressure in the pull-back area. This reduces the pressure to the next lower tonnage rating which enables a 50-ton machine to develop and operate at both 50 tons and 30 tons pressure on the rivet die. Similiarly a 75-ton machine will operate at both 75 tons and 50 tons die pressure. The machine is manufactured by the Southwark Foundry and Machine Co., of Philadelphia, Pa.

ALIGNMENT GAUGE

As perfect alignment of connecting rods is essential if an internal combustion motor is to give the best results, and be free from many common troubles, the introduction of the "Twistest" connecting rod gauge will be welcomed by manufacturers of motors. The gauge consists essentially of a cast iron base and on one side flush with the edge, is located a vertical plate integral with the base. On top of the plate, and cast integral with it, are three vertical standards well tied together with cast integral ribs. In the solid vertical plate is located a ground hole surrounded by a circular machine finished facing piece. In this hole is inserted the steel pin used as a gauging part and which lines up the large end of the connecting rod in a manner precisely as it is assembled on a crank shaft. In the small end of the connecting rod a steel pin is placed and attached to this pin is a four pointed star of cast iron. On each corner of the star is a machine finished pad ground true. The rod is placed on the large pin and the small pin is placed in the rod. The four points on the star are widely separated and should touch the three vertically machine ground ways of the gauge. The middle way has two star points in contact for alignment in the one plane. The two other star points should come in contact with the two outside ways to test the alignment in the other plane at right angles to the first plane of reference. If all four star points touch, the rod is in alignment. Feelers are not required as the construction of the gauge enables the contacts to be verified by the eye through the light test. A complete range of large pins for the crank shaft end of the rod and stars on small pins for the wrist pin ends is manufactured. The size of the star is sufficiently great to magnify the error to a great extent. The capacity of the gauge is for rods from 6 inch centres to 12½ inch centres. The gauge is manufactured by J. S. Imlach, Ottawa, Ontario.

DIAL FEED MULTIPLE SPINDLE TAPPING MACHINE

An electric driven three spindle dial feed tapping machine has recently been placed on the market. The work holding dial is indexed by means of cams mounted on the main vertical spindle. The machine was designed primarily for tapping nuts and other small pieces requiring a number of tapped holes. Such parts in brass and steel are required in large quantities in electrical apparatus. Any piece requiring one, two or three tapped holes can be tapped at one movement of the dial past the spindles. Taps of different leads can be used on the several spindles at the same time. The two outside spindles are adjustable so that holes in varied and staggered positions may be tapped. One hole is made to register with the centre spindle and the outside spindles adjusted to the other holes in the work. Taps from size No. 4 to No. 10 are operated at a rate of 56 strokes per minute, which gives an hourly production of 3360 pieces having either one, two or three holes. On pieces with only one hole to be tapped, production can be increased by 100% by doubling the number of slots in the dial, which can be conveniently done by staggering them and adjusting one of the outside spindles to suit. This gives a production of 112 pieces a minute. By furnishing a cam and a slide which will work in conjunction with the dial the machine may be modified so that round pieces may be tapped without difficulty. Ball bearings are provided for all shafts that run at comparatively high speeds, and all gears are accurately cut. The motor is mounted on a bracket attached to the column and it is directly connected. The machine is manufactured by the Anderson Die Machine Co. of Bridgeport, Conn.

LARGE ROLL GRINDING MACHINE

Recently there were built two large roll grinding machines which are capable of grinding rolls up to 54 in. in diameter and 28 feet in length. These are believed to be the largest machines of their kind ever built, the weight being about 50 tons, for each machine. Electric drive and control throughout, has been employed. The drive for each machine comprises four motors. A 40 h. p. motor on the wheel carriage operates the grinding wheel and traverses the carriage. A 20 h. p. motor on the head stock revolves the work. A 3 h. p. motor on the foot stock traverses this member along the ways of the work base. A 3 h. p. motor on the wheel carriage drives the coolant pump and traverses the grinding wheel at right angles to the work.

The operation of the machine is governed by magnetic controllers, the position of the operator being on the wheel carriage beside the wheel where the grinding process may be observed. Rolls may be rotated between centres or on bearings. When the operator is in his position there are within reach all the handwheels and levers necessary for stopping or starting the roll, reversing the traversing wheel carriage, either by hand or by power, starting and stopping the traverse of the wheel carriage changing from the maximum to the minimum speed of the wheel carriage traverse, moving the wheel carriage for slight adjustments by hand, moving the wheel toward or away from the work either by hand or by power, and controlling the amount of coolant water flowing over the work.

Changes in the speed of the work are accomplished at the head stock by means of a drum controller and change gears. Four speed changes for the traverse of the wheel carriage are accomplished by means of a lever on the front of the carriage. Eight speed changes for this unit are available through the use of back gears. An attachment adjustable to any radius up to 3½ inches is furnished for forming the corner of the grinding wheel to suit the grinding of fillets while the trueing device maintains the face of the wheel. The machines were designed for dressing steel mill rolls and were recently installed in the shops of the Jones and Laughlin Steel Co. The manufacturers were the Norton Co., Worcester, Mass.

FORM AND CUT OFF MACHINE

An automatic machine with two spindles designed to have two operations only, form and cut-off, has recently been developed and placed on the market. The two spindles work simultaneously as two separate single spindle machines working on different pieces of the same product. The machine will make any one piece that can be produced with one forming and one cutting-off tool, or with a forming tool and a combined forming and cutting off tool. Under these limitations come the pieces such as special shaped rivets, knobs, studs, handles, etc., etc.

The two spindles are placed side by side and the double set of forming and cutting-off tools work together on two bars of stock, producing two pieces in the time required for one. Adjustments are provided in all directions which greatly facilitates setting up. All adjusting members are graduated. The machine is rigidly designed enabling heavy cuts at high speeds to be made without vibration. All parts are amply proportioned for heavy duty service and long life, yet simplicity is evident. The spindles are hardened ground and lapped, and operated in phosphor bronze boxes of adjustable design. Thrust is taken care of at the rear end of each spindle through the medium of hardened steel and phosphor bronze bushings. The spindles are driven from a three step cone pulley shaft, through enclosed spiral gearings running in oil. The pulley shaft runs on roller bearings. Six chucks are easily changed and are adjusted by a nut at the rear end of each spindle. There is no end-motion when opening or closing the chucks.

Work can be fed in any length up to three inches but by means of a special arrangement lengths up to twelve inches can be fed. Feeding may be accomplished at any time during the revolution of the cam shaft. The forming tools are carried on cross slides and can be adjusted independently in any direction. The cutting-off slides are set at an angle to provide extra clearance for the forming tools. Tools can be adjusted independently or in unison. Change gears supplied with the machine permit of a production of from 60 to 1,800 pieces per hour, the rate depending upon the character and size of the part. The floor space required is 44 by 26 inches. The manufacturers are the L. P. Brown Machine & Tool Co. of Attleboro, Mass.

The report is current that the Wabash Railway Co., is planning the erection of a locomotive repair shop at St. Thomas, Ont. in the near future, at a cost of about $500,000, in order to take care of the rapidly increasing business in Canada.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron Steel, and Metal Working Industries.

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Standardization is Needed

IN THREE months' time, the mechanical engineers of Canada and the States will open up a convention at Atlanta, Ga. One of the chief topics to be considered will be standardization of industry, and it is to be hoped that important rulings will be passed on that occasion as there is a great need of standardization in all industries at the present time.

Germany has found the benefit of standardizing their products, and a few pioneers of the movement in this country have made a success, in a mild way at least, towards producing standard lines. They usually classify this as simplification of their lines, and by reducing the number of styles carried, made a forward step towards standardization. This, however is only local in character, and what we urgently need is a nation-wide movement.

Standardization, if properly applied, stabilizes production and employment. It allows manufacturers to plan accurate stocks during slack periods, and reduces automatically the selling cost. It also lowers the unit cost to the buying public by making mass production possible. The automotive industry is an ideal example of standardization. Another feature is that by concentrating on fewer lines, a manufacturer can place more thought and energy on the products being manufactured.

Before the war, pocket knife manufacturers in the States made as high as 650 basic patterns for pocket knives, and from the 650 patterns, as high as 6,000 to 7,000 distinct numbers or styles were evolved. Under government regulations this enormous amount was reduced to 85 basic patterns, and 250 knife styles, and speaking of the change, C. W. Silcox, secretary of the industry said that they found that they had formerly been paying for a lot of things that were absolutely unnecessary. What can be done in knife manufacture, can be accomplished in other lines.

At first, certain difficulties may be met with, but nothing worth while was ever accomplished without a certain amount of trouble. Once let the idea take root among manufacturers and our foreign trade will develop, for we will then be more able to compete with other nations, where the scale of prevailing wages is much lower than that in Canada. The results of the coming convention will be watched closely, and it is more than likely that valuable experiences in standardization will be related at that time.

Do Your Own Thinking

THE MEN who have made a success of life are those who have been brave and energetic enough to get away from the beaten track. Anyone can be a routine worker, but it takes courage and initiative to step into fresh fields of endeavor.

When people speak of a trade or profession being overcrowded they seldom realize the real root of the trouble. It simply means that a large number have become fairly proficient in some particular line. True, they may have mastered a trade, but they are routine workers nevertheless, or at least the large percentage of them are. The really worth while men are seldom out of employment, for they are so far above the average in that profession, that they are invaluable. In other words, rather than be content to follow a regular routine, they have done some thinking for themselves, finding new and more efficient ways of performing the same tasks.

Take the case of the chemist. He has standard tests which he can follow up to obtain certain results, but discoveries of importance are not made in this routine fashion. Edison would never have become a world-famed personage had it not been that he refused to stick to routine work. He delved into new methods, used his brain to advantage, and even when results were not encouraging, kept faith in his ideals.

We all need some of the Edison spirit. Get away from the idea that because a task was completed in a certain fashion a year ago, yes even a day ago, that it must be done that way for all time. No matter what line of industry you are in, make up your mind to be a searcher, rather than a plodder. Think for yourself, find out some better method of performing your daily tasks and success will automatically follow.

The process is also eminently adapted to the welding of side sheets and fire boxes of boilers, and the cutting torch is extensively used for cutting out patches, removing rivets and stay bolts.

It would be difficult to mention an industry which has developed to such an extent as the one under review, and its possibilities are practically unlimited. It would therefore, appear that machinists, garage owners, etc., would do well to see that they keep up with the developments of the process in order that they may not be handicapped in the never ending competition to which they are subjected and may be on even terms to compete with their business rivals.

Pay as Promptly as Possible

FINANCING is not an easy matter just at present. In fact, some firms frankly admit that the reason they cannot pay their bills as promptly as they would like to, is because they in turn cannot collect from their customers. Unfortunately some who do not really need to do so, are taking advantage of the situation, and are issuing notes, and retarding the payment of same as long as possible.

When any number of firms start this practice, it is not long before the majority of the business community is following suit, financing on long terms instead of prompt acceptances. This is bad business, and while every leniency necessary should be extended to worthy institutions, who may be rather pressed for ready cash at the moment, still, on the other hand, no financially able firm should hold back payment when they are able to pay their way. Let a few of this type start the ball rolling, and it would not be long before collections would become easier all around.

Business Conditions Are Picking Up Slightly

Small Tools and Supplies Show Good Volume—Machine Tools Fairly Active—Non-Ferrous Metals, Scrap and White Metals Are Quiet—Pig Iron Not Active But Business Has Better Tone

BETTER FEELING NOTED ON MARKETS

THE bright spot on the Canadian market at present is the small tool and supply business. From figures compiled, we find that the month of January, 1922, was better than November and December, 1921, put together, and that February was 20 per cent in advance of January. From the number of orders received so far this month March should pass last month's figures.

Business continues to improve as the season advances, but not any more than was reasonably expected. This is especially true of the steel market, for although the month of February was better than January, the figures now totalled show merely the seasonable increase.—The outlook for March indicates further slight improvement in sales. As a result of the higher prices for farm products, and the feeling that there will be a good demand at those advanced prices for this year's crops, there is a marked change in sentiment among business men.

A few reductions in price have occurred during the week on Canadian markets. Copper lines are down about 25 cents per ton in Montreal, although Toronto prices remain stationary. Galvanized wire products and nails are also down from 15 to 25 cents. While these are not very important changes it shows that the tendency is downward, not upward.

Machine tools remain quiet, but some dealers are securing a fair amount of orders by aggressive sales methods. Oils and waste are in fairly good demand, the latter having shown an improvement in February, over the former month.

The activity along the waterfront in Montreal has lent an impetus to trade in that locality, and boiler tubes are featuring this market, together with other marine requirements.

Pig iron is very quiet, also non-ferrous metals and scrap. Until foundries pick up no improvement is looked for.

There has been a general falling off in the demand for steel products in the States. This is practically the first recession since the beginning of the year. Shading continues on this market, and on an attractive order bars, shapes and plates can be bought at 1.35 cents, Pittsburg against the former figure of 1.40 cents. Pipe is also being shaded more extensively. The demand for wire nails is good, but the demand for wire products, such as barb wire and fencing is poor. Pig iron basic is now admitted to be $17.75, although some held out for $18. Bessemer is $19, foundry iron between $18.75 to $19, and Connellsville furnace coke between $3.25 to $3.50. Demand for coal has dropped off during the past ten days.

Toronto

March 8.

ALTHOUGH we cannot point to any sensational improvement in the local market since our last report, we can, without doubt, say that every week sees a further step up so far as increase in business is concerned. Dealers are thoroughly convinced that the market will climb slowly but steadily from now on, and of course, as the season advances, the improvement will be all the more noticeable.

Iron and Steel. Take for example iron and steel. January was slightly better than November or December, February gained a little on January, but from present outlook March will show a decided step up over last month. Of course, in the iron and steel field this is to be expected, as with the good weather coming on builders are getting ready for the spring. Dealers feel, that while commercial building, in other words, building for speculative purposes, will not be as brisk as formerly, public buildings and garages will be erected in fair numbers.

Another thing that is helping the iron and steel trade is the fact that manufacturers' stocks as a general rule are down almost to nothing. This is clearly shown by the number of orders placed on the condition that immediate delivery is given. A few orders are being placed on second quarter business, but very few. Prices remain unchanged, and shading still continues where the order is very desirable. No particular line is featured, the demand being general. Following are existing quotations in the Toronto field:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron. There still remains a dull market for pig iron. The price has not changed, being still quoted at $27.15, but as mentioned, last week, a slightly better price is usually obtainable when the quantity ordered is of large, or even medium sized proportions. Foundries are dull, and until manufacturing plants secure better business this condition is likely to continue. It is a generally understood fact that the pig iron demand will not pick up until manufacturing lines improve.

Non-Ferrous Metals. These metals continue dull, brass and copper being particularly weak. Red metal is plentiful, but no buyers can be found. White metals are also inactive, and in fact there is a somewhat depressed feeling throughout this whole market. There has been no change in prices, dealers feel as there being no use for the metals ing that price is not the trouble so much with business so quiet in the lines usually requiring them. Following are present prices.

Lake copper	17 00
Electric copper	16 75
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	27 00

Scrap Metals. Here again we have a quiet market for the reason already stated. The demand is simply not there so that dealers have to be content to hold on to their stocks for the present. One large user is not expected to enter this market for some time, adding to the already quiet feeling in scraps generally. Following are existing prices:

Copper, light per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	18 00
Steel axes	15 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	3 00

Machine Tools. A very spotty market exists in machine tools. Some dealers are getting a fair amount of orders, and claim they are doing as good as can be expected under present circumstances, but others again feel that the market is down and out for some time to come. Striking a happy medium would be about right, for while conditions are bad for some, others who are going out after the business are finding a certain amount of it. This is well exemplified by a conversation which Canadian Machinery overheard when on a call. "I am much impressed by their attitude, I think they will buy. I'll write them a letter tonight," remarked a salesman to his manager. "Write," yelled the executive, "write be ———, get a time table look up the first train, get up there and

and land the order." Naturally the firm we refer to, say that all things considered they are doing nicely. It's the man who goes after the orders that gets them these days.

Small Tools and Supplies. This section of the market shows added improvement every week. It is a healthy growth being gradual and in all lines. For example here is a statement given to Canadian Machinery by one dealer, and based on actual figures in the ledgers. January, 1922, was better than November and December, 1921 put together. February was 20 per cent. better than January, and according to the way March has started, a further gain will be made this month. No one line is in demand, and the orders are coming in from a scattered territory. The very nature and size of these orders show that a hand to mouth buying policy still exists, and that stocks in the tool stock room in manufacturing plants must be very low.

Oils and Compounds. A slight reduction in price has occurred in oils this week, black and petroleum oils being the ones affected. Black oil dropped from 21 cents to 19 cents, and petroleum from 10.40 cents to 9.90 cents.

Miscellaneous. Wire nails and galvanized wire products have dropped a little in price, this ranging from 15 to 25 cents. The demand for waste is slightly improved, and those engaged in this line are not complaining. Steel pipe is moving at a fair rate, but other lines such as lead sheets and copper products are not very active. It is a highly competitive market, and dealers have to be right on their toes to land orders.

Montreal

March 8

THE IMPROVED tone in the general conditions that made itself noticeable last week is now a little more in evidence. It will, however, be remembered that merchant bars and structural steel were still quite sluggish and no perceptible change in these commodities has been noted. This is, of course, the result of the quiet times being experienced by those manufacturing and contracting activities that form the chief sources of consumption of these materials. This quiet period only indicates that the pendulum, which swung from the side of great activity to the other side of practical stagnation, has not yet swung back far enough to bring these plants in the sphere of increased activities. Our trade locally, however, is improving, and there is every indication that the coming season will be more encouraging than in 1921. No one expects that there will be a boom year, but we do believe that there will be a marked improvement over present conditions all along the line.

The cause of the better trend of business lately is the activity along the water-front. Spring always lends a certain impetus to trade, but in a city situated as is Montreal, where the harbor activities are tied up entirely for three or four months every year, the direct and indirect results of the approaching spring have a much greater influence than they would have if the city had a harbor that was open twelve months of the year.

Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00

Boiler tubes are again featuring the market, together with other marine requirements. Sheets and plates are also moving in a somewhat better manner. The prices of all steel products remain the same and there is a tendency for prices to be firm. Very few jobbers have much of a stock on hand. The rumoured reports of a coal strike on April first are entering into the situation to a certain extent. Most jobbers believe that when April arrives there will be an increased demand over the present, and if the strike tends to tie up transportation to any great extent, and supplies cannot be obtained, a shortage will occur which will send prices soaring. Whether the strike will actually take place is another question.

Pig Iron. Very little change has been reported in the pig iron business. The demand has not materially increased, and the hand-to-mouth method of buying is much in evidence. An example of this was noted last week, when one firm had a little run of orders that completely exhausted their supply. After a hurried canvass of the dealers it was found that not one had a car of pig iron in stock. The situation was taken care of by buying a few tons from one of the consumers in the city and ordering a car by wire with the usual instructions for car number, etc., to be forwarded to consignee, trace by wire and such other practices that were of common occurrence a couple of years ago.

The survey of the city resulted in uncovering the fact that there is not more than three or four hundred tons of pig iron in the whole of Montreal. The prices are the same, and producers claim they lose money on every ton of iron they sell at prevailing figures. There does not appear to be any changes in quotations contemplated, and the prices of American iron are such that Canadian figures come to about the same thing. Thus, if prices on the Canadian product were advanced, it would result in the importing of American iron which can be placed in foundries at about the same figure that is being asked by Canadian producers today.

Machine Tools and Supplies. There is no increased activity in the sales of machine tools. Dealers are, however, feeling somewhat better than they were a short while ago. It was pretty generally understood that there was a large number of remanufactured and second-hand tools for sale. A very careful survey of the situation on both the Canadian and United States side of the line has resulted in the finding that there is only a limited number of these tools, and that they are being slowly absorbed. In fact at the present time there is no more than would be ordinarily on the market in normal times. This means that when the demand does appear it will be new tools that will have to move. Prices have not changed a great deal as there is not enough business to warrant same, although the tendency is for quotations to be gradually reduced.

The small tool business still keeps on slowly improving from week to week, and the revenue from this department really forms the major portion of the total revenue obtained by many jobbers. Prices are reasonably firm, but are being reduced slightly from time to time as business improves. In case of large orders, which are few and far between, a slight discount can usually be obtained.

Non-Ferrous Metals. Copper weakened still further during last week, and is at present being quoted at a lower figure than has been seen for many months. Quotations for other metals are the same and business generally is slightly improved over last week. There have been no outstanding events in this market, and the improvement in Canadian exchange has made Canadian funds a little stronger in New York. Following are Montreal quotations on non-ferrous metals:

Lake copper	16 75
Electric copper	16 50
Castings, copper	16 25
Tin	34 50
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	27 00

Scrap Metals. Very little activity has been evident in scrap metals for the last week and quotations have not changed to any extent. Dealers still claim that something approaching a shortage exists, and that the prospective consumer is willing to take his chances on this shortage materializing. Following are Montreal quotations on scrap metals:

Copper, light	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 machine composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	4
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate	9 00
Heavy melting steel	12 00
Axles (wrought iron)	20 00
Rails (scrap)	12 00
Malleable Scrap	12 00
No. 1 machine cast iron	19 00
No. 1 machine cast iron	19 00
Pipe, wrought	6 00
Car wheel	18 00
Steel axles	18 00
Mach. shop turnings	6 00
Stove plate	16 00
Cast boring	6 00

Pittsburg

March 8, 1922

PITTSBURG, (Special to Canadian Machinery).—On the whole the buying of steel products has fallen off somewhat in the past week, this being the first recession since the market began to grow more active, at practically the beginning of January. The decrease is not seen in every line, but it is moder-

ately general. However, the experience is too short to justify any conclusion that the market has turned quiet, for there are naturally ups and downs. According to the best judges a period of 30 days should be allowed to elapse before any definite judgment is formed.

The quieter market just at the moment, sounds a proper note of warning and emphasizes a fact that has already attracted some attention, that the increase in demand during January and February was very rapid indeed, surprisingly rapid even to those of most sanguine temperament. Many steel men were remarking in substance that they just wished the improvement would continue.

The magnitude of the increase in demand that has occurred is brought out by comparing ingot production rates. The rate now is about 29,000,000 gross tons a year. Last July, at the low point, it was only 10,000,000 to 11,000,000 tons. It was stated in well posted quarters that the liquidation of stocks of steel in the hands of buyers was practically completed by October 1, and production in October and November, representing last autumn's seasonal demand, was at 23,000,000 tons a year. Then at the end of December the rate was down below 18,000,000 tons, perhaps no more than 16,000,000 tons in the holiday week. Production during the entire year 1921 was approximately 19,500,000 tons. With a rate of 29,000,000 tons the first week in March one can see what a sharp increase has occurred.

Early in January there developed fresh price cutting, competition becoming particularly severe, even for relatively small orders. In some lines it seemed as if there were no order so small that some mill was not willing to cut the "regular" or open market price a trifle in order to get that tonnage. As stocks in the hands of buyers were thoroughly depleted, and such attractive prices were being quoted, it would not be unnatural for buyers to replenish their stocks in a moderate way, to a level that would enable them to conduct their business efficiently and economically. Some of the heavy production of the past few weeks may have been on this account. This is merely deduction or theory, for it should be noted that the mills do not admit that their customers have been stocking at all. According to the statements commonly made by the mills the evidence of their order books is that the steel shipped from day to day has been going immediately into consumption.

However this may be, in detail, it is quite certain that there is no speculative stocking. No tonnage is being accumulated that will have to be liquidated in anything like the style of last year's liquidation. Production may increase some more or it may in time go off somewhat, but it is inconceivable that it should ever again get down to the phenomenally low rate of last summer.

Steel Prices. The fact that the price of a given finished steel product is low by any comparison is no criterion that it will not decline farther or that it has reached the rebound point. This is exemplified by a comparison between black and galvanized sheets on the one hand and bars, shapes and plates on the other. At the beginning of last December sheets stood at 3.00c. for black and 4.00c. for galvanized, while bars, shapes and plates were 1.50c., with possible concessions on attractive orders. By statistical comparisons as well as by estimates of production costs prices for bars, shapes and plates appeared lower than prices for black and galvanized sheets. Yet the history of the market since then is that bars, shapes and plates dropped recently to 1.40c. as an open quotation and now 1.35c. can be done on a moderately attractive order, while sheets have stayed at the same old prices, for more than three months. One theory to account for this disparity is that in bars, shapes and plates, mills have been feeling that prices were already so low that they could hardly go much lower, and to make lower quotations might cause some producers to quit, thereby arresting the decline, while on the other hand sheets might find they had quite a distance to fall if mills once began tampering with prices. The manufacture of sheets at 3.00c. and 4.00c. may not be particularly profitable, but at any rate losses can be avoided, with a fair operation, while no mill can possibly come out whole on bars, shapes and plates at 1.35c. The mills are losing a large part, in some cases perhaps all, of their overhead and general expense.

Pipe is being shaded somewhat more extensively, the 2½ per cent. extra discount frequently given by independents, from the regular prices of the leading interest, having extended to 5 and 2½ per cent. in many instances. The extra 5 per cent. is equivalent to an average of between 1½ and 2 points in the discount list, hence it is thought in some quarters that the published discount list will have to be revised in the near future. The present card carries a basing discount of 71 per cent.

Wire Products. Demand for nails is quite good, while demand for other wire products, particularly barb wire and fencing generally, is very poor. Prices of wire products are steadier than a week ago, as the special price of $2.40 on nails has become fairly general, without leading to fresh concessions on large lots, while plain wire seems to have stiffened up some, report having it that 2.25c. is rarely if ever shaded.

Pig Iron. While throughout February the merchant blast furances were claiming that basic pig iron was $18, valley, the average computed by W. P. Snyder and Company, taking all sales of valley iron in lots of 1,000 tons or over shows that no such sales were made during the month except at $17.75, and that may be taken as the quotable market price. Bessemer has sold at $19 and $19.50, depending on tonnage. Foundry iron, which was cut in a sale recently reported to $18.75, valley, has been selling well in small lots at the full $19 price.

Connellsville furnace coke has no more than held its recent advance, to a range of $3.25 to $3.50. It seems that one can pick up a moderate tonnage at $3.25 but a large lot might require a higher price, as operators will not blow in ovens unless assured of a demand for a reasonable time, hence the spot buyer must depend on the floating supply. Foundry coke has experienced another advance and is now firm at $4.25 to $4.75, depending on brand, which makes a total advance in about three weeks of 50 cents a ton. As a rule the coke that used to sell at $3.75 now brings $4.25 and the coke that used to sell at $4.25 now brings $4.75.

Demand for coal has fallen off in the past ten days, either because buyers have changed their minds about there being an important mining suspension April 1 or because they have accumulated all the stocks they think necessary.

The Pittsburg Steel Company and Jones & Laughlin Steel Company, absent from the scrap market for several months, have bought more than 10,000 tons of heavy melting steel scrap in the past week, the price reported as paid being $15, delivered.

"MYSTERY OF ROARING RAILS"

On many of the railway systems of the world the phenomenon of "roaring rails" has been a too familiar trouble to engineers. The surface of the rails developed ridges at regular distances of an inch or so, and these corrugations led to excessive noise and vibrations. On electric tramway systems the same trouble appeared in even greater degree; frequently the noise was so excessive that the rails had to be ground flat at great expense—only to reveal fresh corrugations as soon as the traffic was resumed. All sorts of explanations were offered and for a long time the precise cause of the trouble remained a mystery. Now the problem has been settled by a series of experiments carried out by a committee of British experts on a tramway subway in London, where the rails and track could be altered freely so as to test the various explanations put forward. The conclusion reached is that vibration has nothing to do with the case and that the real cause lies in the action of a very heavily loaded wheel running along the rail. This action makes the material of the rail surface "flow" into waves or corrugations very much as an ordinary road surface flows into waves under the action of a steam roller. The remedy therefore lies in the use of harder rails and, where possible, of larger wheels.

There are more passenger cars owned in Ontario than in any country in continental Europe, South America, Africa or in all Australia, and the fact that per capita only three cities in the world of a half million or more population are as motorized as Toronto. London, England, New York, Paris and Chicago in proportion to their population lag far behind this Queen city in numbers and values of motor vehicles owned by citizens.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 4
Tank plates, Pittsburgh mill price	1 40
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 25
Castings, copper	16 25	17 00
Tin	34 00	34 50
Spelter	7 00	7 25
Lead	6 50	6 75
Antimony	6 50	8 00
Aluminum	24 50	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel		Gen. Wrot Iron	
	Blk.	Galv.	Blk.	Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

	Steel		Gen. Wrot Iron	
Size	Blk.	Galv.	Blk	Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 00	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 50	3 50
Medium brass	4 50	4 50
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00

	Per Ton	Gross
Boiler plate	$9 00	$9 00
Heavy melting steel	9 00	12 00
Axles (wrought iron)	17 00	20 00
Rails (scrap)	10 00	12 00
Malleable scrap	10 00	12 00
No. 1 machine cast iron	18 00	19 00
Pipe, wrought	7 00	6 00
Car wheel	18 00	18 00
Steel axles	16 00	18 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	16 00
Cast boring	3 00	6 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... Net

Solder, strictly	$0 24½
Solder, guaranteed	0 26
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 50	....
Galvanized sheets, No. 28	....	5 55
Queen's Head, 28 B.W.G.	7 25	.....
Fleur de Lis. 28 B.W.G.	6 75	.....
Orbal's Best. No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. 12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sixes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B. ¼ in. $20.00; 3-16 in. $16.50; ¼ in. 15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	37 50
Black oil, per gal.	21 00
Cylinder oil, Capital	66 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 35
Linseed oil, raw, single bbls.	1 00

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	12
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored. 13
Mixed colored. 14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute).	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

The York Sandstone Bridge Co., East Toronto, Ont., is asking for prices on a horizontal tubular boiler.

Preliminary work on the plant of the Three Rivers Pulp and Paper Co., which is capitalized at $3,000,000, will be started in March, 1922.

The mill owned by the Canadian Lumber and Timber Co., Vancouver, B. C., was destroyed by fire with a loss of $110,000. It will be rebuilt at once.

The City of Toronto has had plans prepared for a steam heating system for the live stock arena at the Exhibition Park to cost $100,000.

A Nottingham, England, firm handling all kinds of machine tools, new and second hand, for shipyards, engineers, and kindred trade invites correspondence from exports.

Hopes are entertained that a permit will soon be granted to construct the proposed bridge over the Niagara River between Fort Erie and Buffalo.

The cartridge factory of the Dominion Arsenal at Quebec was destroyed by fire last week. About a million rounds of small ammunition were destroyed.

Barnett, McQueen, Co. has received a contract from James Richardson & Sons for the erection of a million and a half bushel storage annex to the existing grain elevator at Port Arthur.

E. D. Mitchell, special representative of the Alfred Herbert Co. and associate companies, visited the Toronto office at Jarvis St., a few days ago. Mr. Mitchell paid the Canadian representatives this visit prior to his return to England.

The Ford-Smith Machine Co., Hamilton, Ont., who recently started to make imers for Ford cars, report very good business in this line. They also look for further demand now that the motoring season is opening up.

Seattle retailers through the Retail Trade Bureau of the Seattle Chamber of Commerce, have announced that Canadian money will be accepted at par for the first time since the unfavorable situation created by the war.

An old established business in Birmingham, England, is well situated to deal with the following metals if prices are satisfactory; copper, lead, zinc, nickel, aluminum, babbitt, metal, brass and bronze.

British Smelting and Refining Co., of 120 St. James St., Montreal, announce that on May 1st they will move into new offices in the Canada Cement Bldg., Phillips Square, Montreal.

The machine shop of the Home Logging Co., Courtenay, B. C., was almost destroyed by fire recently. The shops were equipped with machinery valued at about $50,000.

A prominent tap and die manufacturer told Canadian Machinery that the past two or three weeks have shown a decid improvement in the volume of business closed. Orders are coming in faster, and the number requested on such orders is also increasing.

The report has been submitted for a water supply system including steel reservoir pumping equipment, etc., to cost about $900,000. The programme called for an expenditure of $90,000 initially. This is quite some expenditure for Todmorden.

The Board of Education, London, Ont., decided upon a building program this year with an expenditure of approximately $700,000. Of this amount, $120,000 has been set aside for an auditorium, gymnasium, and additional class-rooms for the Technical and Arts Schools.

R. C. Douglas, of the Norton Co. of Canada, gave an address on the subject of "Grinding," at a meeting of the purchasing agents in Hamilton a few days ago. B. C. Ball, of the Steel Co. of Canada, spoke on the coal situation at the same meeting. After the regular meeting and dinner, the plant of the Canadian Westinghouse was visited.

The census of Canada's population taken in 1911 totalled 7,206,643. The figures as taken for the year 1921 show a total of 8,769,489. These figures show an increase in all provinces with the exception of Prince Edward Island, the Yukon, and the North West Territories.

The Office Specialty Mfg. Co. has been incorporated to take over the plant and business now carried on at Newmarket, Ont., by the Office Specialty Mfg. Co., Toronto, to manufacture office furniture, vaults, filing cabinets, desks, etc., with $1,000,000 capital stock.

The Empire Cotton Mills, Welland, Ont., has decided to erect a dye mill adjoining its present plant in Welland at a cost of $200 000. Between 150 and 200 employees will be added to their present staff. Construction will start within six months of the passing of the local industrial by-law.

A plant will be built in Galt by the International Tank and Silo Co. A four-acre site has been purchased and a one-storey building 200 feet by 120 feet will be erected. The Galt company will manufacture the same products as those made by the Endlock Mfg. Co., of Des Moines, Iowa. Both companies are controlled by Canadian interests.

One of the best known among high-grade English cars is the Vauxhall, which was in course of being introduced into the Canadian market when the war broke out. Canadian business will be handled by a branch office—Vauxhall Motors, Limited, 188 King St., W., Toronto, Ont., with agents and distributors in the principal cities throughout the Dominion.

The Hon. W. S. Fielding, Canada's Minister of Finance, has had a lengthy conference at the Commerce Department in Washington, the object of which it is understood was to canvass the possibilities of the reciprocal trade agreement between Canada and the United States.

The preliminary survey of the manufacturing industries of the Province of Quebec for 1919, conducted by the Dominion Bureau of Statistics, indicates a substantial growth in potential industry. The number of establishments for the period from 1917-1919 was an increase of 1,061. Capital increased $113,500,000. Number of employees decreased 5,500. Production increased $150,000,000.

One evidence of the revival of business conditions in Orillia is the fact that the Orillia Worsted Co. will immediately enlarge its factory premises in order that fifty more hands may be employed. At present the factory is employing 120 hands which is about a full staff, but the demand for the factory's products is such that 40 or 50 more can be profitably employed almost immediately.

The telephone was invented by Dr. Alexander Graham Bell, a Canadian scientist, and Canada has nearly one million telephones, representing a capitalization of one hundred million dollars. The telephone companies spend annually for research, the results of which are all about us, a sum greater than the total income of many universities, and the enormous amount saved by the use of the telephone is incalculable.

Birmingham Motors, Ltd., Peterboro, Ont., has been organized under the Canadian charter and has acquired the Dominion rights for the manufacture of the Birmingham car now being manufactured at Falconer, New York. The Hope plant in Peterboro has been taken over and the manufacture of the car is to begin in a few weeks. The company has contracted for the past upon its own specifications and is not buying any equipment.

Prof. H. E. T. Haultain of Toronto, who is attending the meeting of the Mining Institute in Ottawa, will describe some novel experiments on Tube Mills. The striking feature of this work is an interesting film, taken at the speed of 120 photos per second by means of an ultra rapid camera. Mr. Haultain has been working for three years under the auspices of the Scientific Research Council. This is the first instance of the application of high speed photography to research in Canada, and it is stated that the method gives promise of great possibilities.

Business this year has been much in advance of the corresponding period in 1921, according to officials of the Buhl Stamping Co. Since January 1, the company has been employing 35 men on full time, and is now working on several big orders.

At the annual meeting of Canada Foundries and Forgings, held at the Brockville office on February 28th, Hon. W. J. Shaughnessy of Montreal retired as a director, at his own request, and was replaced by Harry B. Housser of Toronto. Mr. Housser is connected with an influential financial house in Toronto.

L. A. Paddock, vice-president and general manager of the Canadian Bridge Company, Walkerville, declares that things are now on the upward trend, and that hopes of revlving industry can now be reasonably entertained. He declares that prices of raw materials have now reached almost a pre-war basis, and that good business may be looked forward to this year.

Up until the middle of January, the Walker Twist Drill and Tool Co. was working only four days per week, but since that time the working week has been increased to six days, five of ten and a half hours and nine hours on Saturday, and the firm is being kept at capacity production, filling orders already on hand.

Through the efforts of the Border Chamber of Commerce, the Canadian Aluminum and Brass Co., is opening a branch in Windsor, in a part of the plant occupied by the Dominion Motor Castings Co. The company is affiliated with the General Aluminum and Brass Co., Detroit, and the president, J. P. Carritte, states that actual work will start at the new plant about the middle of March.

Brampton, Ont., had the most costly fire in its history on February 24th, when part of the Pease Foundry was destroyed. Superintendent J. Davidson, who has been in charge of the plant for the past two years, estimated the damage at $150,000, the machine shop, as well as the stock room, with a heavy stock of furnaces being completely destroyed. These buildings are valued at $100,000.

The National Slag Products Co., Hamilton, of which Hon. G. D. Robertson, former Minis er of Labor, is president, is beginning construction work on its building for the manufacturing of building tiles in a few days. The necessary machinery has been ordered and should be delivered about the first of April. This plant will use slag that has hitherto been discarded and carted away at considerable expense by the Steel Co. of Canada. Speaking to Mr. Hobson, president of the Steel Co., regarding the above information, he told Canadian Machinery, that while the using of the formerly discarded slag was perfectly true it was not as large a saving as one might expect, as on'y a very small percentage of the slag at their plant was used by the National Slag Products Co., this being of the granulated variety.

The article on Overcoming Defects in Drop Forge Work, which appeared in March 2 issue was a paper by the author, to be read before the March Meeting of the American Society of Heat Treaters.

A. H. Milne, British Trade Commissioner for Canada and Newfoundland, announces that a British firm in competition with the American manufacturers has secured a contract with the provincial government of Manitoba for the installation of six-thousand-line automatic telephone exchange for the Fort Rouge district of Winnipeg. The contract amounts to about $483,000.

Twenty-two Canadian manufacturers have arrived at Kingston, Jamaica, for a visit which has as its object the fostering of trade between the two countries. They were given a hearty welcome by the delegation of business men who expressed the hope that a large portion of the trade with the United States would be diverted through the Dominion under the Preferential Tariff.

Wm. Kennedy & Sons, Owen Sound, are converting the tug Alexandra from a side wheeler to a single screw propellor for the Upper Ottawa Improvement Company. The boat has been and will be used for towing large rafts of logs. She is 150 feet long, 26 feet beam and 14 feet draft. The change calls for installation of propellor, rudder, stern frame, bearings, steering gear, and main shaft.

Rebuilding of furnaces and extensive additions to the plant of Pilkington Bros. at Thorold, Ont., are responsible for a temporary close down of the plant, according to a statement issued by J. E. Harrison the Canadian general manager of the company. Coupled with that statement, Mr. Harrison declared that he was looking forward to a revival of the building trade that would control to an extent the speed with which the alterations would be accomplished.

There is a fleet of fifty freighters in Midland harbor for the winter season and necessary repair work and overhauling is giving considerable work to such concerns as the Midland Engine Works, Midland Shipbuilding Co. and the Georgian Bay Shipbuilding and Wrecking Co. Three of the French freighters recently purchased for the Playfair interests are tied up here. Numerous tugs and other small craft are also being made ready for the approaching navigation season.

Interviews with heads of local industrial plants in Windsor, Ont., lead to the conviction that an industrial reawakening is imminent. The consensus of opinion among industrial leaders seems to be that the bottom of the depression has been sounded, and that better business will ensue immediately. This condition is attributed by the industrial leaders to a general decrease in the price of raw materials, and the fact that buyers are eager to take advantage of this circumstance, with the result that trade will be revived to a great extent.

The reductions in prices announced during the recent automobile show at Detroit, Mich., were important factors in bringing about the surprising rush of business which is rapidly swinging all the big factories into their full stride, reached before the usual boom. Managers point out that the full effect of the public interest has not been felt. Thanks to highway construction all over the country and particularly about big cities, urban orders have broken all records since early in December.

The Durant Motors of Canada turned out their first Canadian-made car at their Leaside plant on the morning of March 1st. Total production for the day amounted to ten cars, and it is expected that the output will be brought up to 50 cars daily within a few days. The Leaside plant, it is stated, is now equipped and ready for quantity production, and all of the cars to be absorbed by the Canadian market will be manufactured there. The present year's schedule calls for between 12,000 and 15,000 automobiles.

Canada Electric Castings, Limited, are building on the site of the foundry of Canada Electro Foundries, destroyed by fire, a two story foundry 250 ft. by 50 ft., for which they are using the steel frame and other material bought from the Baldwins when they dismantled the Collingwood Steel foundry. W. H. R. Burrows, the manager, states that he hopes to have his new plant in operation by the middle of April. He is specializing in steel castings, including grinding balls, for the mining and concrete industries. His equipment will include 2 electric, three phase furnaces of the Heroult type, with Volta attachments, giving him a daily capacity of 18 tons.

H. B. Peabody, vice-president of the Peabody Corporation, announces that his firm is planning a real industrial revival, and to this end, all former employes, who were laid off during the period of depression, are being offered employment. Mr. Peabody states that, within a short time, the staff at the Walkerville plant will be increased by 50 percent. The statement declares that, from the standpoint of the firm, business conditions in Eastern Canada are as favorable as they were in 1919, and that an increase in the price of wheat in the West will make a material difference in that section.

Electrical energy is the power of the present and is likely to become more important year by year in the life of the Canadian people. A writer in Pulp and Paper magazine stated lately that the investment in electrical development of Canadian water powers is already $475,000,000 and will be not less than a billion dollars by the year 1940, if the present rate of growth in installation continues. The power now utilized represents coal that would cost $148,000,000 yearly. By 1940 it would be necessary to burn 42,000,000 tons of coal yearly at a cost of $336,000,000 to provide the power this writer estimates will be produced from Canadian waterfalls.

Canada heads the list of countries from which the United States imported iron and steel during the year 1921, the report which has just been made public discloses. Importations from the leading countries during the year were: Canada 24,079 tons, Belgium 18,529 tons, Sweden 5,507 tons, China 4,610 tons, Germany 4,282 tons, United Kingdom 3,385 tons. Of the total importations from Canada 21,251 tons consisted of steel rails. Canada and Belgium furnished 65% of the total exports for the year.

A large contract has been signed which calls for 200,000 h. p. and has been made with the Shawinigan Power Co., by a United States group, presumed to be the Aldred group with which it already has a connection through its directory. The Shawinigan Co. is also reported to have secured control of the Southern Canada Power Co., which operates on the south shore of the St. Lawrence River and it is believed that the transmission privileges of this company will be used for the transfer of the new power when developed to the border.

Toronto recently had a Made-in-Canada exhibition of goods with a view to stimulating the use of Canadian products and now one is to be held early in March in Montreal at Almy's Limited. It is the first of its kind ever promoted in Montreal and the seven spacious floors of the department store with an area of 300,000 sq. ft. will be fully occupied by the exhibits. Approximately 225 Canadian manufacturers will have their handicraft on display and every phase of Canadian industry from the products of the tiniest loom to the output of the largest factory will be represented.

It was announced at the inaugural meeting of the 1922 Board of the Canadian National Exhibition, Toronto, that still another new building is in prospect for the grounds. The textile interests are the latest industry to favor the segregation principle and to take up the question of separate housing for their exhibits. For some time past the machinery manufacturers have been negotiating for a building under the same terms as the pure food interest, to exhibitors to contract for space for a period of ten years or more at a figure to care for all interest, reserve funds and maintenance charges.

Electro-Castings, Limited, Collingwood, expect to have their foundry ready for operations early in April. W. T. Stephens, manager, is supervising the installation of a two-ton electric furnace of his own design. It will have a capacity of 12 heats in twenty-four hours. Production along general and special lines, will be in grey iron, hard iron and semi-steel. Mr. Stephens has had experience with electric furnaces. He was formerly with the Canada Electric Castings, Limited, Orillia, and operated a foundry for Wm. Kennedy & Sons, Owen Sound, in the building now occupied by the new company. He is assured of an abundance of power, and given that he declares the prospect to be very encouraging.

An announcement has been made by the St. Thomas Chamber of Commerce officials that the Wood Gorrie Motors, a newly incorporated company formed for the manufacture of the Warwick automobile has selected St. Thomas for the location of its plant and has engaged temporary assembly quarters in a section of the factory building occupied by the St. Thomas Boxes, Limited. At the outset the plans will be an assembling concern only using standard automobile parts.

Figures for the first two weeks of January show a marked increase in employment throughout the Dominion, in comparison with the similar period a year ago. Returns received by the employment service men to the Department of Labor from 5,800 firms with a total payroll of 641,146 persons, show that increases in staff gave employment to approximately 19,000 additional workers. This indicates partial recovery from the heavy declines registered at the end of the old year and is a marked increase over that recorded in the early part of January, 1921.

Oddfellows of the Border Cities are formulating plans to erect a $250,000 temple on Ouellette avenue, Windsor, the main street of the city. The lodge already has a temple in Windsor, but it has become inadequate for the needs of the Order, so a stock-selling campaign for the proposed new building, which will be erected early next year, will be started immediately. The temple will be built on a lot which has been owned by the Order for some years. Alderman Sam Keyser, a prominent local building contractor, is president of the organization promoting the project.

The Collingwood Shipbuilding Co., are operating at present with a force of 300 men, which will shortly be increased to 500. In addition to the construction of a sand-sucker, described elsewhere, repairs are being made on the Matthews freighters, Glencadam, and the Easton. The Str. Winona of the Canada Steamships line is also being repaired and the lighthouse and buoy ship, Grenville, department of Marine and Fisheries, is being overhauled. In the Kingston yards the Str. Keyball is having her bottom repaired. Several other ships are to be docked as soon as navigation opens for slight repairs.

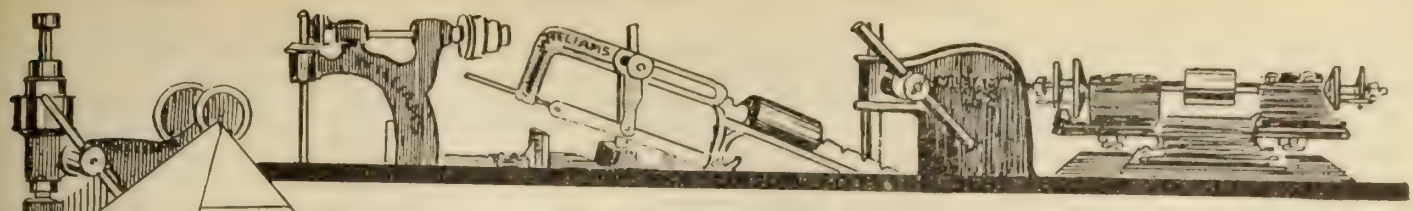
William H. Randall, now managing director of the Neptune Meter Co., Toronto, returned home recently after a trip to New York, where he placed orders for some special machinery with the object of extending the company's plant at 1197 King St., W., Toronto. For the past two years practically all of the company's standard makes of meters of the sizes that are usually in demand by Canadian municipalities have been manufactured in Toronto, but the large meter and all special types have been imported from the Neptune Meter Company's plant in the United States. The object of the proposed extension is to enable the Canadian company to make practically all sizes and types for which there is likely to be any demand in Canada.

The new building planned by Ontario Hydro Electric Commission on University Avenue, Toronto, will cost approximately $500,000 and will involve about 450 tons of steel. It is understood that the Robert Redford Co. is considering the erection of an office building near Bay and Wellington Sts. This building erection is under contemplation but a definite decision is not expected for several weeks at least. The highways department of the Ontario Department of Public Works is proceeding with some bridge construction. A larger programme of bridge construction is understood to be under consideration.

The Midland Engine Works, manufacturers of steering engines and gasoline marine motors, are adding to their line a marine motor of the Scripps type. For the present, they will build them in four cylinder size, 25 to 40 horse power adaptable to cruiser types of boat from 35 to 40 feet or for speed boats 20 to 25 feet length. J. Bruce Hanly, the manager, who is an authority on motor and water boat construction, states that for a wide range of purposes this type of engine appears to him as one of the most uniform in his experience. In time he hopes to develop three sizes, two, four and six cylinder. His plans are to have 25 ready for the early summer demand.

The Georgian Bay Shipbuilding and Wrecking Co., Midland, are building for the Sauble Spanish River Boom Co., a wooden tug 70 feet in length and 15 feet beam with Heeple compound engine 10 in. x 20 in. x 14 in. stroke. This company is also converting into a floating dry dock for their own use the old wooden freighter Major. To do this they are cutting off the bow and installing a gate which may be raised or lowered as required and fitted with valves for flooding purposes. This drydock when completed will accommodate a vessel 200 feet in length and 33 feet beam. Mr. Dobson expects to have it ready for operation by the opening of navigation.

The annual report of the J. G. Brill Co., which has just been issued to the stockholders indicated that this well known manufacturing concern has now become well entrenched in its Canadian position. It was only last September that they took over the Preston Car Works, and H. D. Scully, the general manager of the Canadian Brill Co., states that in extending and improving the plant at Preston, Ont., where between 50 and 60 hands were being employed last summer, there are now 250 employees engaged and the payroll amounts to $5,000 a week and a car is being turned out every working day. Deliveries of street cars have been made in recent months to many of the outstanding cities in the Dominion. They are reported as having stated: "As a result of our experience in Canada it is our present intention to remain there permanently, and officers of the company are now investigating several sites in Toronto and elsewhere in Ontario, which would be suitable for new and larger car shops."



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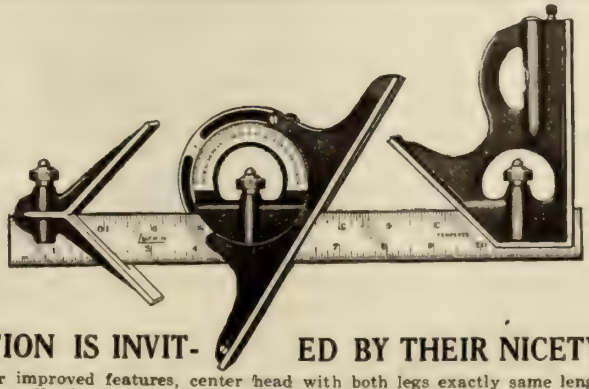
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A value of $92,490,000 was represented in the production of cotton textile goods in Canada during 1920 according to a report just issued by the Dominion Bureau of Statistics. The total capital invested in the industry was placed at $76,431,000.

A British Syndicate proposes the establishment of a woollen mill in the city of Victoria, B. C. says Reuter Dispatch. The company state that it is their intention to specialize in worsted materials of the highest quality and carry through the entire process from cleaning and preparing the raw wool to the production of finer grades of worsted suitings.

"Canada is coming to the front as an industrial country and in due time will make a bid for the trade of the world," stated John S. McKinnon, past president of the Canadian Manufacturers' Association, in an address before the Canadian Club, New York City, on February 26th. He further stated that as a manufacturing country, Canada was making solid progress. She was sending out manufactured goods today which before the war had been considered could not be made in Canada. The export trade of the Dominion and its relation to the United States was such that what Canada bought from the United States represented $95.00 per capita of the population, while what the United States bought from Canada represented $5.00 per head of the population.

IMPROVEMENT WILL BE STEADY AND GRADUAL

Commenting on his recent trip to England, Mr. Ford-Smith, of the Ford-Smith Machine Co., Hamilton, Ont., told Canadian Machinery that conditions in engineering circles were far from bright in England at the present time. He mentioned that in many cases, plants usually working overtime, were shut down, and that other factories were hit in like proportion.

Mr. Ford-Smith did not paint an altogether blue picture, however, for he mentioned that things were bound to right themselves and England would once more be supreme in trade. He felt nevertheless that there was a danger of over-optimism, which later might lead to disappointment. He is thoroughly convinced that any improvement will be gradual and not spectacular, and that it will be some time yet before the machine tool business becomes normal. He mentioned that he had great faith in Canada's future, and that any firm having a good reserve need not worry about what is ahead.

It is only a mttter of time, in Mr. Ford-Smith's opinion, before the real buying will once more open up. "From then on the improvement should be steady," he concluded.

Trade between Canada and China is constantly expanding, and the general trade outlook in Canada is much improved over that of one year ago, according to Canadian Trade Commissioner, J. W. Ross of Shanghai. He states that Canadian timber is constantly being placed upon the markets of China, while Canadian flour and other food products are in good demand, as are an extensive list of manufactured articles.

NEW MACHINE SHOP OPENED IN GALT

A NEW shop has opened in Galt, Ont., under the name of "Smith's Machine Shop." The owner, Cecil H. Smith, is an example of what sticking to the task in hand will accomplish. He served his apprenticeship with the Waterous Engine Works, Brantford, spending three of his four years there in the tool room. After serving his time, he went to Goold Shapley & Muir of the same city, and remained in their tool room for another nine months.

St. Thomas next appealed to Mr. Smith, and he spent two years in the railroad shops up there, three months in the Michigan Central shops, and two years in the tool room of the Pere Marirquette.

While there he took out a draftsman's course with a correspondence school, then after leaving St. Thomas returned to the same work he had left in the Goold Shapley & Muir plant in Brantford. He remained there another year and a half, in the meantime attending drawing classes in his spare time.

In July, 1911, he went to Galt to take charge of Goldie & McCullough's tool room, holding this position up to the decision to start business for himself. While in charge of the above mentioned tool room, Mr. Smith designed many jigs and tools, many of which Canadian Machinery viewed while on a recent visit to that plant. During the war Mr. Smith designed numerous shell tools, looking after making and maintenance as well.

In his newly opened shop, at 34-36 Ainslie St., Galt, Mr. Smith intends to handle machine shop work of all kinds, and will make jigs, tools, fixtures, etc., or special machinery to order. He has always had the aim in mind to own a plant for himself, and by persistent plugging has now reached his ambition.

MEN OF NORTH VISIT TORONTO

NORTHERN Ontario was well represented last Friday at the Government House, Toronto, when His Hon. Lieutenant-Governor Cockshutt, entertained the men from the North. About thirty-eight municipalities were represented, these including Kenora, Fort Frances, Cochrane, Timmins, Englehart, Haileybury, South Porcupine, Cobalt, North Bay, New Liskeard, Sudbury, Sault Ste. Marie, Port Arthur, Fort William, and other localities. His Honor and Mrs. Cockshutt received.

After luncheon, Premier Drury made a short address, dwelling on the pioneer work being done by those in Northern Ontario. He emphasized the fact that to get the greatest good out of the work now being done, the North and South sections of Ontario must work in close harmony. He dwelt on the need for eliminating waste, and reforestation, also the importance of education and good roads.

Hon. Mr. Mills spoke briefly of the mining situation in the North, calling attention to the rich mineral resources of the country. Hon. Mr. Bowman also dwelt on the development work going on in the North, this being followed by speeches from Lieut.-Col. Little of Port Arthur, and Mayor Le Henp of Haileybury. Lieut.-Col. Little assured His Honor that they appreciated his bringing them all together and in a neat reply, Lieutenant-Governor Cockshutt told them how he in turn was pleased to have them down at the Government House to show them he was just the same as when in Brantford. He displayed a keen interest in their work and felt they had much to be proud of in the development which had already taken place.

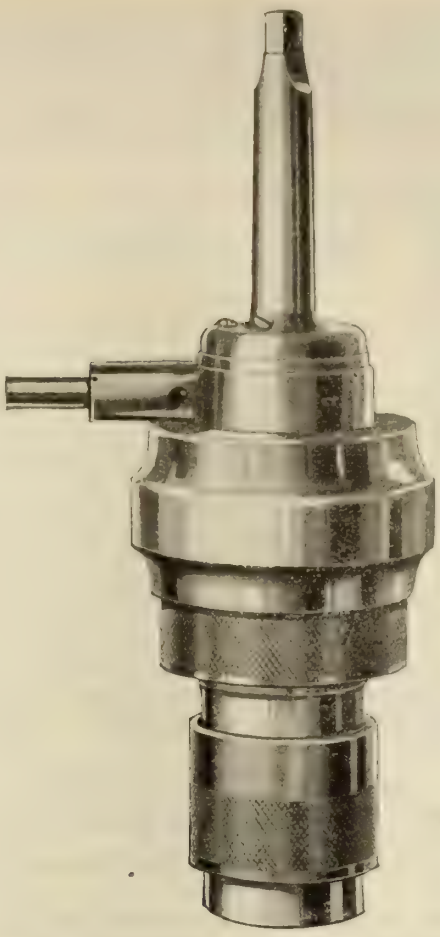
WILL WORK FOR STANDARDIZATION

Standardization of industry will be the main topic at the five day meeting of the American Society of Mechanical Engineers at Atlanta, Ga,. beginning May 8. E. C. Peck of Cleveland, chairman of the standardization committee of the society, says that billions can be saved by industry by a comprehensive program of standardization. He points to Germany as the most effective instance of standardization, and said that the movement began years ago.

"Germany is making amazing propress," Mr. Peck said in the way of warning to manufacturers. "She is using standardization of industry as a link in a chain of industrial processes by which she aims once more to be a power in world trade, and she is building up an unprecedented industrial structure which must rest in a large measure on an intensive foreign trade. In no other country except Great Britain is standardization work being carried on upon such a scale or with the intensity found in Germany," concluded Mr. Peck.

Following a meeting of line employes held in the Hydro sub-station at Windsor recently, an energetic organization for the promotion of safety among the workmen was formed. About 50 employes were present at the meeting, which was addressed by G. A. Keuchenmeister, secretary of the Border Cities Safety Council. Mr. Keuchenmeister pointed out that safety work could most efficiently be done by the individual employes, rather than by the employer, and appealed to the men to form habits of safety. Fred D. Hubble, line superintendent of the Hydro, was also a speaker. The men are planning to elect their officers soon, and it is also planned to have Willis McLachlan, secretary of the Electrical Employers' Safety Association, address the new organization during March.

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Then Compare the Steady Saving When Using a Jarvis High Speed Tapping Device with Quick Change Chuck.

With the ordinary equipment, the machine must be repeatedly brought to full stop in shifting tools, where there are a number of different operations in a radial drill or heavy duty drilling machine.

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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

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SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

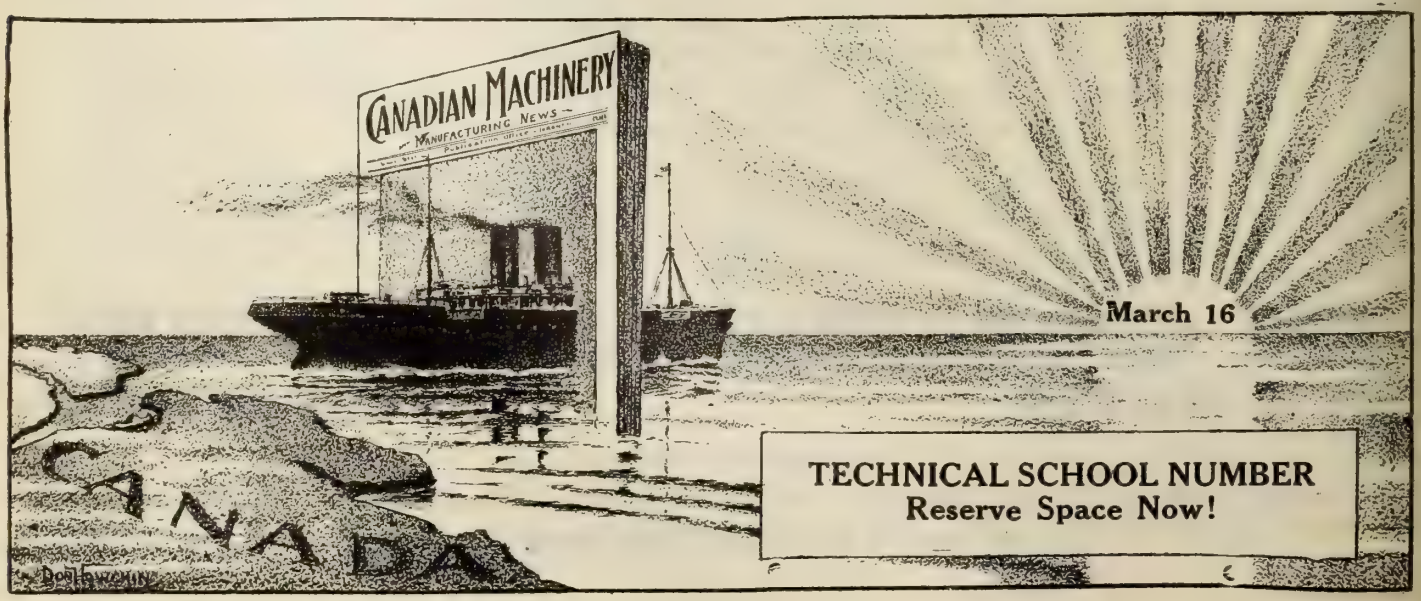
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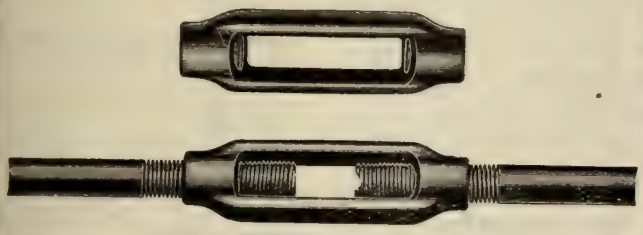
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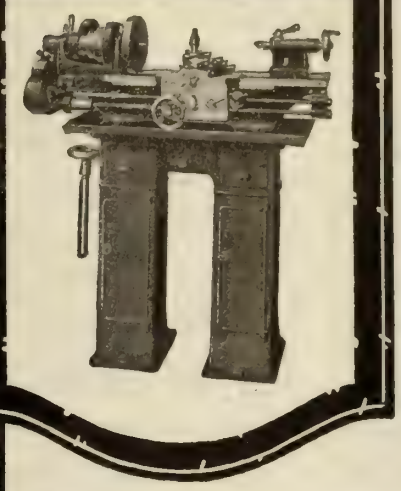


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Liquide Air Company, Toronto.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Attachments, Tapping
William I. Procunier, Chicago, Ill.

Axles, Car
Beardmore & Co., Ltd., Wm., Montreal, Que.

Babbitt Metal
Canada Metal Co., Ltd., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Bake Ovens
Brantford Oven & Rack Co. Brantford, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pilot Steel & Tool Co., Montreal, Que.
Railway Roller Bearing Co., Syracuse, N.Y.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Aikenhead Hardware Ltd., Toronto, Ont.
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Fittings, Ltd., Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd, Montreal, Que.

Belting, Fabric
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E., Eng.

Bench Countershaft Standards
Ford-Smith Machine Co., Hamilton, Ont

Benches, Work
Aikenhead Hardware Ltd., Toronto, Ont.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Ltd., Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach. Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Fittings Ltd., Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que.

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Grey Iron
Fittings Ltd., Oshawa, Ont.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BUYERS' DIRECTORY

Castings, Semi-Steel
Hull Iron & Steel Foundries, Hull, Que.
Katie Foundry Co., Galt, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Steel
Beardmore & Co., Ltd., Wm., Montreal, Que.
Can. Steel Foundries, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Chains (See Sprockets and Chains)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Aikenhead Hardware Ltd., Toronto, Ont.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Prybil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks,
Chicago Watchman's Clock Co., Chicago, Ill.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont

Collets
Butterfield & Co., Inc., Rock Island, Que
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Ford-Smith Machine Co., Hamilton, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Can. Mathews Gravity Carrier Co., Port Hope, Ont.
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Aikenhead Hardware Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Ltd., Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co. Montreal, Que

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electric Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bort
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Desmond-Stephan Co., Hamilton,
Ford-Smith Machine Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que. Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Banfield & Sons, Ltd., W. H., Toronto.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut Ohio
Ford Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machines, Bench
Burke Machine Tool Co., Conneau Ohio
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drill Press Sleeves.

BUYERS' DIRECTORY

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal, Q.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd. W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Handey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Corp'n, Sound Beach, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng.
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Belt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.
Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont.

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston Mass
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.

BUYERS' DIRECTORY

Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Tune
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rebuster Co., F. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can Fairbanks-Morse Ltd., Montreal Q.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

BUYERS' DIRECTORY

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Barnes Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Alkenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwartz, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres,
Beardmore & Co., Ltd., Wm., Mon

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd. Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton,

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto
L' Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Davis-Bournonville Co., Jersey City, N.J.
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Supplies
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wiping Cloths
The Levi's, Toronto, Ont.

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire Coiling Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co Montreal, Que.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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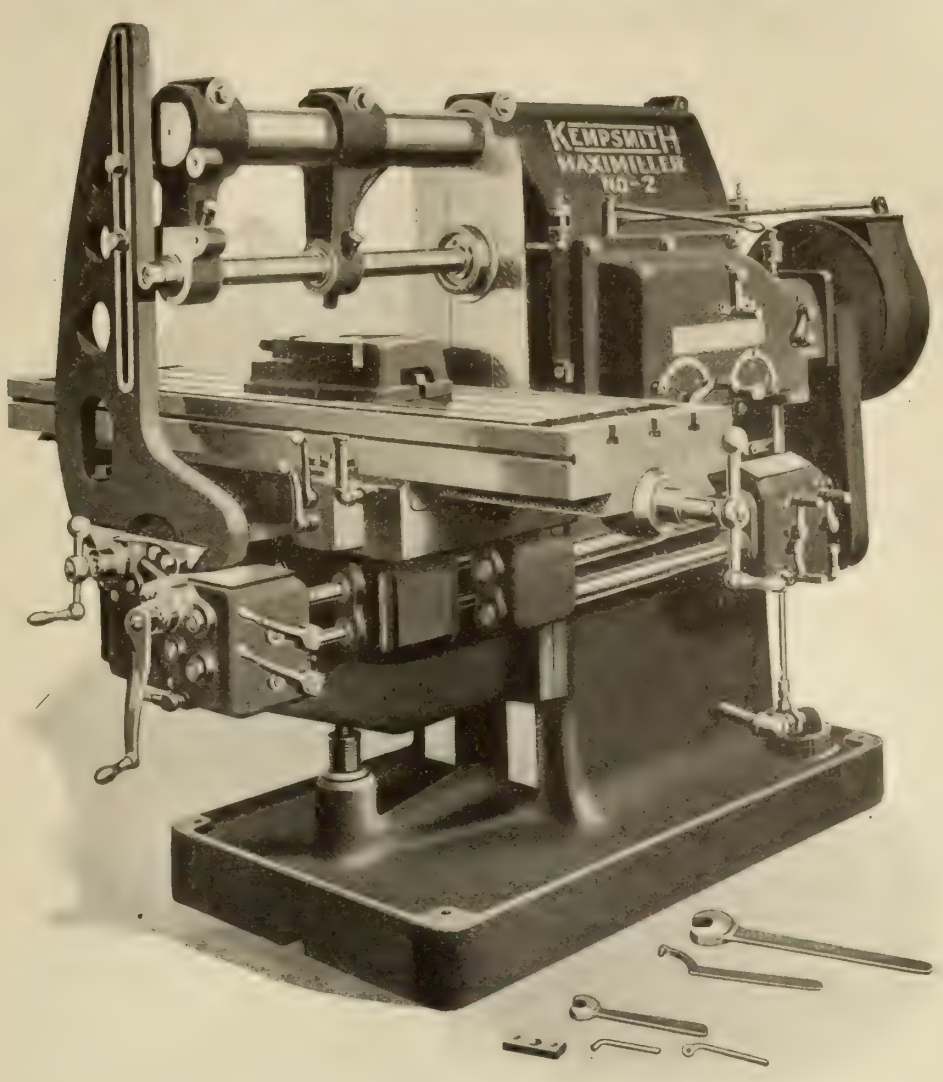
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BRITISH-AMERICAN FUEL & METALS LIMITED
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KEMPSMITH



NO. 2 PLAIN MAXIMILLER

Kempsmith Millers are built in three sizes each in the Plain and Universal Cone Types, two sizes of Maximiller Geared Head Types, a Production Type, with a choice of three table ranges, and two sizes of Vertical Geared Head Type. Our Knee Type Millers can be fitted with a complete line of attachments, which greatly increase the range of the milling machine.

Literature will be gladly sent upon request.

THE KEMPSMITH MANUFACTURING CO.

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CANADIAN DEALERS:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

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Reliable Belting

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CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVII. No. 11 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | March 16, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Laboratory Accuracy at a Toolroom Price

A TRIAL of Hoke Gages under your own conditions will convince you that our claims for these blocks are justified. You take no risk—the Pratt & Whitney guarantee is broad enough to assure satisfaction. The price permits the use of Hoke Blocks in everyday toolroom work. A reference set laid away in the safe is not earning for you what it should.



Using a stack of Hoke Gages for checking profile on a Maag Gear Cutter.

The Story of Hoke Gages—
A Booklet that will Interest You

THIS interesting catalogue will be sent on request to Manufacturers, Superintendents, Engineers, Inspectors, Tool or Production Foremen, and others who want to KNOW. It contains information covering — Gage Blocks, Registered and Identified; Means of Identification; Guaranteed Reliability; Advantages of Square Design; Reason for the "Hole"; Various Combination Sets; Attachments and How to Use Them; Some Everyday Applications—Testing Tapers, Scribing Lay-outs, Checking Profiles, etc.; Toolmaker's Flats; Mikechecks; Swedish Type Gages.

Details, prices—all the information you want—Are yours for the asking.

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P & W

Pratt & Whitney Taps

"With the 'Con-eccentric' Land"

P & W Taps are **Good** taps—easily the best where accuracy and high speed are essential. They cost more to buy, but less to use than others.

If you're doing work that calls for big production and for unusual precision, give them a trial. You'll be back for more when you see them prove themselves.

The "con-eccentric" land — the special feature of Pratt & Whitney Taps, permits sharpening on face of the cutting edge without affecting size. It lengthens life and assures accuracy hitherto thought impossible in a commercial tool.

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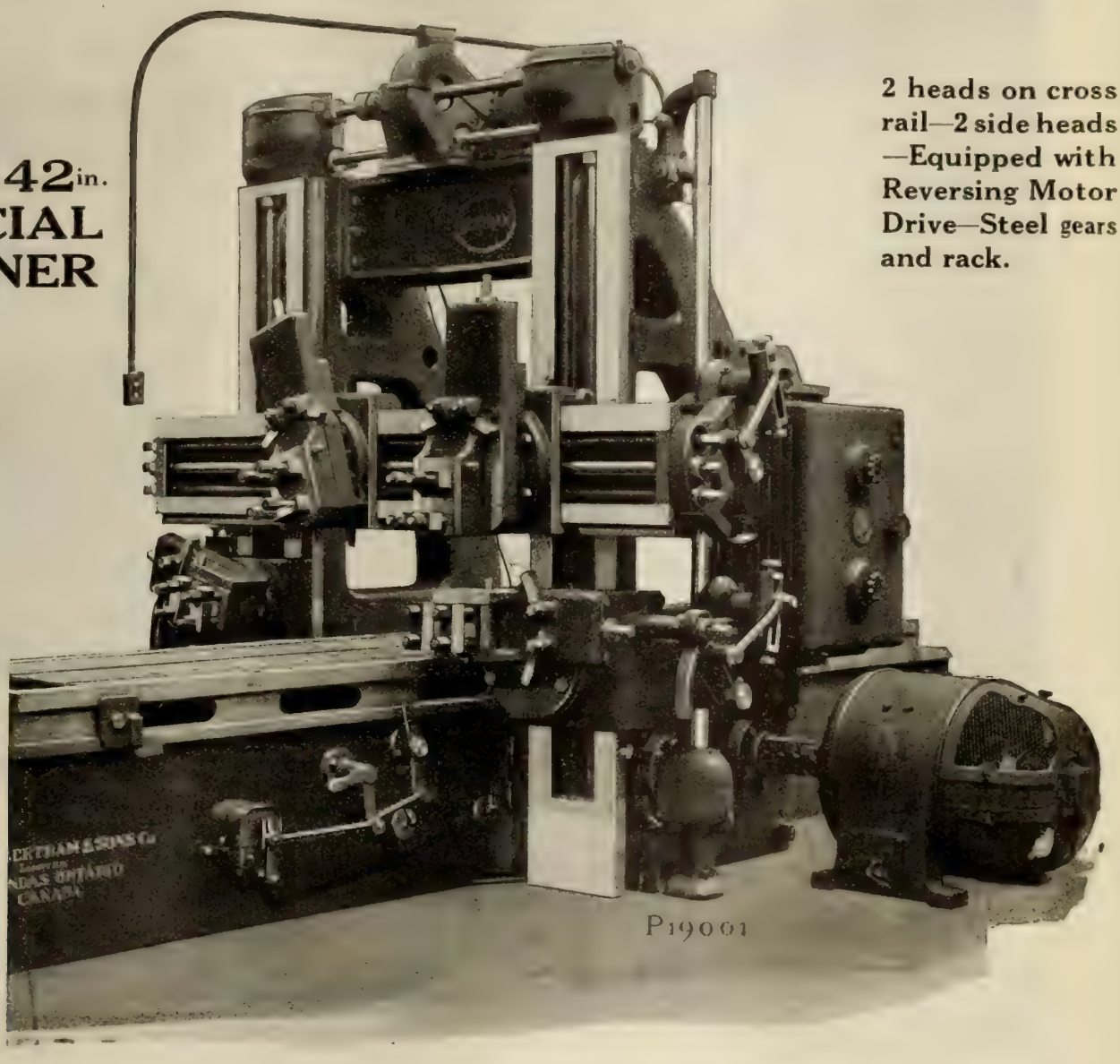
WALKERVILLE, 103½ Sandwich Street

The BERTRAM MACHINE TOOLS Page

J.B.&S.CO

42in. X 42in. SPECIAL PLANER

2 heads on cross rail—2 side heads —Equipped with Reversing Motor Drive—Steel gears and rack.

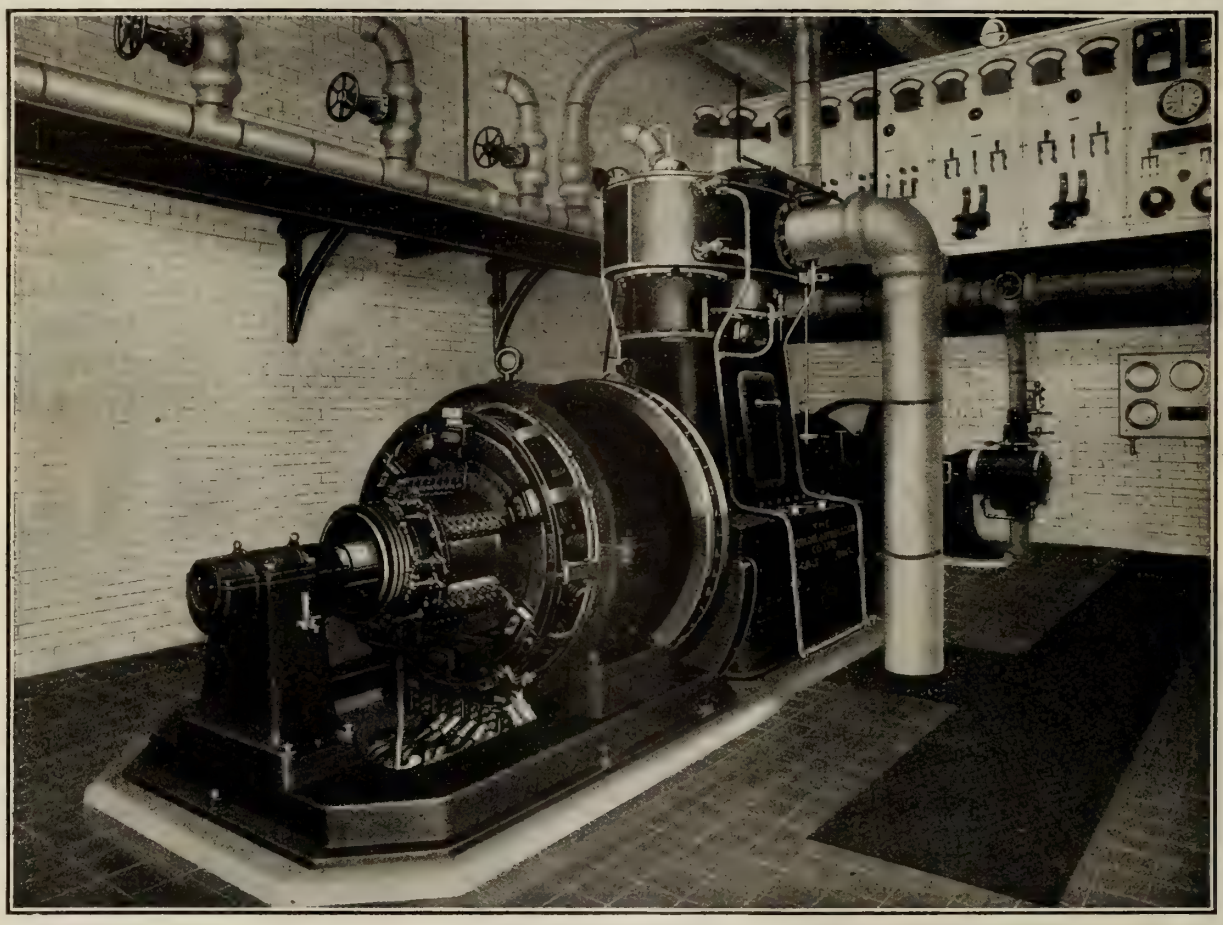


The John Bertram & Sons Co., Limited

DUNDAS. ONTARIO. CANADA.

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DEPENDABLE POWER EQUIPMENT



SHOWING A G. & McC. 2-CYLINDER COMPOUND ENGINE DIRECT CONNECTED TO A 250 K.W. ELECTRIC GENERATOR

At The Central Technical School, Toronto

An engine similar in type to the above is being installed in the new Technical School in the course of erection at Windsor, Ont. It is a 2-cylinder compound, 11″ and 17″ x 8″, 500 R.P.M., direct connected to a 90 K.V.A. 220 Volt generator. The Montreal Technical School has a G. & McC. installation consisting of a simple, heavy-duty Goldie Corliss Engine, 11″ x 30″, direct connected to a 90 K.W. generator, 150 revolutions per minute. At the Toronto University a G. & McC. installation consists of a three quarter million-gallon Rees RoTurbo Pump.

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DEPENDABLE POWER EQUIPMENT



Installation shows two double-drum G. & McC. Sectional Water-Tube Boilers at the Amcs-Holden Tire Company's plant, Kitchener, Ontario.

G. & McC. Installation, Parliament Buildings, Ottawa

SHOWING FOUR DOUBLE DRUM SECTIONAL WATER TUBE BOILERS IN CENTRAL HEATING PLANT

At the new Calgary Technical School a G. & McC. installation consists of two 250 horse-power boilers of the same type as illustrated.

G. & McC. equipment is built to meet the demand of legislative buildings, technical schools, colleges and all other large buildings and institutions. Nothing but the best material and workmanship are used in the construction of G. & McC. equipment.

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SULPHATE OF AMMONIA

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SLABS

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OPEN HEARTH ALLOY STEELS

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CHROME-NICKEL
NICKEL

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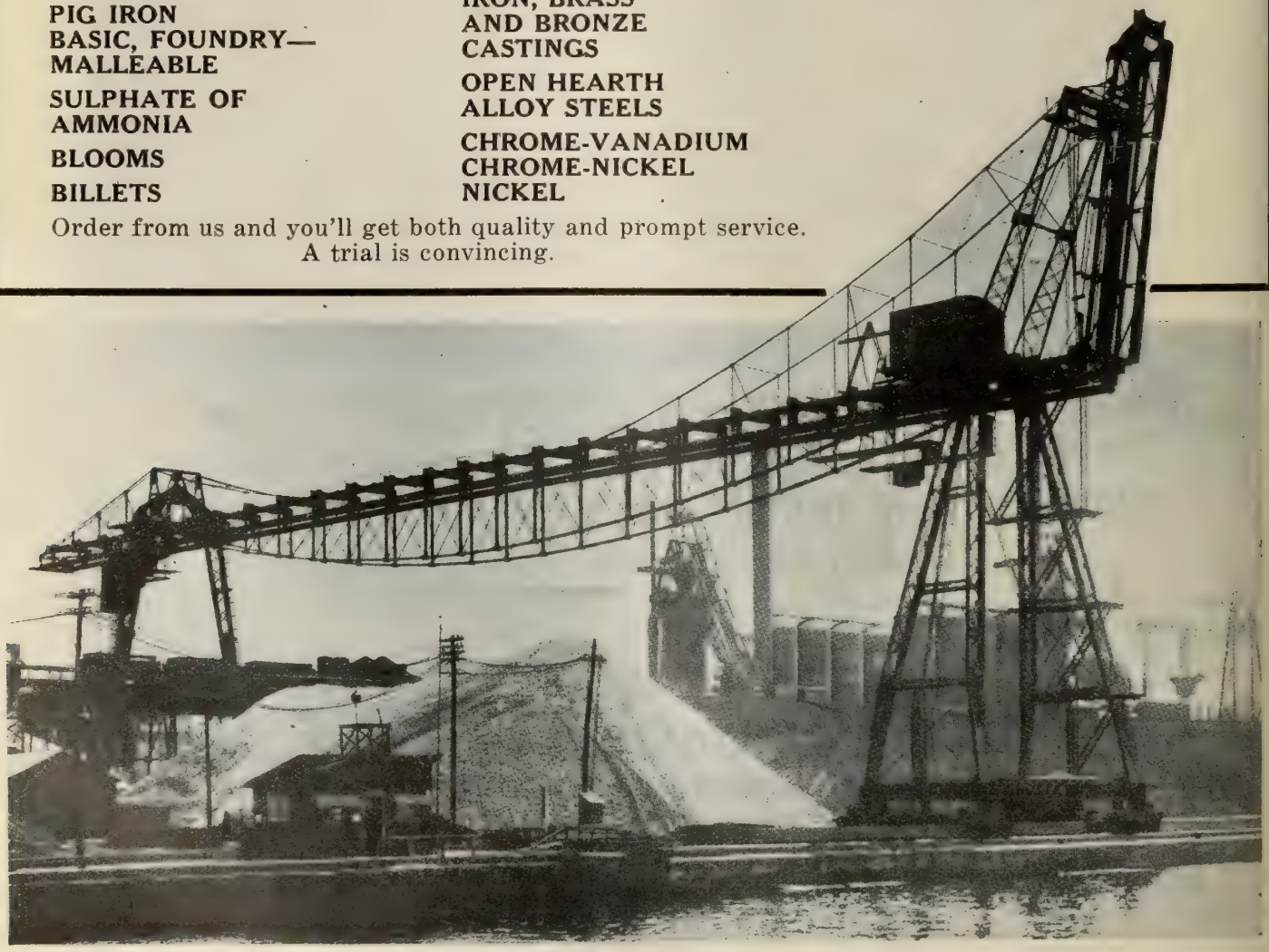
HOT ROLLED BARS

We also furnish in

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SULPHURIC ACID
NITRE CAKE

Order from us and you'll get both quality and prompt service.
A trial is convincing.

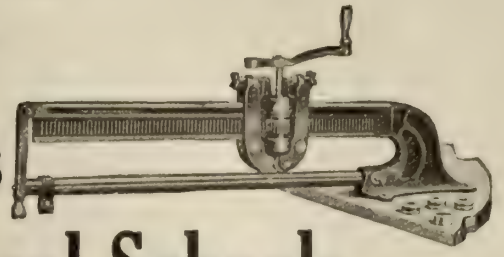


BROWN-BOGGS

B B

Modern Educational Methods
Favor These

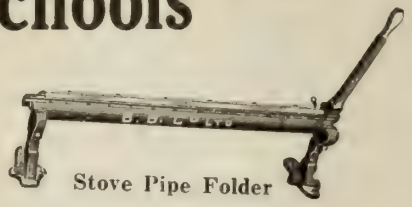
Sheet Metal Tools For Technical Schools



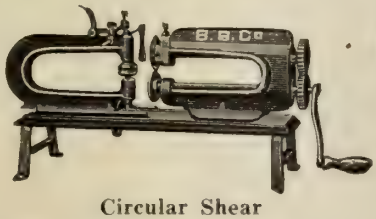


Forming Rolls





Stove Pipe Folder



Circular Shear





8-ft Steel Brake

It is only fair to Technical School students themselves and to the firms who will subsequently employ them that all instruction in Sheet Metal practice be aided by the use of "B-B" Equipment.

"B-B" Sheet Metal and Tinsmiths' Tools are the product of the oldest and largest manufacturer of this equipment in Canada. Consequently the student will find more "B-B" tools in general, satisfactory use than any other.

"B-B" Sheet Metal Equipment includes Bench and Floor tools for almost every purpose. All are fully guaranteed. Why not have us send catalogue No. 25?

Toronto Office: Holbrook Building

A. B. WALKER, Representative

THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.



A battery of 12 "Preston" Woodworking Lathes as installed at the Central Technical School, Toronto

PRES

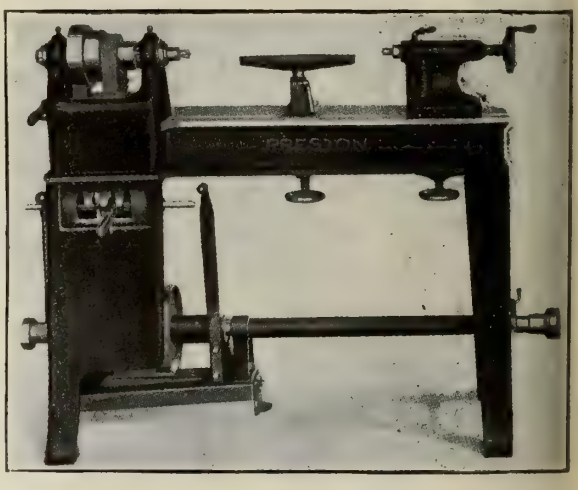
Preston Woodworking Equipment is recognized as the proper equipment for Technical Schools of Canada. This is evidenced by the fact that Preston Equipment is installed in the Technical Schools of Toronto, Hamilton, Ottawa, Niagara Falls, Windsor, Chatham, Woodstock, Sudbury, Fort William, Prince Rupert, B. C., Chilliwac, B. C., and London, Ont. The Institute for the Blind at Belleville and different Soldiers' Civil Re-establishment Schools are also users of Preston Equipment. Note the illustrations on these two pages, showing Technical School Installations.

These machines are standard equipment for technical schools and have been installed in these institutions all over Canada.

To appreciate better the superior construction of these machines you should send for complete description.



Another battery of "Preston" Lathes and Preston Double Arbor Grinders as installed in the Central Technical School, Toronto



"Preston" Manual Training Speed Lathe, used in Technical Schools of Canada

The Preston Woodworking

PRESTON, ONT.

TON

Standard Woodworking TOOLS for TECHNICAL SCHOOLS



"Preston" Motor Driven Ball bearing Buzz Planer and Jointer, as installed at the Central Technical School, Toronto.

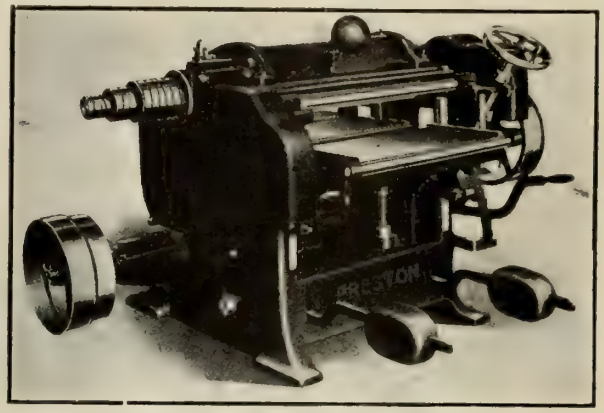
Following is a list of Preston Machines in the Central Technical School, Toronto:

- 23 Manual Training Lathes
- 3 Band Saws
- 3 Saw Tables
- 2 Buzz Planers and Jointers
- 1 Ball Bearing Shaper
- 1 Sander
- 1 Power-Feed Saw
- 1 Roller-Top Saw Table

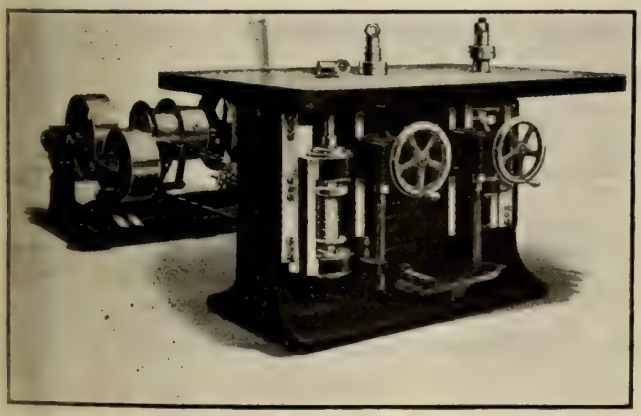
All these machines have ball bearings and individual motor drive.



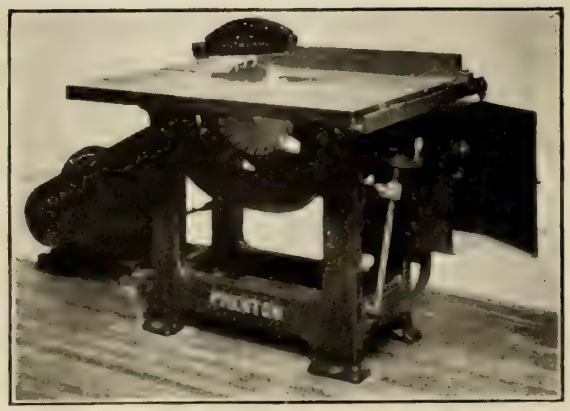
"Preston" 36-inch Ball Bearing Band Saw as installed at the Central Technical School, Toronto.



"Preston" Pony Planer of improved design, as now installed in various technical schools.



"Preston" High Speed Ball Bearing Shaper as installed in Toronto, and a number of other Canadian Technical Schools.



"Preston" Motor Driven Saw Table as installed at Central Technical School, Toronto.

Machinery Company, Limited

CANADA

THE JOHNSON FRICTION CLUTCH

Friction Clutches From Stock

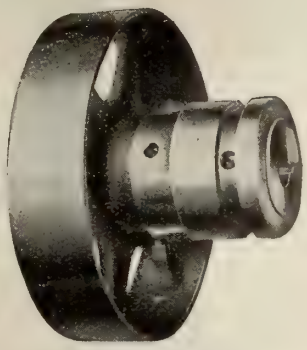
Johnson Clutches, both single and double, can now be obtained from stock in our standard slow speed type to fit all common shaft diameters and all standard pulley bores, within the range of light and medium horse powers that we cover.

State definitely —

Just what the clutch must drive.
Actual maximum horse power.
Speed of clutch shaft.
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Diameter, width and bore of pulley.

We Will Select the Proper Clutch and Make Immediate Shipment on All Ordinary Requirements.

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Write for our stock list and Yellow Catalogue

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GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING and DRILLING MACHINES
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

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DUNLOP



Means Transmission Belt Supremacy

Note the Long Grain Rubber Friction

Dunlop "Gibraltar Red Special" has a friction of Special Dunlop Rubber that retains its life indefinitely.

"Note the Long Grain Rubber Friction," as illustrated.

Elasticity has not been sacrificed for abnormal friction pull.

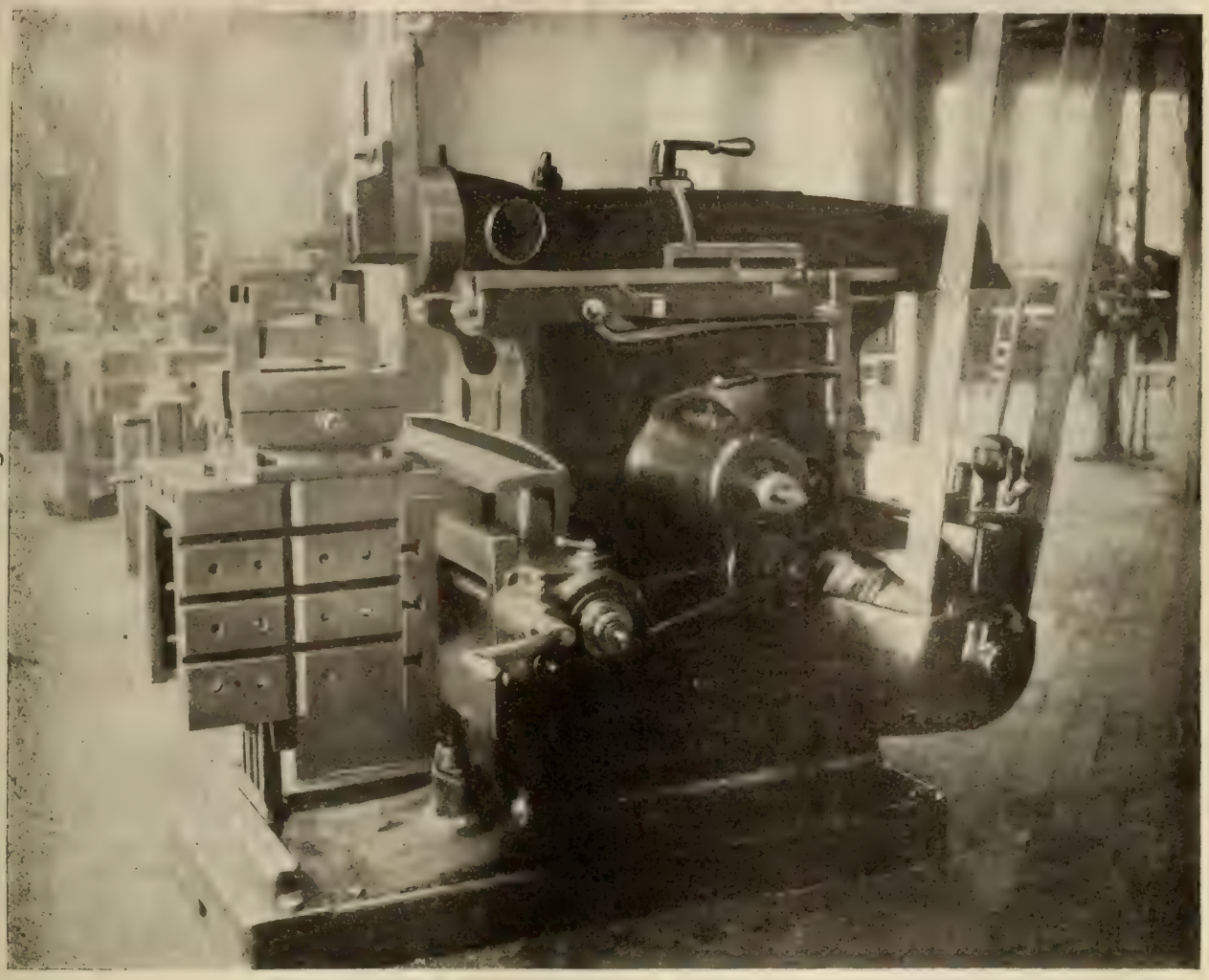
Also makers of high-grade Conveyor and Elevator Belts, Packing, Hose, etc.

Dunlop Tire & Rubber Goods Co., Ltd.

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Branches in the Leading Cities

HENDEY



Gives Excellent Tool Room Service

Hendey Crank Shapers and Hendey Lathes are of great value for general tool room service. The adaptability of both machines is truly remarkable.

This installation, in the plant of the Waterbury Buckle Company gives an excellent idea of the convenience of the Hendey 20-in. Crank Shaft. The machine is planing off the bottom of a cast iron die bed.

Bear the reputation of the Hendey in mind when considering additional shapers or lathes.

The Hendey Machine Co., Torrington, Conn., U.S.A.

Canadian Agents:

A. R. Williams Machinery Co., Toronto.

A. R. Williams Machinery Co., 269 Princess St., Winnipeg.

Williams & Wilson, Montreal.

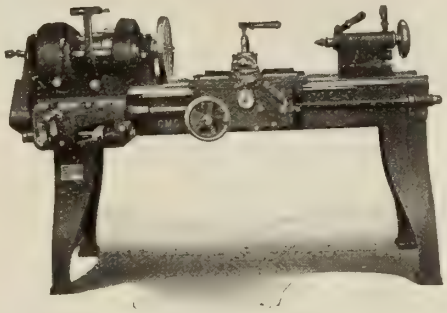
A. R. Williams Machinery Co., Vancouver.

A. R. Williams Machinery Co., St. John, N. B.

Ideal Technical School

C.M.C. MACHINE TOOLS and

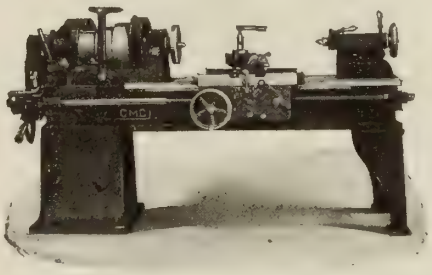
Start the student on C.M.C. Manual Training Machines. Up to date tools will help to make him a fine workman, and when he graduates, he will find more of them in operation than any other make. They are good to learn on and good to work on.



14″ x 6′ Toolroom Lathe
(Quick Change)

14 inch Tool Room Lathe

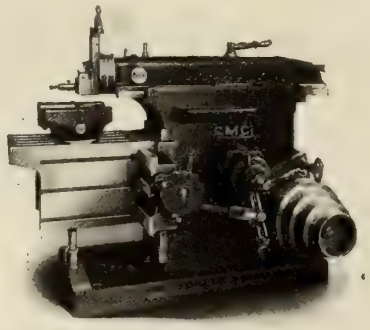
This is the Lathe that was originally designed and built for one Technical School which installed sixteen of them. It is very compact but is capable of a great variety of work. Notice the "back gears" are placed in front of the headstock.



16″ x 6′ Quick Change Gear
Engine Lathe

Engine Lathes—*Quick Change*

Accuracy, strength and convenience are outstanding features of this Lathe. Changes of belt or gears are within the operator's reach, and a special belt shifter safeguards the Student from danger in shifting the belt.



20″ x 22″ Crank Shaper

20 inch Crank Shaper

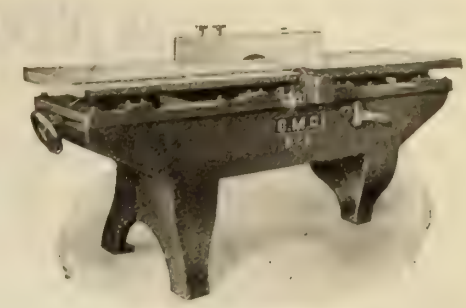
A tool especially adapted for Technical Instruction. The operator can change the length of the stroke, the position of the ram, the cutting speed, the rate and direction of the feed, and operate the down feed to head without moving from his position or stopping the machine, and without endangering himself in any way.

CANADA MACHINERY CORPORATION, GALT, ONTARIO
LIMITED

Toronto Sales Office : 721 Bank of Hamilton Bldg.

Equipment

WOODWORKING EQUIPMENT



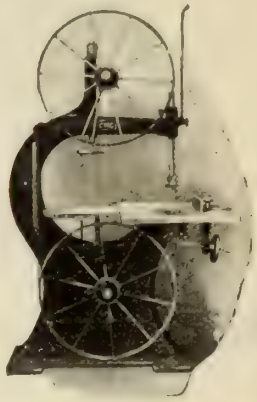
No. 823—16″ Buzz Planer

Buzz Planers, 8-24 in. wide

It is simple to operate, is accurate and strongly built. Round Safety Cylinder and guard is regularly supplied to protect the student from many of the dangers of jointer operation. Equipped with ball bearings when desired.

No. 714 36-in. Band Saw

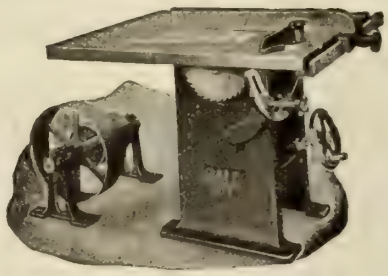
Demonstrated to be a leader among Band Saws. Equipped with well-balanced steel spoke wheels and special tilting device. Hand feed re-sawing attachment and ball bearings supplied when required.



No. 714—36″ Band Saw

No. 617 Variety Saw

A popular saw for manual training work as well as for woodworking plants. Will rip, cross cut and dado, cut mitres and bevels, and when equipped with a foot treadle boring and mortising attachment, it makes a very compact and complete unit.

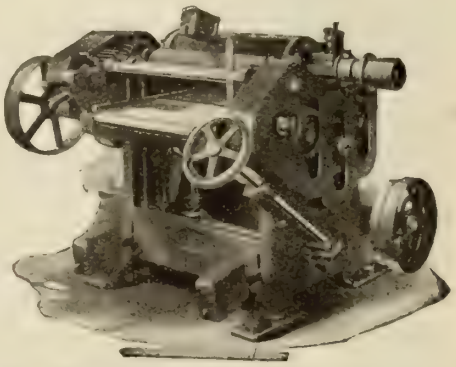


No. 617—Variety Saw

No. 221 24-in. x 8 Heavy Pony Planer

A Surfacer that is capable of doing rough dressing and also the finest panel work. Especially suitable for Manual Training Departments. Its design lends itself to a very efficient and compact motor drive.

Full particulars of any of these machines will be gladly furnished on request.



No. 221—24″ x 8″ Heavy Pony Planer

CANADA MACHINERY CORPORATION, GALT, ONTARIO

LIMITED

Toronto Sales Office: 721 Bank of Hamilton Bldg.

ANNOUNCEMENT

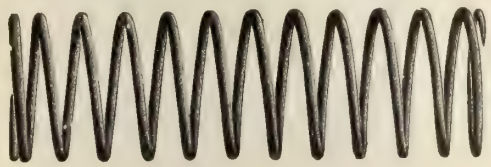
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are prepared to supply to the trade, through their Canadian Office the following products at manufacturers' prices:

Steel Shafting and Forgings up to all sizes. Tyres and Axles. Lap-welded Furnaces, corrugated or plain. Sheets. Ship and Boiler Plates and Sections. Boilers, Scotch and Locomotive. Centrifugal Pumps, direct connected and belt driven. Semi-rotary Wing Pumps. Lighting and Generating Sets.

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They Conserve time, energy, and man-power.

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We will be operating our new plant by May 1st, 1922, with modern equipment, manufacturing high-grade grinding wheels for all purposes. Vitrified and Silicate processes used.

Your enquiries are solicited and will receive our most careful attention.

Lion Grinding Wheels Ltd., Brockville, Ont.

Province of Quebec Agents: J. R. Baxter & Co., Ltd., Montreal, P.Q.

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Fifteen years and more is not an unusual length of service for Bristol's Recording Instruments. In many industrial plants there may be found recorders which have been in constant use for this length of time. We are proud of these "old recorders"—they stand for just the sincerity and reliability we have endeavored to put into them.



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Recording Instruments

have earned the confidence which could not be gained otherwise. They have proved beyond any doubt that the performance in service is all and more than we claim.
The ever growing demand for recording instruments is shown by the fact that a little over thirty years ago the only recording instrument was a pressure gauge, while now our line includes: Recording Instruments for Pressure, Vacuum, Temperature, Electricity, Time, Motion, Speed, Humidity, etc.

Get copy of information Bulletin 1-303, telling about this line of Recorders.

THE BRISTOL COMPANY

Waterbury, Conn., U. S. A.

Canadian Distributor: A. H. Winter Joyner, Ltd.
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REGISTERED J TRADE MARK

"JARDINE"

Hand and Power

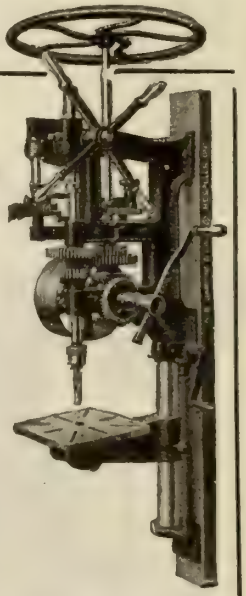
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MADE IN CANADA

The exacting requirements of an unusually wide range of drilling are effectively served by "Jardine" Hand and Power Drilling Machines.

The sizes in these machines range from the Ratchet Hand Drilling machine to the big No. 6 Power Machine. The Ratchet Hand Drilling Machine is portable, may be applied to the job in any part of the shop and is particularly valuable for repair work, being universal in its adaptation to angles of different positions.

The Large No. 6 Power Machine is especially designed for Blacksmith's use. Get particulars of these tools.



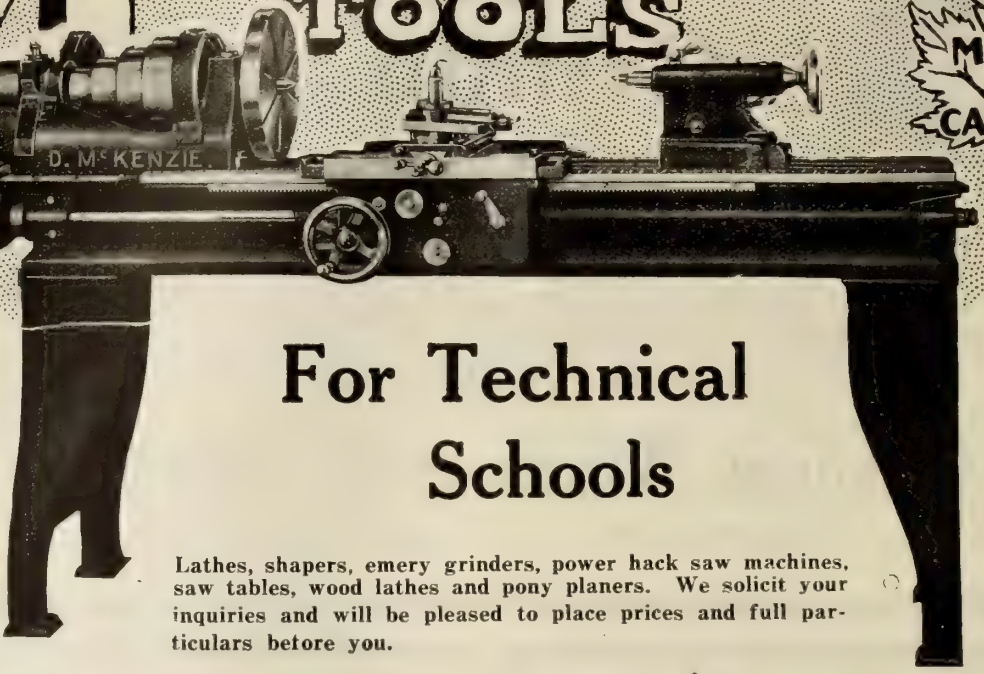
Speed Up Your Drilling—With "Jardine" Tools

A. B. JARDINE & CO. Ltd.

HESPELER, ONTARIO

McKENZIE TOOLS

MADE IN CANADA



For Technical Schools

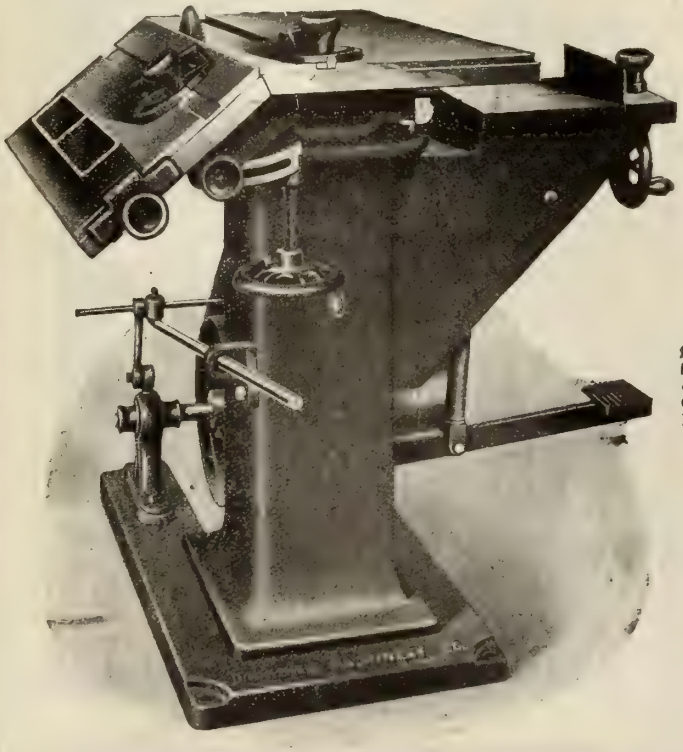
With high carbon hammered steel spindle and newest design.

Lathes in 4'6", 6 and 8 beds.

Lathes, shapers, emery grinders, power hack saw machines, saw tables, wood lathes and pony planers. We solicit your inquiries and will be pleased to place prices and full particulars before you.

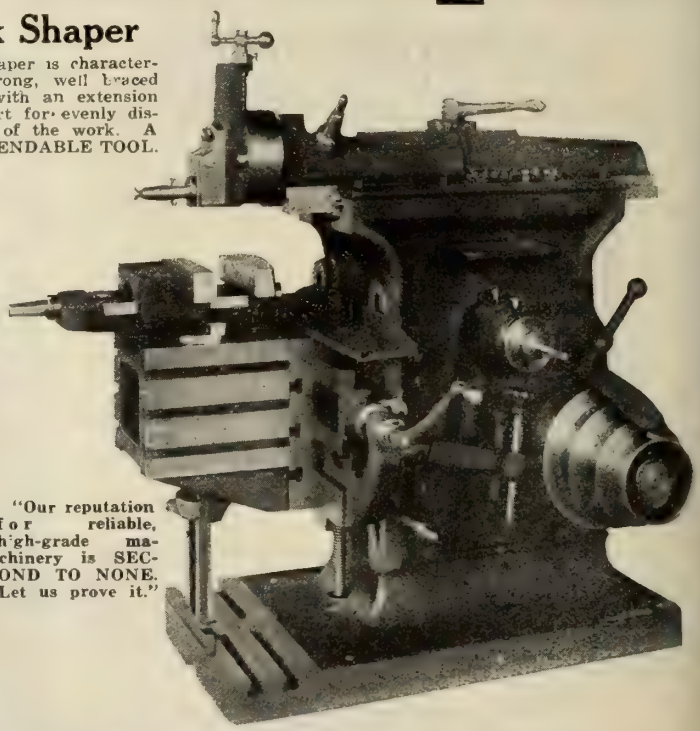
Combination Saw Table

This table can be tilted and locked at any angle up to forty-five degrees. When in position it is rigid and accurate. Arranged for dado heads or hollow chisel mortiser. Note the construction of the boring attachment



16" Crank Shaper

This Back Geared Shaper is characterized by a heavy, strong, well braced and ribbed column with an extension base and knee support for evenly distributing the weight of the work. A VERY HIGHLY DEPENDABLE TOOL.



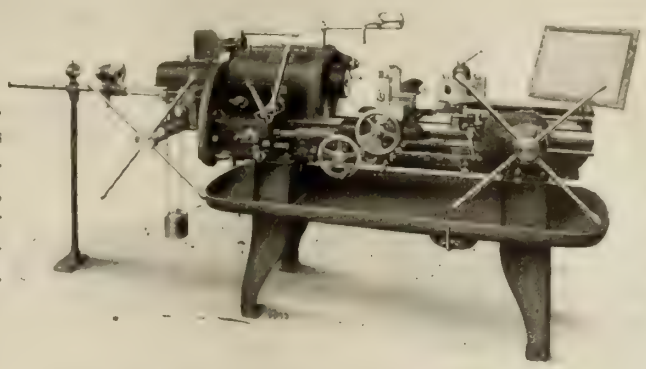
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Our No. 4 Universal Turret Lathe with Chasing Saddle.

We have a number of technical publications of exceptional interest such as How to Lay Out Turret Lathe Tools, Cutting Tools, their manufacture and maintenance, The Turret Lathe and its Work, Rapid Drilling, Profiling and Cam Milling, etc., etc., copies will be gladly furnished to interested parties on request.

We solicit your enquiries

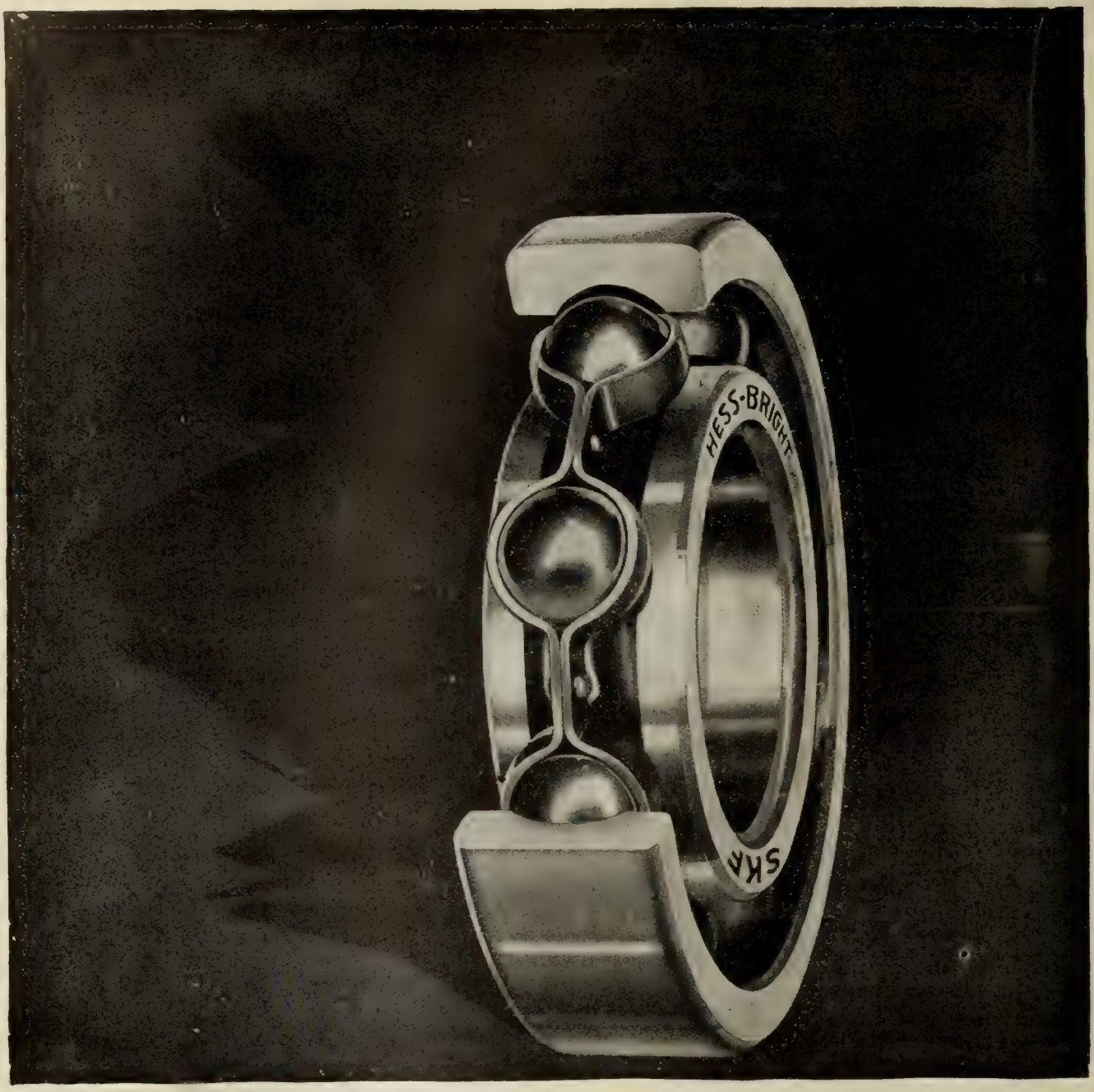
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IN SCHOOL OR SHOP—this Outfit will Start You Right



In learning to work metals within close limits, here's two good rules for every beginner:

Be sure of your *tools.*
Be sure of your *methods.*

Starrett Tools and the Starrett Book for Machinists' Apprentices will start you out right on both counts.

Copy of Starrett Catalog No. 22 '3' describing and illustrating 2100 fine precision tools—also copy of special Supplement to the Catalog showing latest additions to the Starrett line—sent free on request.

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The World's Greatest Toolmakers
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Starrett Tool Set, No. 901
Especially designed for use by students and apprentices. A thoroughly practical set of fine tools recommended by instructors and master machinists. See the Starrett Catalog No. 22 for details.



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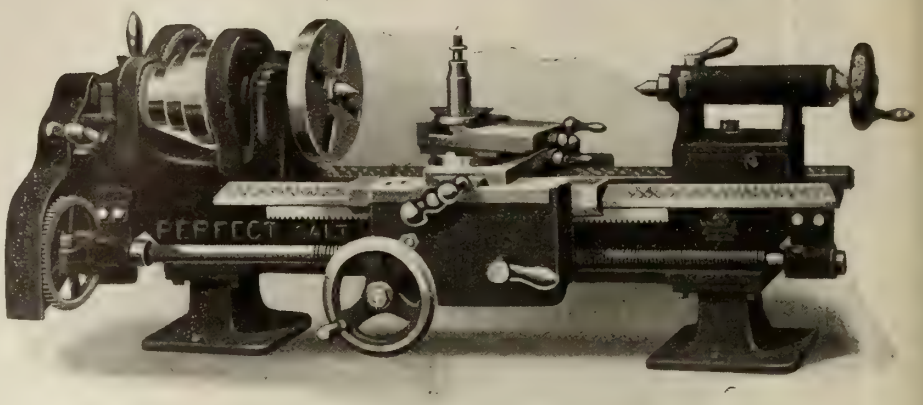
STARRETT TOOLS — STARRETT HACK SAWS CUT QUICKER LAST LONGER

Use Starrett Tools

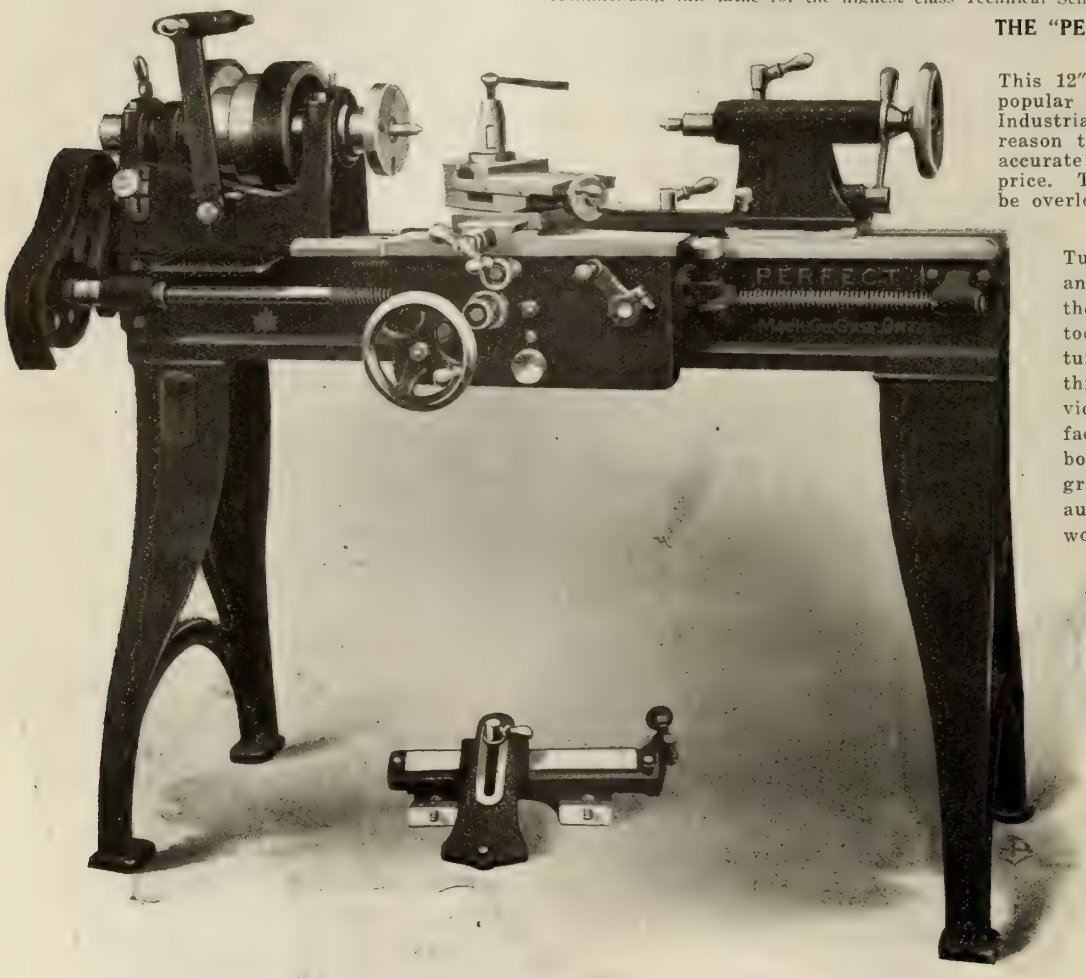
"Perfect" Lathes Make Perfect Schools

The "Perfect" Little Bench Lathe--The Most Useful Tool in the Technical School.

It is an accurate producer of an unusually wide range of work yet easy to operate and small power consuming. With 8-inch swing, 13 inches between bed it has every improvement found on a large Tool Room Lathe. The handy size and great adaptability prove an ideal means of high class instruction.



A simply designed headstock; high carbon steel spindle; carefully cut lead screw; properly built carriage and screw cutting range from 3 to 144 per inch are features recommending this lathe for the highest class Technical School work.



THE "PERFECT" TECHNICAL SCHOOL LATHE

This 12" x 4'6" lathe has proven a popular choice with Technical and Industrial Schools for the simple reason that it combines high-grade, accurate work with very moderate price. This is a point that cannot be overlooked.

Turning out work on a quality and quantity footing with the more expensive lathes this tool has many valuable features. A good range of threads and feeds, spindle providing for actual centering of face plate; belt shifters on both heads and countershaft; graduated countershaft and automatic carriage stop are worthy of note.

When in need of Hack Saw Machines, High Speed or otherwise, Drilling Machines, Grinding Machines, Bench or Machine Vises, Dumping Grate Bars, Stokers, Grey Iron Castings or special machine work of any kind let us talk to you.

Agents: All the leading machine dealers in Canada.

THE PERFECT MACHINE CO., LIMITED, GALT, ONT.

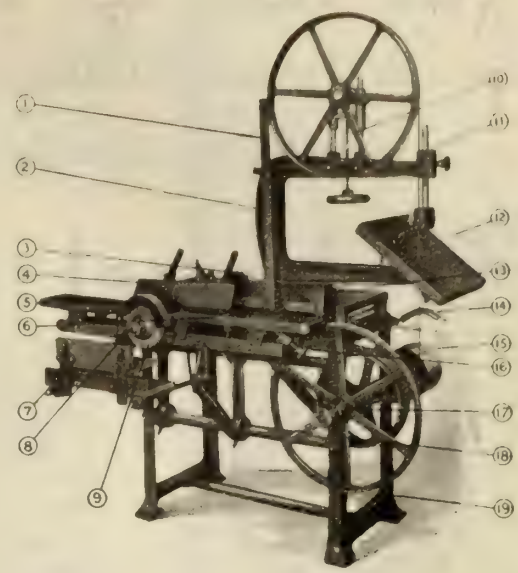
The "Canadian" Woodworker

AN IDEAL MACHINE

For Technical Schools

This machine will give good service for years. It is well built of the best materials with a minimum of moving parts. Read the features listed below and then write for our Folder No. 1669-W.

1. Band Saw Guide.
2. Heavy H-Section Frame.
3. Rip and Cross Cut Saw.
4. Saw and Planer Guide.
5. Jointer or Planer.
6. Adjustable Jointer Table.
7. Adjustable Guides for Drilling.
8. Drill.
9. Sander or Emery Wheel.
10. Adjustment for Band Saw.
11. Movable Saw Guide.
12. Tilting Table for Band Saw.
13. Adjustable Saw Table.
14. Belt Shifter.
15. Tight and Loose Pulleys.
16. Screw for Tilting Table.
17. Clutch for Band Saw, Drill Sander and Jointer.
18. Self Aligning Bearing.
19. Very strong Base.





For Every Requirement

"Canadian" Forges

The No. 90-D Stationary Down Draft Forge shown here is one of the most approved models for technical school use. The hearth is large and deep—made of cast iron. A deep, round cast iron tuyere bowl is provided with clinker breaking blast valve. Each forge has a blast gate, coal box and water tank as shown. The blast gate is operated by a lever at the side of the forge.

The down draft principle used on this forge is the most approved type and is in use all over America. We have a complete line of forges for all requirements with various types of blowers. Send for our catalog 108-16.

"Canadian" Drills

HAND AND POWER—ANY SIZE

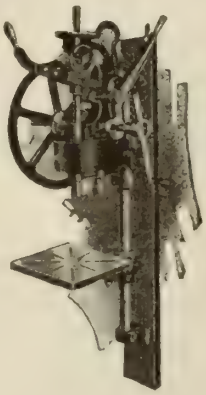
We illustrate the Canadian 10-inch Junior Drill, with two speeds, and the No. 421. We make many other drills.

"CANADIAN" DRILLS
HAND AND POWER—ANY SIZE

Technical schools all over the country are users of Canadian drills. We have a type for every service. The 10-inch Junior shown here is a small bench drill; has two speeds, lever feed, tight and loose pulleys. It will do accurate work, drilling ⅜-inch holes to center of 10-inch circle.

The No. 418 is a good substantial post drill, with a capacity of 1½ inch holes to the center of an 18-inch circle.

Write for the catalog which illustrates our complete line of drills—210-16.





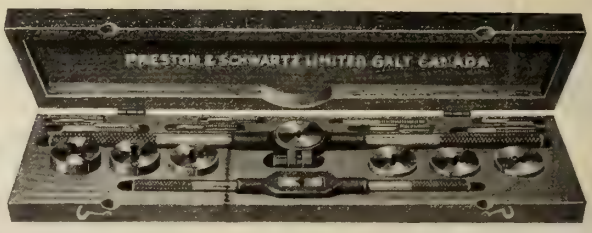
Canadian Blower & Forge Co., Limited

Kitchener Ontario

The Best in Taps

Dies & Thread Cutting Tools

Is None too Good for



Technical School Students



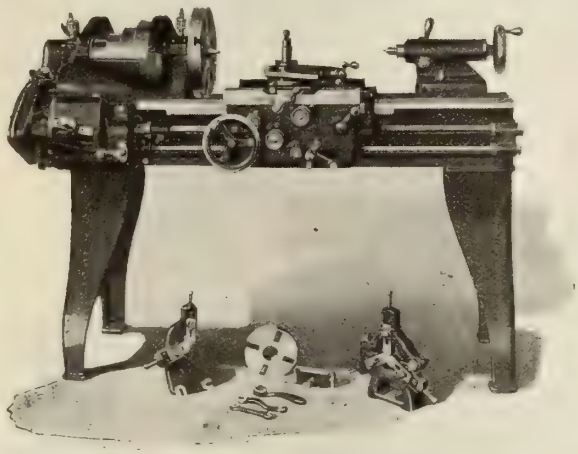
True—they are only students now. Almost any kind of tool would seem good enough to experiment with. But is it? Watch these same students tomorrow as they step out to fill important places in Canadian industry. Superintendents, Shop Foremen, Engineers, Executives. They must know all about good tools, **then—NOW** is the time to teach them.

Preston & Schwartz Tools are made by Tap and Die **Specialists.** We make nothing but Cutting Tools. All are unconditionally guaranteed. A trial order will prove their superior merits.



Preston & Schwartz Limited

Galt, Ontario, Canada



Rockford "Economy"

(13 INCH SWING)

Quick Change and Safety Feature Adapt it to Technical Schools

A small heavy duty machine capable of **big** production. All gears are completely covered safeguarding operator against injury. Cut steel gears.

32 changes of thread may be obtained without reversing. Lead screw used only for thread chasing. **Write for circular.**

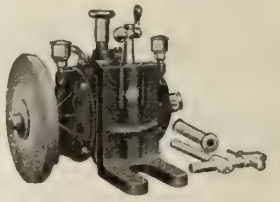
ROCKFORD LATHE & DRILL CO.,

ROCKFORD, ILL., U.S.A.

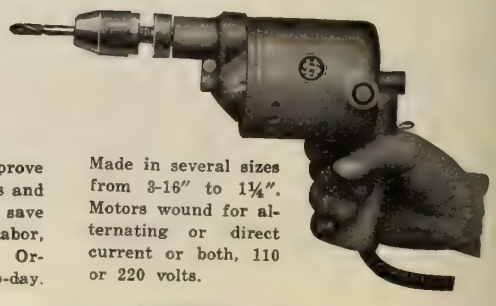
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Can be Attached to any Lamp Socket



For drilling in metal these drills are the superior of every other kind of portable drill. Their operating cost is only half that of air drills. And they can be attached to any lamp socket.



A trial will prove that our drills and grinders will save you time, labor, and expense. Order a few to-day.

Made in several sizes from 3-16" to 1¼". Motors wound for alternating or direct current or both, 110 or 220 volts.

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THE UNITED STATES ELECTRICAL TOOL CO.

CINCINNATI, OHIO

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Stores: 220 King St. West, Toronto; 131 St. Paul St. West, Montreal.

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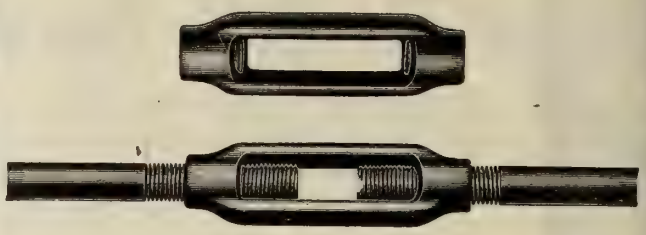
Great Britain, Geo. H. Alexander, 83-84 Coleshill St., Birmingham, England; France, Italy, Belgium, and Switzerland, Fenwick Freres, 8 Rue de Rocroy, Paris; Sweden, Norway, and Denmark, Ab. Sigfr. Anderson & Co., Malmo; Spain, Casamitjana Hermanos, Barcelona; Japan, Abe-Kobei & Co., Yokohama; Greece, Stephen C. Stephanson, 11 Lycourgan St., Athens; Netherlands, Wynmalen & Hausman, Rotterdam; Australia, Fairbanks-Morse Co., 9 Young St., Sydney; South America, Charles Dreyfus, B. Mitre, 785 Buenos Aires, R.A.; South Africa, H. Parker Wood, Cape Town, Durban and Johannesburg.





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16 Sizes with / without } Stubs

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Good Lubrication Demands Efficient Oil Storage

No matter how good the oil you buy, you cannot have correct lubrication unless it is stored and handled properly. Gritty oil means added friction on machinery parts, with a resultant rapid depreciation.

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PISTON-TYPE MEASURING PUMPS

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QUICK DELIVERIES

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Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS
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OWEN SOUND, ONTARIO
ESTABLISHED 1860

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Buy Harris Heavy Pressure for all-round machinery work, and you get

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IMPERIAL GENUINE



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THE LONG RUN

The first cost may be more, but **THE LONG RUN** makes the value, and, if combined with no trouble, the profits are accumulative. Buy your Babbitt from Life-Long Babbitt Men, and get

THE LONG RUN

Write us regarding your problems

THE CANADA METAL CO., LIMITED
TORONTO HAMILTON MONTREAL
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PARKER VISES

Built for Craftsmen. Best for School Work.

Students who use the best tools in school have a better chance to product the best work in after life.

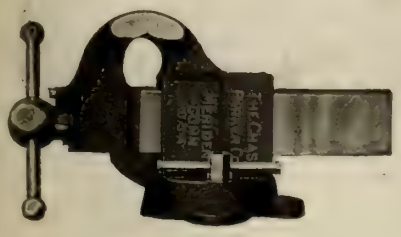
Parker Vises are regular equipment in the big shops of Canada, and students who grow up with these vises will be right at home when they start to work.

There are over seventy sizes and types for every class of work. Three that appeal to the needs of the school are shown below. Folder No. 12 shows the others; send for it.

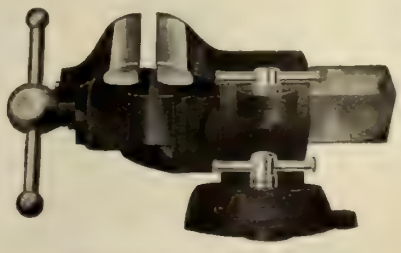


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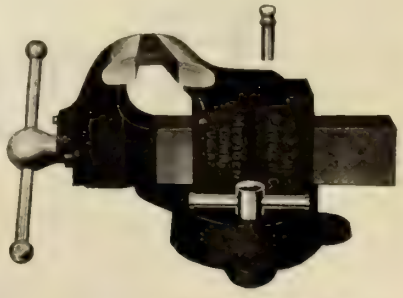
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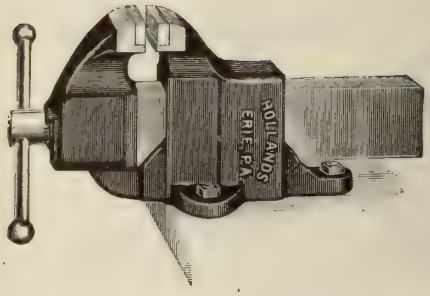
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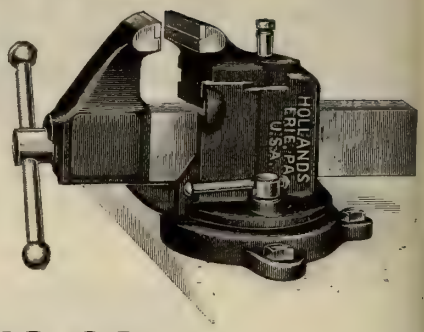
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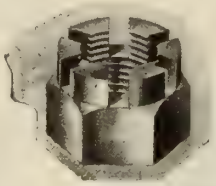
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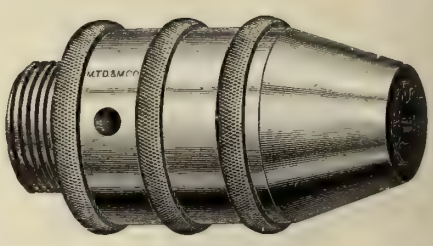
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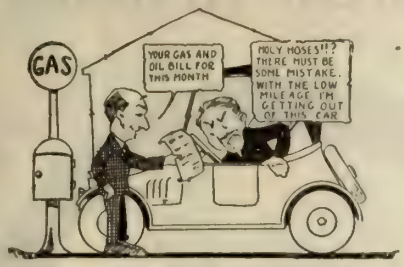


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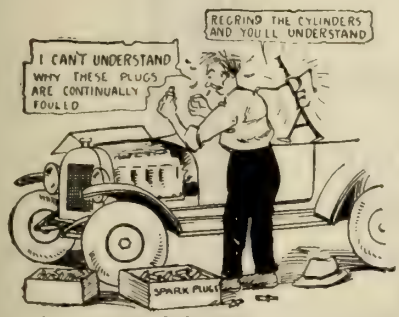
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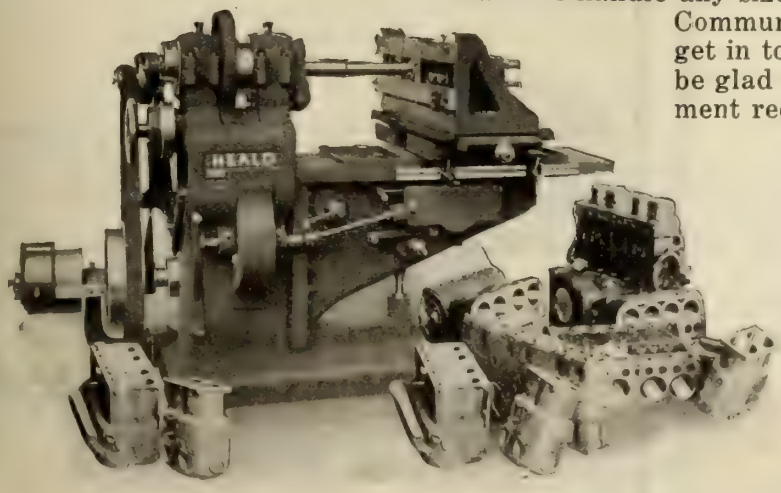
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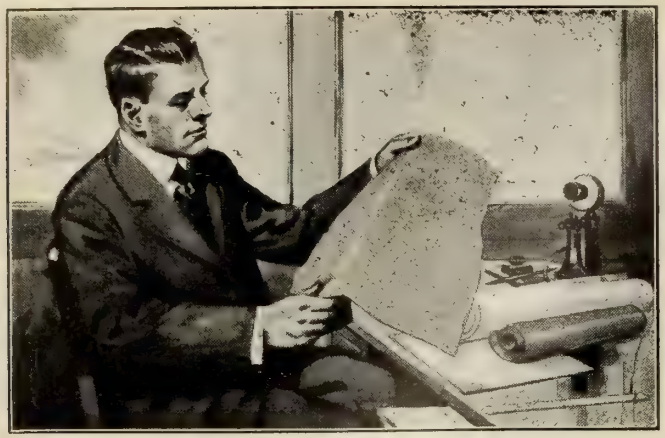
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Metallurgist or Prospector	DESIGNER
STATIONARY ENGINEER	BOOKKEEPER
Marine Engineer	Stenographer and Typist
ARCHITECT	Cert. Public Accountant
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Architectural Draftsman	GOOD ENGLISH
Concrete Builder	Common School Subjects
Structural Engineer	AGRICULTURE
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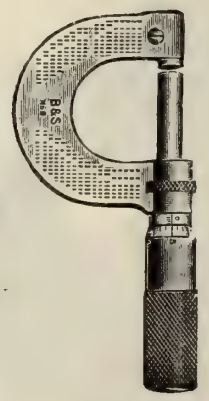
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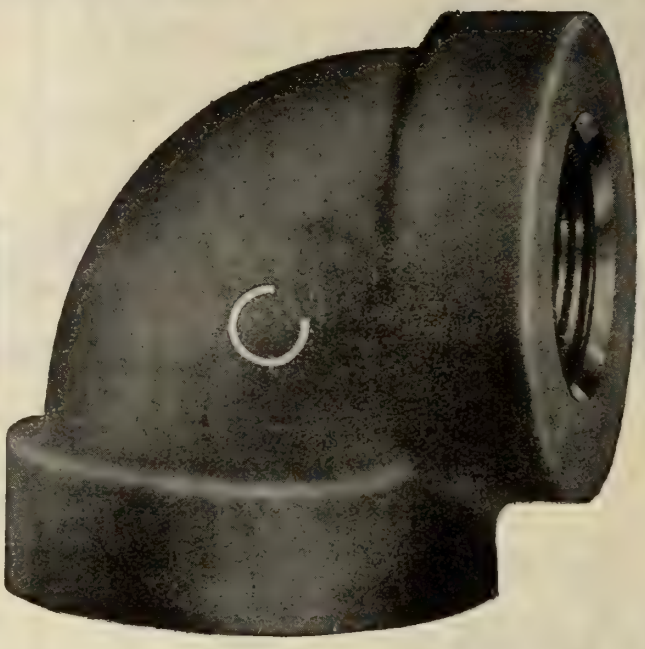
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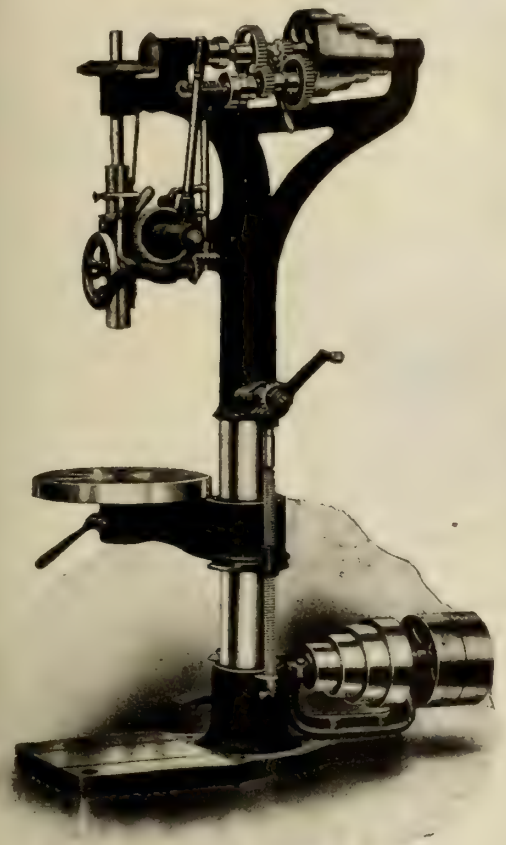
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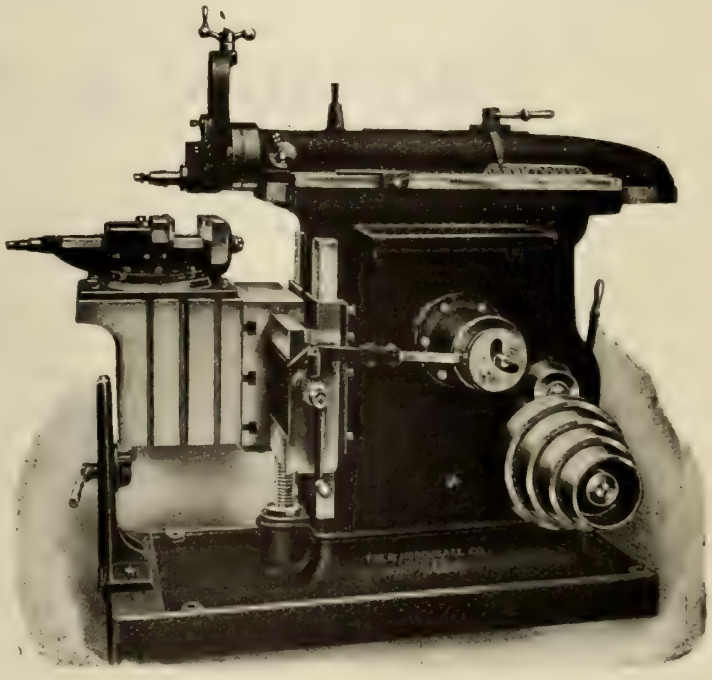


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CANADIAN MACHINERY
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MANUFACTURING NEWS

VOL. XXVII, No. 11 MARCH 16, 1922

As the Twig is Bent, The Tree's Inclined

"WHAT SHALL we make of our boy?" is a question thousands of parents ask themselves every year, but few probably realize the enormous responsibility they are taking in arriving at a decision.

The actual choice of a trade or profession is a matter of prime importance, but once this question has been decided, the selection of a method of training is one of equal moment.

The wonderful work which technical schools are doing for the youth of Canada is not fully appreciated. Parents seldom take enough interest in it to visit the schools and see for themselves the work which is entailed in the training of their children.

A technical school in a city of any size to-day is a small city in itself, for there you will find classes in practically every industry. True, the work may not be as intricate as that being completed in the outside world, "but Rome was not built in a day."

The twig is being bent in the right direction and with good results, and later in life these twigs will become trees and will grow up strong in knowledge and well able to fight any industrial storms which may arise.

To those directors of technical education, and principals of the various schools who have helped us prepare this special number we offer our best wishes for future achievements. Let them decide to co-operate with each other, for in union there is strength. Get together occassionally and frankly discuss your various problems. Do not hoard up a good idea. Give it freely, realizing that the very idea you are giving may later bring you back a better one. Above all see that the method of tuition in your schools is as practical as possible.

Keep in mind the fact that after the boys in your establishment leave to take up their work in the various factories it will be results that count. Give the boy a good start by supplying him with as much production work as possible. Get the fundamental principles and methods of operation of the various machine tools thoroughly ingrained into the students' mind, then show him how manufacturing plants would produce different types of work. Do not be content with exercises. Boys will take a deeper interest in work which they know is of practical value, and not merely a piece which when completed is thrown away or stored for exhibition.

Manufacturers are taking a deep interest in technical education, and their viewpoint should be asked for and carefully considered. They can give instructors the benefit of their manufacturing experience and can often suggest to them some part which could be used as a sample for tuition, and which would employ a variety of machining operations.

Some schools make a practice of being self supporting as far as possible making work for outside firms. This is a splendid move and should be encouraged.

Visits should be arranged occasionally whereby students could be taken through the larger manufacturing plants, having the various operations explained to them by competent guides. Some schools are at present following this practice with good results, but the chief value of such a visit rests with the capability of the guide and his powers of quick and accurate explanation. Ideas will be obtained on visits of this character which will have far-reaching results.

The development and growth in technical education during the past few years has been marvellous, but it should be nothing in comparison with the expansion during the next few years. At present many municipalities are contemplating the erection of new schools, and it is to be hoped that when these are completed the courses adopted will be as modern as the building. "Keep up with the times" might well be a good slogan for principals of the various technical schools, and this motto should be carried out to the placing of only the best of equipment for the students' use.

It is questionable if we will reach the point where a standardized course is possible, for local conditions may necessitate a certain variation in practice, but as near as possible, certain fundamentals should be included in every course of a mechanical nature in the province. Get the manufacturers in your locality interested. Induce them to come down and see what you are doing. Ask for their co-operation. Make them feel it is their school as well as yours, then you will be on the royal road to success.

When bending the twig, see that it is bent in the right direction. Do not let a boy study the engineering trade if you feel his time will be wasted in that field. Place him where he will make the greatest success.

Education of Youth Is Most Essential

Necessity of Vocational Training Has Always Existed—Those Entering Industrial, Commercial or Agricultural Fields Have Equal Rights With Those Preparing for Professional Callings—Needs Vary With Conditions

By DR. F. W. MERCHANT
Director of Industrial and Technical Education in Ontario

WE ARE hearing a great deal about fads and frills in education. New subjects of study and new methods of instruction and organization are usually characterized and often condemned by these terms, but in discussing the vocational education of the youth, one cannot be accused of advocating the new or faddish, because, without doubt, this type of training is the oldest of all forms of education.

Education had its origin when primitive man began to store up his experiences and to utilize them for the guidance of the youth. These experiences grew out of his primitive needs for food, clothing, shelter, and defence. Accordingly, in the beginning, instruction was concerned with subjects that were purely vocational in character.

The necessity for training the youth in the vocations by which they are to serve society and to earn their living is not to be argued. The need for such training has always existed, and, in one form or another, provision has always been made for it, although changes have taken place from time to time in agencies and in methods.

The simple occupations of primitive man were taught the youth by their parents. With certain occupations, as for example, of the household and of the farm, this practice remains, in a measure, with us until the present time.

A Specialized Service

In commerce and in trades and industries, vocational instruction passed from the parent and the home, to the employer and the counting house or the workshop. Thus there was built up an elaborate system of apprenticeship which involved a great variety of callings. This system, in its time, proved to be a most effective means of vocational training. It reached its highest stage of efficiency in the training for handicrafts under the Guilds. Apprenticeship remained in more or less effective operation until the end of the last century. But with higher specialization in the processes of manufacture and with the organization of larger industries on a basis for economic quantitive production, the apprentice system has broken down in our day, and we find ourselves now in a period of reconstruction which has created a demand for making vocational training a specialized service.

The need for such a service has led many industrial establishments to set aside accommodations and to provide equipment and instructors for the training of employees. But the present tendency is to demand that schools be established as a part of the national system of education. This demand comes both from the heads of industries and from the workers. The Educational Committee of the American Federation of Labor puts the case thus: "We believe that the education of workers in trade or industry is a public necessity, and that it should not be a private but a public function, conducted by the public, and with the expense involved at public cost."

Recognizing a Principle

Governments are beginning to accept this responsibility for the vocational training of the youth and to establish schools. Our own Provincial Government long ago acknowledged the obligation when it gave support to professional schools of medicine, law, engineering, and pedagogy. In now promoting a wider range of vocational schools it is but recognizing the principle that those who are to enter industrial, commercial, or agricultural fields or to work in the home have equal rights with those who are preparing for the professional callings to vocational training at public expense.

The Vocational Education Act of 1921 which replaced the Industrial Education Act under which vocational schools were previously operated, provides for the establishment and development of vocational schools of a variety of types for instruction in a wide range of courses in industrial, technical, home-making, art, commercial, and agricultural subjects.

Certain fundamental principles underlie the provisions made by the Department of Education for the organization of schools under this Act:

First, vocational instruction is to be based on a thorough training in the essentials of a general education. Not only is such an education necessary as a basis for citizenship, but a survey of the needs of industries has shown that lack of a general education is as frequently the cause of the failure of a worker to secure advancement as the lack of specialized knowledge or skill. To secure for every citizen the advantages of such an education, the age of compulsory attendance at school has been raised by the Adolescent School Attendance Act from fourteen to sixteen years.

Second, a Provincial system of secondary education in addition to providing adequately for a complete and flexible system of general high school training must make provision for the organization of schools designed to give boys and girls looking forward directly to employment a thorough training in the essentials of a general education and, at the same time, to furnish a special training in the subjects and operations which are fundamental to the occupations in which they expect to become employed. Our full-time day organized in response to a very general demand for more practical types of secondary schools to prepare young people who are not to enter professional life for a career in the home, in agriculture, commerce, or industry.

Third, while the training in the direct practical requirements of some vocations can, in a fair measure, be provided for through school instruction, yet in many occupations, especially of an industrial character, this training should be accompanied or supplemented by instruction under working conditions. The provisions for part-time day schools and for evening schools, therefore, are made an essential part of the organization of vocational education. To carry out satisfactorily plans for such schemes, the apprenticeship system in some form should be restored and schools and industrial establishments should co-operate in the complete training of apprentices.

The function of the school should be to give instruction in the related knowledge and the operations fundamental to an industry, while the apprentice perfects his skill and develops his industrial intelligence at work in industrial establishments under productive conditions. The provisions for part-time instruction under the Adolescent School Attendance Act facilitate the carrying out of schemes of instruction on this basis.

Needs Vary With Conditions

The courses on the practical side to be provided for in any school depend upon the particular requirements of the centre in which the school is established. Needs vary with the conditions in different localities. It is clear that the practical work in a vocational school in a centre where mining is the only industry and where a large percentage of the young people who leave school engage in it, should be different from that provided in the school of a large city where the graduates of the school find employment in a great variety of commercial and industrial establishments. The board in charge of a school in any municipality is expected to make a careful survey of the occupations of the district with a view of determining the character of the practical instruction which should be provided to meet the needs of the community.

(Continued on page 49)

This School Shows Remarkable Progress

Over 10,000 Pupils Enrolled—Large Pipe Organ Installed as Direct Effort of Teachers and Students—Special Facilities for Thorough Instruction—Orderliness an Outstanding Feature

TECHNICAL education in the city of Toronto dates back to 1891 when evening classes were first organized and instruction carried on in the old Wycliffe Hall. It was not long, however, until the increased demands for tuition necessitated additional class accommodation, so that in 1900 another building was acquired with the intention of starting day classes, these being inaugurated in the following year. Reorganization was necessary in 1904, when under the new Board of Education the school's name was changed to that of the Technical High School. The need for increasing facilities to provide for the rapidly growing demand for technical education was so evident that plans were laid in 1911 for the erection of a building that would meet all the requirements of the city in this respect. The school was completed in 1915 and the present enrollment shows that nearly 3,000 day pupils and over 8,000 evening students are attending the various classes, about 80 per cent. being enrolled at the Central school. The remainder distributed between the other three branches, Humberside, Oakwood and Riverdale.

Building Features

The building, which faces west of Lippincott Street, is 430 ft. long and 227 feet deep, four storeys in height and occupies two city blocks. The floors are designated A, B, C, D; A being the basement floor, where all the heavy mechanical equipment and shops are located; B the main entrance floor and general offices; C floor is devoted to women's work in domestic science and art, and the boy's lunch room. The top floor is set apart for science, chemistry and drawing class rooms. In the tower of the building, a room is provided for life studies in art.

The Auditorium

One of the most imposing places in the building is the large auditorium, 80 ft. by 90 ft., consisting of main floor and gallery, with seating capacity for almost 1,300 persons. Brief opening exercises are conducted every morning for a period of about ten minutes. It is indeed an agreeable sight to see about 1,300 students and teachers gather together for short devotional service (non-denominational in character) before taking up the work of the day. It will be interesting to mention that only last year an organ costing $14,000 was installed as a memorial to the teachers, pupils and graduates killed in the late war. The fund for this purpose was raised entirely by the pupils and teachers through bazaars and concerts held in the school building. The school has a first-class orchestra composed of boys between he ages of 14 and 20.

The industrial course for boys and young men extends over a period of four years, and is designed to prepare them for the pursuits of industrial and commercial life. During the first two years of a course no attempt is made to have a boy specialize in any particular line of work, but a thorough grounding of the fundamental principles of associated trades is given the boys so that they are better able to make the proper decision when the time comes. Many a young man's career has been hampered owing to the fact that he has been forced into a trade that he is not mentally fitted for. The varied nature of the industrial courses in the technical school make it reasonably possible for a boy to "find himself" before he has committed his future to a trade or profession that will not show him the proper return for time and effort expended. While the instructors are ever ready to assist a boy in making a choice, it is seldom found necessary as the latent faculties are given ample scope long before his course is completed. If a boy expresses a marked desire to continue his studies along specific lines then instruction is given with that end in view, concentrating on the different subjects that are allied to the goal of the boy's ambition.

The subjects covered by the industrial course include mathematics, physics, chemistry, mechanical drawing, free-hand sketching, shop work, English, drill, gymnastic and swimming exercises; these studies being suplemented in the last year by such subjects as geology, mineralogy, steam engine and power plant, architecture and building construction, estimating, clay modelling, printing in all branches, practical painting and decorating, metallurgy and assaying, and electro chemistry. Every needed facility is provided in engineering and chemistry courses for a comprehensive study of these subjects.

Thirty standard class rooms are provided and these are so arranged that a minimum loss of time takes place in going from a laboratory to a lecture room when taking up practical and theoretical studies of the same subjects. Lockers and cloak rooms are provided for each individual class room. These were installed by the Dennis Wire and Iron Works Co.

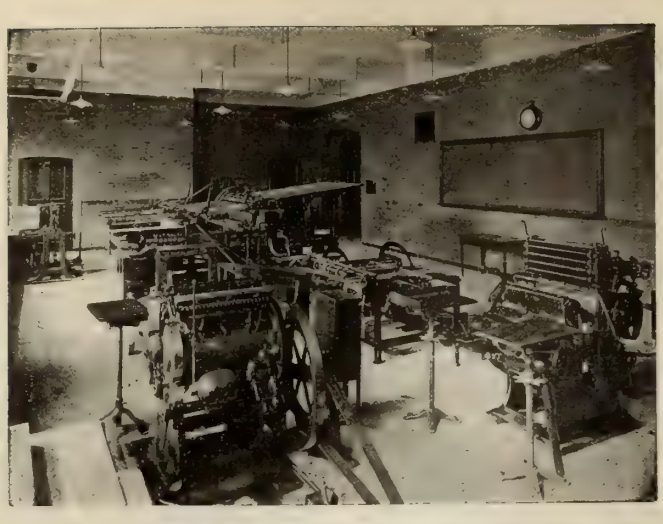
Wood Working Shops

The purpose of the different departments of technical school work, especially the day courses, is not that the boys will become experts in any particular line of activity but rather to make him familiar with the general features of construction and methods of proced-

This article is compiled from information obtained through the courtesy of A. C. McKay, B.A., L.L.D., principal of The Technical Schools, Toronto, and his staff.



Section of foundry



Partial view of printing department

ure in various industrial pursuits. There are seven rooms devoted to instruction in wood-working, viz., two elementary shops, two pattern shops, one cabinet shop, one carpentry shop and one mill room. All of these shops are equipped with modern machinery and material for every class of wood work. Individual instruction is given each boy and in the elementary classes the same work is performed by every boy so that one often benefits by the work of another. In all cases the pieces are made from drawings previously made by the student in the drawing class room.

For advanced pupils a large construction room 80 x 37 x 30 ft., provides ample space for the erection of two fair sized dwelling houses. Instruction is given in framing, roof trussing, cutting in doors and windows, erecting staircases, plastering, wiring, plumbing, paperhanging, and other work, so that boys are enabled to test out their ability to carry out the work of the different trades involved.

Forge Shop

Ample provision is made for the study of forge work and heat treatment as it bears on the associated studies of the industrial courses. Twenty individual "Buffalo" down draft forges are installed, together with a gas heating forge and hardening furnace. Heat treatment control being taken care of by a complete Bristol pyrometer installation. Boys are given a thorough training in the characteristics of various steels, method of heating and forging tools for machine shop, welding, effects of hammering steel at different temperatures, hardening and tempering, annealing, etc., and other details pertaining to this department. A power hammer and hand shearing machine minimizes the physical efforts of forge work so that the boy's time is fully occupied in learning the more essential features of forge operations. Parts are made from previously prepared drawings.

The Foundry

The foundry is a well-lighted room 50 ft. x 30 ft., and contains a one-ton cupola, three brass furnaces, one core oven, a pneumatic rammer, swivel moulding machines, iron flasks and small tools. Class and individual instruction is given by an experienced foundryman. The elementary work consists of the preparation of simple moulds and cores, the study of the materials used, such as sands, binders, etc. Molten lead is generally used in making the simple castings for the beginners' classes, and more intricate work is covered as the studies progress, and the use of the moulding machine and cupola charging are gradually introduced to the work. Brass casting and preparation of non-ferrous alloys are part of the regular work at later stages.

Machine Shop

The large machine shop is 57 ft. x 57 ft., located on the basement floor, and in the center of the building so that the glass roof of the court provided ample light and air. Artificial light is furnished by semi-indirect nitro-tungsten lamps. Five motor-driven tool-room lathes are installed. These tools were supplied by Reed-Prentice Co., Flather & Co., Lodge & Shipley Machine Tool Co., R. K. LeBlond Machine Tool Co., and W. P. Davis Machine Co. General engine lathe instruction work is given on sixteen 14 in. Canada Machinery Corporation machines. Milling machine equipment consists of a motor-driven No. 2 Cincinnati plain miller, one No. 1½ Brown & Sharpe plain miller, and two small universal Hendey machines. The shaper equipment consists of two R. A. Kelly, one Gould & Eberhardt, and one McDougall. A variable speed reversible motor-driven Bertram planer is also installed, and grinding machines of Landis and modern make, and one universal and one cutter grinder of the Cincinnati Milling Machine Co. Other tools include a 12 in. heavy duty motor-driven Colburn drill, a Garvin die slotter, C. M. C. power press and many other smaller tools and equipment. Bench room is provided for twenty students and individual tool racks are furnished with each vise.

Owing to the heavy demands being made on this branch of the work, the Board are equipping another room for additional first and second year students. A recent battery of about twenty small Preston engine lathes has been installed to relieve this period of instruction. It might be stated that the work performed by the boys on the machines is done from sketches or blueprints developed by themselves while in the drawing classes. It has been the aim of the instructors to so correlate the work that the interest of the boys will increase instead of diminish, each scholar continually looking forward to the completion of something he himself has started.

Architecture and Design

Eight class rooms are devoted to the study of drawing and designing, four for architectural and four for mechanical. From thirty-six to forty-five individual drawing tables are provided for each room. Beginners are generally given class work but more advanced students are graded and allowed to prepare drawings in keeping with their individual progress. Third and fourth year pupils in architecture, invariably work in different designs of buildings, working down from the perspective drawing, elevations, floor plans, plumbing and lighting diagrams, sectional views and constructional details. In this way the dif-



Showing top of construction room

ferent boys in the class have the opportunity of studying the various other designs while confining their actual work to the development of their own plans.

The fourth year work of machine drawing comprises separate problems in machine, electrical or structural engineering, for small groups of students, executed as far as possible under commercial conditions, lectures on the various difficulties encountered; gear designs and strength of gear teeth; cams, drafting office systems; relation of the office to the workshop production, inspection, testing, and shipping. The blackboards in all class rooms are equipped with universal drafting machines. The blue printing department is located at the top of the building and is equipped with continuous printing machine, washing and drying machines, while sun printing frames are also supplied. Parts of machine equipment have been donated by various firms to assist students in machine design.

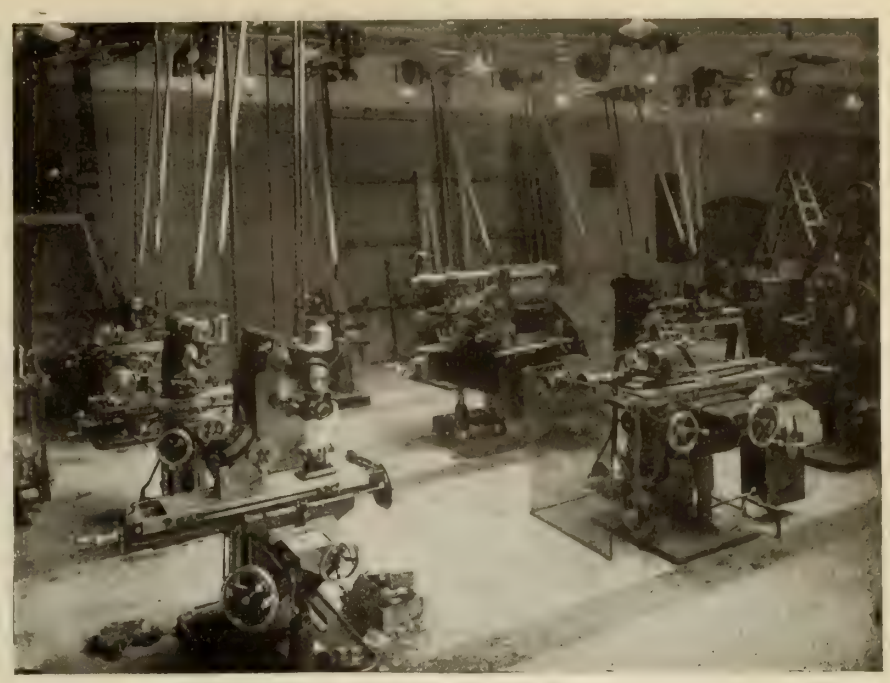
Safeguarding Tools

A noteworthy feature of the drafting class rooms is the system adopted for safeguarding the tools and instruments of the different students. Six different sets of boys are taught in the same class room and special desks have been constructed, each having six drawers, lettered from A to F. Before the present system was developed each boy was given a key for his own particular drawer, but owing to loss of keys, or leaving them at home, with the necessity of requiring an initial deposit, caused so much inconvenience that the old method was abandoned for the one now used. A cabinet is provided with six vertical sliding boards on which hang the keys for each respective tier of desk drawers. When the class gathers the instructor pulls out the board of that particular group and stands there, while each boy removes his key and unlocks his drawer. The key is at once replaced so that a glance at the board shows the teacher that all keys are in place; the board is slid back and the cabinet locked. The boy has no further worries of the key but must take care to snap the lock when class is over.

Instruction Aids

An interesting and highly instructive method of teaching the students the problems of solid geometry is provided by means of wire models, as shown in the line drawing herewith. These forms are made in a number of shapes, such as cubes, cones, cylinders, prisms, etc., and different cross-sections are represented by plain pieces of sheet metal fixed to the wire frame, thus giving the student a clear understanding of the shape of the surface that would be exposed if the object was cut in the plane.

The principle of projection of views is exemplified by means of a glass case in which a model is placed and the outline traced on the glass from the various directions. When this is performed the top and ends are swung out to coincide with the same vertical plane as the front elevation. This brings the plan immediately above the front elevation and the end views to the right and left respectively, making what is known as the third angle of orthographic projection.



A small corner in the machine shop

Many other facilities are provided to make instruction as simple yet thorough as possible. Stands, which can be adjusted to any desired height, are supplied for placing objects on when the class is working on free-hand sketching. In some of the elementary classes these stands are located in the centre of a square of desks arranged about the four sides of the room, so that the representation of the object made by each pupil varies slightly from the others. This method is also followed in all the art and sketching classes.

The instruction sheets, used in connection with the drafting course, and which are printed on the school presses, are made of a convenient pocket-book size, 7 in. by 5 in., and in loose leaf style. These leaflets are handed out to the student for each lesson and kept by him in a suitable holder so that he has a complete set at the termination of the course. A reproduction of one of these sheets is shown in the accompanying sketch. Larger sheets are perforated and arranged so that they will fold within the bounds of the holder.

Chemistry Work

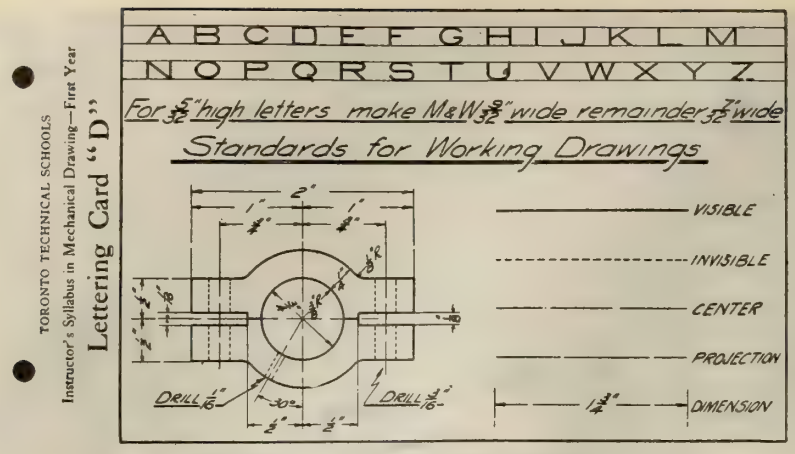
Seven distinct chemical laboratories are provided for elementary and industrial studies. The former has working accommodation for sixty students and lockers for five hundred. The industrial laboratories are specially equipped with apparatus for the various trades. A large fume closet is installed for the hydrogen sulphide generator used in conjunction with qualitative chemistry. The electro-plating room is provided with motor-generator to produce low voltage current suitable for electroplating, ammeters, voltmeters, tanks, etc. The laboratory for metallurgy is furnished with various types of furnaces for use in assaying and the study of metallurgical operations.

It might be mentioned that a separate room is set apart for the housing of the fine precision instruments required by the analyist. The partition between this room and the adjoining laboratories is of glass, so that a clear view of the operations can be seen by the students as the analysis is being carried on. The work benches, in this room, that support the delicate weighing instruments are attached to the main walls of the building and not to floors or partitions, so as to minimize the possibility of vibration and consequent error in the calculations.

The head chemist has made a special study of chemistry in relation to foodstuffs and the important of this science in household work is not overlooked, and it occupies a suitable place in the course of domestic science for young women.

Printing Department

One of the outstanding features of the institution is that branch of the work devoted to the study of the printing trade. The art of printing to-day contributes very largely to the general enjoyment of modern life, and facilitates the advancement of civilization in all parts of the world. The "familiarity" of the public in these days with news in print might easily "breed a spirit of indifference" to the importance that should be associated with this particular phase of industry. The printing trade, like many other activities, has had to fall in line with the universal demand for specialization, so that the apprentice or even the more advanced workman in the commercial workshop of to-day is not afforded the same opportunity to acquire



Instruction sheets issued in loose leaf form

the general allround knowledge that those boys of former days enjoyed.

In organizing the Apprentices' School of Printing as a department of the school work, it was done so not so much to relieve the printing offices of the responsibilities of teaching apprentices in their own plants, but rather to co-operate with these executives in developing the necessary craftsmanship in those striving to increase their knowledge of the art in its many branches. Printing is included in the general industrial course and a brief summary of the lessons are as follows:—practical work of learning the case, setting up straight matter, tabular matter, letterheads, billheads, menus, programmes, advertisements, etc. Impositions of four to thirty-two page forms, folding machine work, platen and cylinder press work, and make ready are also included in this course. The machine work is usually confined to advanced pupils. Many of the newspaper offices of the city have arrangements with the school officials for the younger apprentices to attend one-half day a week, the period suited to the needs of the boy's employer.

Every facility is given for the students to study the process of color work, the necessary plates being often donated by firms who have no further use for them in their catalogue work.

A point of special interest is the fact that all the printed matter used for the school work, such as record cards, instruction sheets, programmes, menus, etc., are produced in the school printing department.

The composing room is well lighted from the north and west, 48 ft. by 33 ft., and equipped with thirteen Tracey cabinets, eighteen type racks, and a large steel imposing stone. This press room, 56 ft. by 28 ft., contains a No. 3 Miehle press, a Colts Armory press, a Phoenix press, a Gordon press, a 38 in. automatic power paper cutter, hand paper cutter, a folding machine and two wire stitchers.

Model Apartment

A unique departure in the way of construction is provided in the arrangement of a suite of rooms as a model living room, dining room, bed room, bath and kitchen. The linen closet in this section, which was designed by one of the principals, has met with such universal approval that it has been copied by many other institutions and private individuals. Advanced students in art decoration and household science are granted an opportunity to demonstrate their skill and training in this suite of rooms. The writer was privileged to see a room that had just been completely decorated by three young girls, and the design and color scheme on the walls and ceiling would compare very favorably with the finished work of many an experienced artisan. Advanced pupils in domestic science are permitted to try their hand at providing a luncheon at stated figures.

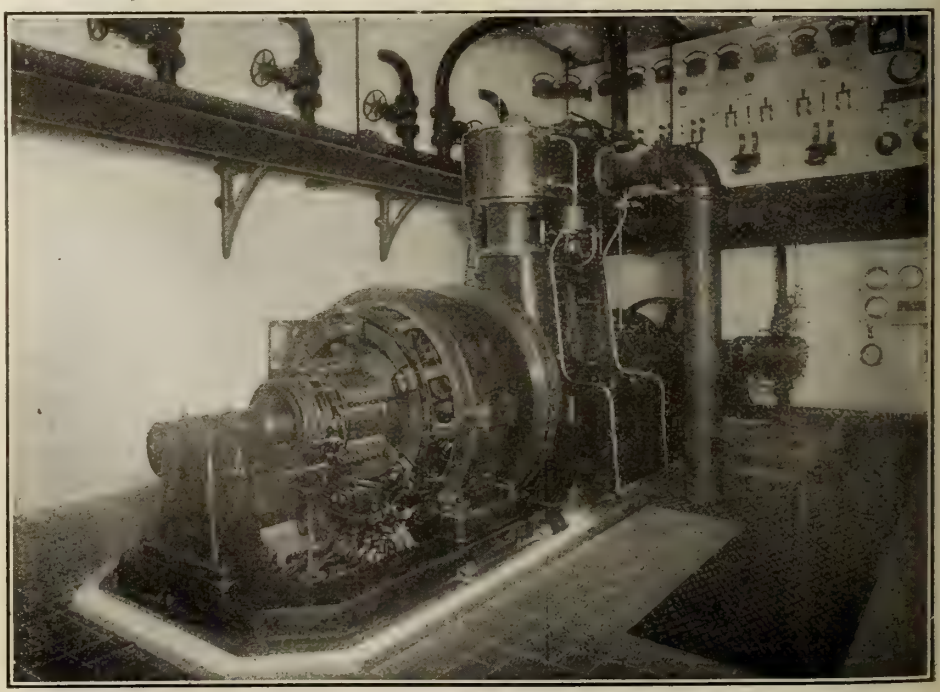
Light, Heat and Power

To render the building independent of outside sources of light and power, and at the same time provide the means of adequate instruction facilities in this essential phase of industrial life, the school has been equipped with its own light, heat and power plant. The system also includes complete ventilating system of washed and heated air, compressor plant, refrigeration plant, hot water system throughout, and other accessories.

The various requirements that had to be considered in the layout of the plant, in addition to providing light, heat and power, were the securing of equipment and apparatus that would give the student an opportunity of acquiring knowledge of the various designs of power appliances which he might encounter in his future career, the distribution of air and hot and cold water to the various class rooms throughout the building, to provide a plant that could be used jointly for practical and demonstrative purposes without any loss of efficiency.

The power plant is situated 25 ft. below the basement level, and is divided into three sections, boiler room, engine room and fan room. Four 180 h.p. Babcock and Wilcox boilers are installed, these are fitted with chain-grate stokers. The coal is stored in bunkers alongside the boiler house and before being delivered to the hoppers is weighed in "Dormant" warehouse scales.

The engine room has an area of 43 by 40 ft. The principle units consist of a high-speed compound vertical Goldie & McCulloch engine fitted with forced lubrication, and rated at 365 h.p.; one 150 h.p. Corliss engine built by John Inglis Co., Toronto, this unit is direct connected to a Canadian Westinghouse generator; a Canadian Westinghouse Motor-generator set; a Canadian Ingersoll-Rand air compressor, with a capacity of 230 cu. ft. of free air per min. at 100 lbs. per sq. in.; an ammonia refrigerating machine built by the Frick Co. of Waynesboro, Pa., circulation being obtained by means of a Smart-Turner centrifugal pump. Other equipment in the engine room is of the most modern



A Goldie & McCulloch vertical engine, installed in power department

type and suitable in every way for practical use and demonstration for the students. The main switch board is located in a gallery along one side of the engine room.

Two large "Keith" fans, supplied by Sheldons of Ga t, are installed for ventilation purposes. The air washer and humidifying apparatus was supplied by the Carrier Air Distributing Co. of America. The air is drawn from the outside through long ducts and forced through a sheet of water and against heated steam pipes, so that when the air is delivered to the various rooms it is pure and of the proper temperature. This system is also used in a general way in instructing the pupils.

Evening Classes

Instruction provided for the evening classes is much the same as that for day pupils, only greater attention is required along the lines of individual supervision. This is necessary owing to the varying degrees of advancement made by the different students. These classes are primarily intended for apprentices, journeymen, salesmen, foremen, and others, who are engaged in industrial or commercial pursuits during the daytime, and who desire supplementary instruction a ong specific lines. While regular courses are scheduled for evening students no restrictions are enforced. The student is permitted to select those subjects he thinks will best aid him in his daily work.

For the convenience of those evening students who live a long distance from the school and take their lunch away from home, the school has provided two large assembly rooms where they may gather and wait until the school session commences. Metal doors are provided so that evening students may be isolated from the main corridors until the arrival of the school officials.



One of the chemical laboratories

A school store has been established within the building and all supplies in connection with the drafting course can be secured here by the students.

Every opportunity is afforded to motor students to acquire a thorough training in the mechanism and operation of different types of motor cars and engines. Cars are obtained from many sources and practical instructors dismantle and rebuild these cars with the assistance of the students.

Instruction in oxy-acetylene and electric welding are carried on when sufficient students are interested to form a class.

The plumbing and heating classes work under direct supervision of practical sanitary and heating engineers and ample opportunity is given for practical application of this teaching in making repairs and installation of equipment about the school.



View of heavy lathes in machine shop

School is Run On Modern Business Lines

Accurate Costs Kept in Each Department—School is Really an Education Shop in Which Is Taught Practical Work of Extreme Value—Productive Work Carries Cost of Supplies

By G. L. SPRAGUE, B.A.
Principal Hamilton Technical and Art School

THE Hamilton Technical and Art School is constructed on the unit plan. The present unit was built and occupied for school work in September, 1919. All departments of school activity were fitted into this unit with the exception of the art department. Under these conditions, temporary allotments of space were made for shop and academic work and temporary partitions were built to serve this purpose.

The new addition under construction which will be ready for occupancy in September, 1922, is a continuation of the original plan. The present factory unit is extended on Wentworth Street, connecting with the administration building which faces the corner. On Huron street, connected with the administration building, is the Girls' building, and the location of the various buildings is such as to conserve the greatest amount of land for an athletic field.

Division and Equipment

The division of space in the different units will be made along the following lines: The present unit and its extensions will be occupied by classrooms, laboratories and shops. On the first floor, will be an engineering laboratory and transformer room in which will be installed all power and lighting control for the entire plant. In addition, there will be a 40 h. p. gas engine, 25 k. w. generator set and smaller generator sets, motors and transformers for experimental purposes. This laboratory is large enough, and is laid out so that as the growth of the work justifies it, additional equipment may be installed.

Adjoining the engineering laboratory on this floor will be a modern tool room for advanced work. During the last three years in evening class work, many machinists have become interested in tool and die making to such an extent as to warrant the installation of this advanced department. During the last three years that this advanced department has been in operation, a large number of machine tools and complicated dies have been made by pupils. This room will be equipped with electric heat treating furnace, universal milling machines, modern toolroom lathes, tool grinders, shapers and all necessary precision instruments.

Across the hall from the tool room will be a motor mechanics laboratory equipped with various types of motors, mechanical parts, carburetors and ignition systems. The present partitions will be removed on this floor and the machine shop and oxywelding departments will occupy the last two bays of the machine shop floor and the present classroom in the corner will be divided into two smaller classrooms for shop instruction.

On the second floor will be a painting and decorating shop, three classrooms, office for woodworking department, woodworking finishing room, two shop classrooms, general woodworking, carpentry, cabinet making and patternmaking shops and power machinery.

The third floor will contain two classrooms, two physics laboratories with apparatus room between sheet metal work, electrical work shop and classroom, and print shop.

The fourth floor will contain a science lecture room, a practical chemical laboratory, high school chemical laboratory, advanced chemical laboratory and drafting departments.

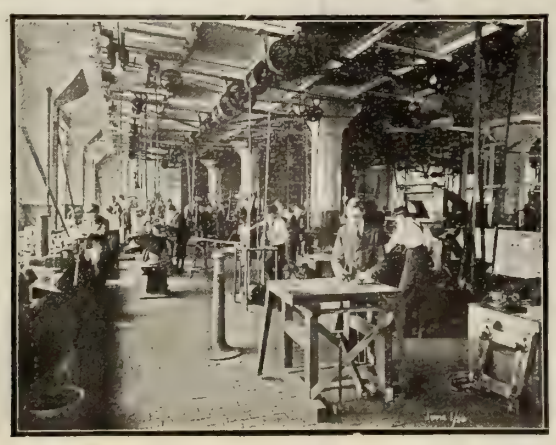
Co-operating With Industry

The practical chemical laboratory will be used for correlating chemistry with the industries of Hamilton by training young men for their laboratories. In this laboratory, tests will be made on steel, varnishes, oils, paints, dyes and materials connected with textile industries. The Technical high school laboratory will be used for the regular department of education courses in chemistry, junior and honor matriculation. The advanced chemical laboratory will be used for practice and theory in quantitive and qualitive analysis.

Re-distribution of space in the present unit and its extension is made on the showing the different shops have made during the last two years. The allotment of space is according to the demonstrated needs. The temporary partitions were constructed in such a manner that enlargement of shops can be made at a minimum cost.

The main or administration building will contain, on the basement level, a gymnasium, one of the largest in the province, and a modern heating plant. On the first floor will be a lunch room for boys and girls, and boys' and girls' waiting room with cafeteria service providing lunch at cost. On the second or main entrance floor will be an auditorium seating 1200, an exhibition and committee room, administration offices, class room and reading room. On the third floor will be seven classrooms. The fourth floor will be occupied by the art department containing two classrooms, freehand, clay modelling, commercial design, elementary antique, advanced antique, life, portrait, oil and water painting, china painting, kiln room and director's office. This floor will have special sky lights in the roof to provide the finest kind of lighting for art work.

On the first floor of the girls' building will be three classrooms and a commercial department; on the second,





Left hand view shows part of machine shop while other illustration shows the automobile section busy at work

three classrooms and millinery rooms; on the third three classrooms and sewing rooms; on the fourth, two cooking laboratories, a classroom, a laundry, kitchen and dining room and bedroom for home nursing.

The complete plant will contain 36 classrooms, 11 laboratories, 23 vocational or trade shops, gymnasium, heating plant, auditorium, library and reading room, lunch rooms, locked rooms, administration offices, and a fine athletic field.

Day Courses

Day courses at present comprise general industrial, special industrial and technical high school work. A boy or girl may enter the technical and art school upon reaching the fourth book. In the first two years of the general industrial course, they would cover the regular academic work of the junior and senior fourth book and qualify to enter the high school course. In addition to the academic training, pupils receive instruction half time in vocational shops. The school day is six hours long, three hours of which is spent in classroom work and three in shops. By the time a boy completes the second year he has a fair idea of the operations and theory underlying various trades and is in a position to choose, either to follow the technical high school course leading to the university or to specialize in some trade.

The special industrial course consists of instruction in mathematics, English, literature, history, and civics, and related drawing and science. In this course, pupils are given a considerable amount of time in the shops where they are trained on productive work. For example, special trade pupils are engaged in the machine shop on commercial trade orders, production orders consisting of machine tool parts and machinery; in the motor mechanics, in the actual overhauling of automobiles, five or six of which are in this shop continually. These automobiles are placed in there by outside owners for the very complete overhaul which is made in this shop, and they pay sufficient for the work to cover all costs and give a profit to the school. In the carpentry, cabinet making and pattern-making shop, productive work is the rule. Teachers' classroom desks, bookcases and other school furniture, as well as outside orders, are handled by special trade pupils. In the practical electrical work shop, pupils construct special transformers for the trade, house transformers and toy transformers, electric motors, electric irons and other special electrical work which cannot be obtained anywhere else in the city.

The print shop pupils do all the board of education printing except the minutes. All technical and art school day and evening calendars and other publicity material is set up by these pupils. The drafting department designs all wood, machine and electrical work required. At present, special trade pupils in this department are turning out floor plans showing the layout of equipment in different departments, detail drawings of desks, and laboratory tables. The result of this productive work training for special trade pupils is that they have a grasp of actual trade conditions, so that when they find employment in their trade, either as apprentices or improvers, they advance more rapidly and are of more service to their employers. Actual shop conditions are approximated in this work all along the line.

The technical high school course is for pupils who look forward to taking an engineering course in the university. In addition to the regular academic work, required by the department of education, these pupils study pattern-making, machine shop practice, electrical work, drafting and machine design, all of which is a material help to them when they enter the faculty of applied science.

With the addition of a Girls' building, the courses in sewing, millinery, commercial work, domestic science and dietetics, will be further developed. Courses will be organized to qualify pupils to enter Lillian Massey Hall, Toronto University, and Macdonald College, to train for teachers of domestic science.

An Education Shop

Six years ago, the present management undertook to develop the technical school into an education shop, in which educational values should not be sacrificed, but rather increased as far as related to special trade pupils. This effort has been attended by a considerable measure of success. Junior trade pupils work on exercises until the instructors are satisfied that they are ready to proceed with productive work. The reason is obvious. They must learn how to handle tools before they can be trusted with valuable material. The amount and character of productive work, both for the school and commercial orders turned out each year, is surprising.

For example, the practical electrical trade pupils installed the electrical wiring in the chemical laboratories, the domestic science laboratory, the electrical engineering laboratory, the practical electrical shop and the print shop. In addition, they have manufactured transformers, electric irons, washing machine motors and performed other special electrical work on commercial orders. The woodworking special trade pupils constructed, during the last two years, over sixty teachers' classroom desks for the board of education, and a large amount of special school furniture for the school. The machine shop trade pupils have made seventy-five per cent. of the special machine tools required, such as reamers, drills, milling cutters, arbors, lathe face plates, lathe chucks and special dies. The motor merchanics pupils have overhauled and rebuilt practically over a hundred automobiles during that time.

Earns Operating Supply Costs

During the last year, the productive work of special trade pupils has carried the cost of all supplies required for the operation of the entire school. The average public school manual training shop is a clear outgo as far as expenditure is concerned. If the technical school were operated along the same lines, it would cost the taxpayers about ten thousand dollars a year for the supplies. Under the present management, it does not cost taxpayers a dollar. During the last year, the productive work has brought in enough to purchase all office, classroom, drafting, cooking, sewing, millinery, print shop, electrical shop, woodworking shop, machine shop, and motor mechanics shop supplies, also to cover the cost of publicity and chemical





View to left shows woodworking department. Right hand illustration shows physics laboratory

laboratory supplies, leaving a small margin of profit.

Business Organization

To accomplish this, the school is organized along business lines. There is a production system. Shop orders cover every class of work undertaken in the shops. Material and stores records are kept and each shop is debited with supplies and credited according to receipts obtained from work done, or material sold. There is a regular purchasing system with card price record, keeping the management acquainted with the varying cost of materials and supplies, A cost accounting system keeps record of detailed costs in every department of the school, so that it is possible for the vocational committee to know just how much the operation of the school costs. By this means, the cost of technical education to the taxpayers is confined to fifty per cent. of the cost of buildings and equipment and two-thirds the cost of instructors' salaries, and, in addition, caretakers' salaries and coal, power and light.

Instruction of Apprentices

In addition to regular all-day courses, special instruction is given to apprentices from over twenty firms one-half day per week. These apprentices come from the following trades:—patternmaking, machine and tool making, electrical work, drafting and printing. Related mathematics, drawing and underlying sciences of the trade comprise the course of instruction given. Printing apprentices from all news and job print offices study composition, advertising design and linotype operation. The progress made by apprentices in this shop and in other branches of apprenticeship has proved very satisfactory to employers for the last six years. Employers in Hamilton have continued this plan of part time instruction of apprentices voluntarily because the apprentices who have been permitted to avail themselves of this opportunity, have shown improvement in their several trades.

The enrollment during the year 1921-22 in day classes has averaged more than 700, over 600 of whom are boys. The girls' department is limited to 100 because of lack of space in the present unit. The new addition, together with the present unit, will provide room for 1200 all day pupils and over 1000 part time pupils.

Provision for Instruction of Permit Workers

When the provisions of the Adolescent Act requiring the attendance 400 hours each year of all minors between 14 and 16 years of age who are at work, goes into effect in September, at least 1000 will have to be taken care of in the technical school. In order to provide instruction, for number of hours specified in the Act it will be necessary to have an organization of courses and staff on lines differing from the all day courses. It is planned to operate these classes from 8.30 a.m. to 12.30 a.m., and from 1.00 to 5.00 p.m., five days a week and fifty weeks in the year.

By this plan, permit workers could be allowed to attend two different days each week. The four-hour period of instruction could be divided equally between classroom and vocational instruction. This method would simplify the problem from the employer's standpoint and at the same time meet the provisions of the Adolescent Act. This plan is proposed because there will always be a considerable number of boys between 14 and 16 years of age compelled to go to work for economic reasons and another class of boys of the same age who would be far better for the discipline of regular employment. The provisions of the act are wise in providing for the part time instruction of permit workers of this age. Statistics show that the majority do not possess a good elementary education before leaving school and the requirements of good citizenship make it incumbent upon the government to continue their education on a part time basis. When this forward step in education has been given a fair trial in a reasonable period of time, employers will approve of it. Several States to the South have carried on similar plans for part time instruction of permit workers of this age and after a decade of experiment found it perfectly satisfactory both from the standpoint of the employer and the citizenship.

During the year 1921-22, over 3700 pupils have attended the evening classes in 50 different courses. The range of subjects is indicated by the following list:

Arch. drwg., 1st year, arch. drwg., 2nd year, carpentry, 1st year; carpentry 2nd year, care and oper. autos, (men), care and oper. autos, (women), chemistry, analytical, chemistry, fundamental, cooking 1st year, cooking 2nd yr., dressmaking, electricity, 1st year, electricity 2nd year, electricity, 3rd year, electrical workers, elementary boys, (Sr. 3) No. 1, elementary boys (Sr. 3) No. 2 elementary boys (Jr. 4) No. 1, elementary boys (Jr. 4), No. 2, elementary boys, (Sr. 4), No. 1, elementary boys, (Sr. 4) No. 2, elementary girls, (Sr. 3), elementary girls, (Sr. 4), French, commercial, and linotype operation.

Then we have machine drawing, 1st year, machine drawing advanced, machine operation, millinery, motor mechanics, oxy welding, patternmaking printing, sewing, plain, sheet metal drafting, Spanish commercial, shop math., 1st year, shop math., 2nd year, shop math. 3rd year, stationary engineering, structural steel design, telegraphy, toolmaking, woodworking, 1st year, woodworking 2nd year, showcard writing and sign painting, commercial designing and china painting, clay modelling drawing from caste, still life painting and freehand drawing.

In motor mechanics and care and operation of automobiles, pupils were mostly garage workers, chauffeurs, truck drivers and car owners. One class of 12 pupils in one motor mechanic class operate on their own responsibility, a night service garage up town three evenings a week, where they are applying the instruction obtained at the technical school and at the same time making a profit. The instructor visits them each evening and when they get stuck on any class of work, explains it to them and they go ahead with the work. In patternmaking, pupils were mostly apprentices who were given the opportunity to do a class of work they have never been trusted with in the place where they are employed. The class in stationary engineering is composed of engineers studying for their certificates. They have followed the course laid down by the department and

(Continued on page 51)





Pattern-making department to left. Other view shows electrical department.

How to Place Equipment In Technical Schools

Manufacturers and Dealers Should Get In Touch With Secretary of Advisory Committee Mentioning Type of Machines They Have to Offer—Give Fullest Particulars in Order to Avoid Delay

HOW ARE purchases of equipment made for the various technical schools throughout the country? How can I sell the machines I manufacture, or handle to such schools? Manufacturers and dealers are vitally interested in both these questions, so Canadian Machinery, went to those in charge, asked for the official procedure and following is the information we received:—

First of all each technical school is under the management and control of an advisory committee. This committee is appointed by the board of education, and is composed of an equal number of persons belonging to the board. The gentlemen not belonging to the board, half of whom are employers, and half of employees, are chosen from the representative industries of the community. Such an advisory committee is intended to ensure a close relation between the work of the school and the needs of the local industries.

This committee has full charge of the establishment and management of the technical school, including the erection of buildings, the installation of equipment, the appointment of teachers, and the courses of study, subject to the regulations of the government and the approval of the school board.

The advisory committee may appoint a special committee for the purpose of determining the type and amount of equipment to be installed, and the secretary of the board is also secretary of the advisory committee. Manufacturers and dealers should communicate with the secretary of the board in making proposals for the sale of equipment.

Provincial grants are paid to local school authorities in support of the technical classes. These grants are paid on maintenance charges and on capital account for the purchase of equipment, or the erection of buildings.

When a local advisory committee has decided to purchase a machine or piece of equipment, they recommend to the board the desired purchase, then if the recommendation is accepted by the board, it is submitted to the department of education to see whether the government will pay a grant on the cost of the machine or equipment. The committee may make the purchase without the approval of the department, but in that case they will receive no grant on the expenditure.

As a general rule the type of machine needed in a technical school is the ordinary, commercial, up-to-date article of good quality, such as is used in the common machine shop. Special duty or one operation machines, or heavy duty machines as a general rule find no place in a technical school. On the other hand the machines must be heavy enough to turn out a good job of moderate dimensions. Combination machines designed to perform the duties of a number of machines are not satisfactory in a technical school shop.

Examples of the type of equipment usually found in a technical school are as follows:—

The woodworking mill room should contain a surfacer, a variety saw, a jointer, a band saw, four to six speed lathes, and a boring machine or hollow-chisel mortiser. Other machines will be found only in the larger schools.

The machine shop should contain from three to ten engine lathes, a shaper, a milling machine, a back-geared drill press, a sensitive drill, a hack-saw, a forge and anvil, and a tool grinder. In the larger schools the number of these machines may be greater, and other machines such as a planer may be added. All of these machine tools should be ordinary, standard, good quality articles, not heavy duty weight, or not too light in weight.

The lathes should be about 14 inch by 6 feet capacity. Lathes with a wide gap or a long bed are not ordinarily needed in a school. At least one of the lathes should be of the open train gear type, while the others may be quick change. At least one lathe should be fitted with a taper attachment. The question of whether the lathes should be all of one make or should be of different makes and types is an open one, with much difference of opinion about the matter. The weight of opinion seems, however, to favor the installation of a variety of makes. At least one lathe should be of what is called tool-maker's quality and design.

The method of drive varies greatly with local conditions, but generally the wood working machines have individual motor drive, while the iron-working machines are group driven from shafts.

Good Results From Individual Instruction

By GEO. W. ROBB
Principal Industrial Classes, Orillia, Ont.

THE ORILLIA evening industrial classes were organized in January 1920, and this is the third year of their existence. This year on account of the business depression and consequent reduced factory staffs, the initial enrollment for these classes, in Orillia, as in most other towns, was smaller than in previous years. In spite of this the board of education decided to carry on and classes were formed in millinery, dressmaking, arithmetic, English, mechanical drawing and shop mathematics. The classes opened on Nov. 22, and have been held on Tuesday and Thursday evenings from 7.30 to 9.30 and will continue until the end of March.

During the first year temporary rooms were used. Last year permanent quarters were secured, and several rooms in the central public school were fitted up.

The arithmetic and English class was organized to meet the needs of those who had not completed their public school education and also for those preparing for more advanced work. The work is largely individual and the subjects are taken up on alternate nights under Miss G. Watterworth, and Mr. J. C. Smith of the Collegiate staff.

Personally I have been in charge of the class in shop mathematics, and the text book used has been Warren and Rutherfords "Mathematics for Technical Schools." The course has however been modified to meet the needs of the class nearly all of whom are machinists.

Mr. E. G. Arens head draughtsman of the E. A. Long Co., has been in charge of the class in mechanical drawing. This has been a beginners' class this year, and the class started with the plain drawing objects, followed by freehand drawings of actual objects and complete detailed drawings from these sketches. At present the class are inking in the development of plane and curved surface and to complete the work for the year will make a detailed assembly drawing of some part of a machine, making a tracing of it.

Excellent work has been done in all the classes and the majority of students have shown their interest and appreciation by their regularity in attendance.

It is a matter of regret however that more have not taken advantage of these classes.

EFFICIENCY AND COMPRESSED AIR

Air when compressed and converted into a form of energy and power ceases to be "free;" fuel, machinery, equipment, and labor enter into making it an item of cost. And the cost of compressed air greatly rises, through any waste by leakage before final distribution to the tool which it operates, or to the points of its ultimate use. Due to leaks through joints in piping, valves, split pipe, defective castings, and wastage at a tool or machine, the over-all efficiency of compressed air is very often reduced 40 to 60 per cent. throughout the system.

Cutting Production Time in Four

Grinding Method Which Reduced Operation Time Seventy-Five Per Cent. and Increased Accuracy—Rounding Gear Teeth on Milling Machine—Producing Long Shaft on Automatics

By J. H. MOORE

TO IMPROVE production methods is the aim of every ambitious and successful executive. He is never content to lay back on his oars and say "Well we are turning out piece E.G.6 at 40 per cent. what it cost us three months ago." Instead of this self satisfied attitude, he is encouraged by his former successes, and is determined to go them one better in the next attempt. He is continually on the lookout for new methods of machining, and it is this idea which prompted the present short article. It will only scratch the surface so far as varied methods of performing different work is concerned, but perhaps among the ideas shown, one or two may be applicable to other plants. No particular type of work will be considered, but rather a few scattered examples of different opperations.

Automatic Work

Quite often a piece comes up, which at first sight looks too complicated for automatic work. Before making up your mind on such an important point it is always well to study the part very carefully, and if you are anxious to make it on an automatic, and are not yet quite convinced as to its feasibility. do not hesitate to ask for the benefit of the experience of others, viz, makers of such tools. Even if you do not use one of their machines, ask them anyhow, for you will find they will be only too willing to impart information.

Take for example the piece shown at Fig. 1. This is a rather unusual part for an automatic, yet it is being successfully made on a 3-in. multiple spindle machine. Fig. 2 shows the detailed tool layout of the part being machined, and from this all information of a mechanical nature can be gleaned. Fig. 3 shows the machine in actual operation.

At Fig. 4 we see a 1¾ multiple spindle automatic screw machine specially equipped for handling long shaft work. This view is taken from the forming side, but the length of shaft is clearly shown as 11-3/13-in. under the head, emphasizing the unusual nature of this type of piece for automatic work. The average conception of work suitable for automatic machinery is something not

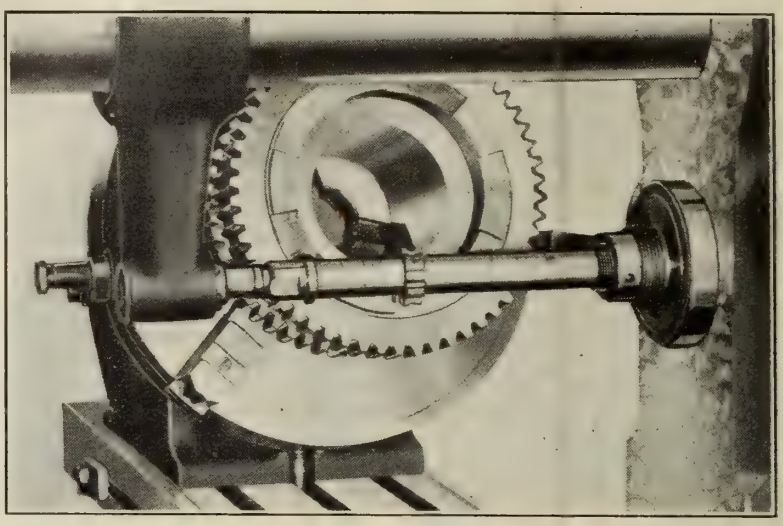


Fig. 6.—Rounding edges of gear teeth

The following firms were good enough to allow us the use of illustrations in this article: Figs. 2 to 5, National Acme Co., Cleveland, Ohio; Figs. 6 and 7, Rockford Milling Machine Co., Rockford, Ill., and Fig. 8, from Norton Co. of Canada, Hamilton, Ont.

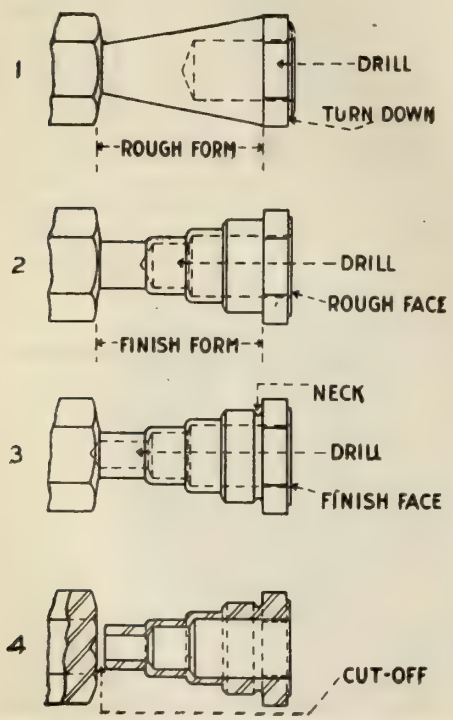


Fig. 2.—Tooling layout for piece shown in Fig. 1

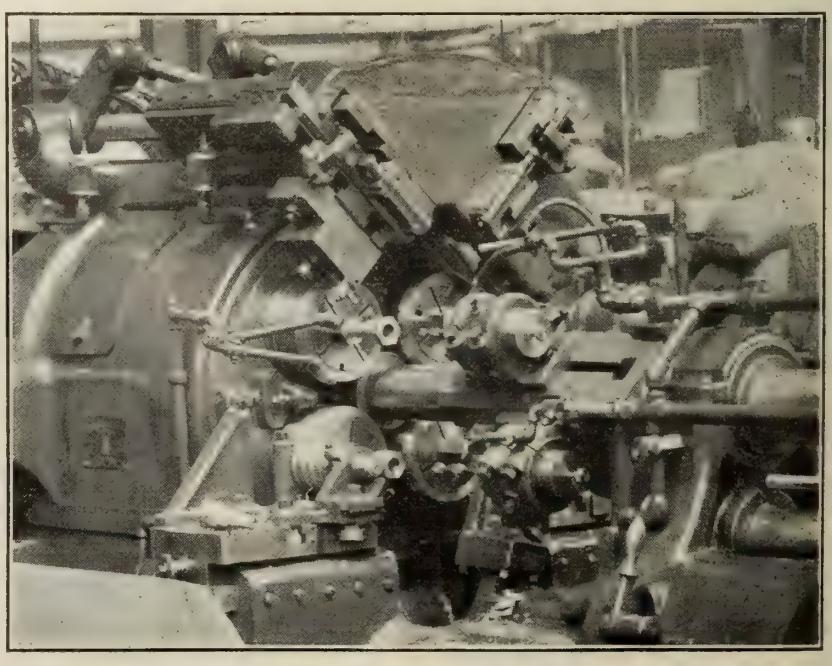


Fig. 3.—Multiple-spindle automatic producing piece shown in Fig. 1

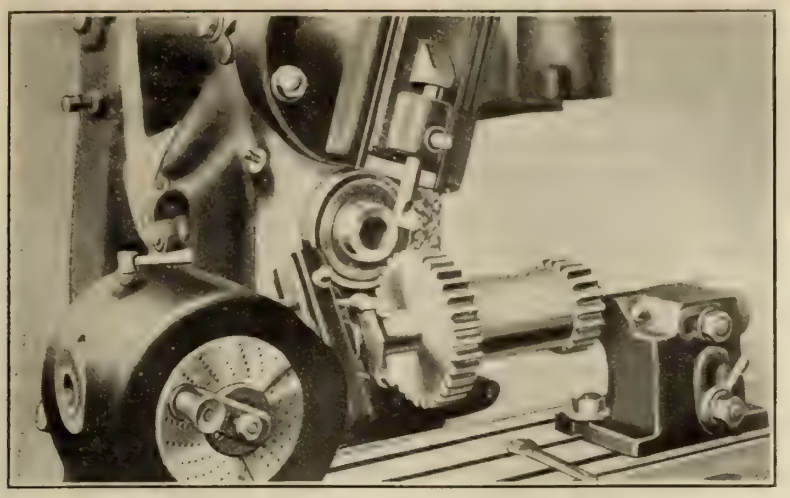


Fig. 7.—Special method of rounding gear teeth made of alloyed steel

too large or too long. Of course, this is an erroneous idea, and as mentioned previously, when in doubt ask for information.

In Fig. 5. we see the cutting off side of machine on the same shaft, and following is the list of operations. In the first position, the piece is turned for one third under head with auxiliary slide, and one third with a special turner.

In the second position one third is turned with special support and end is faced with stud turner.

At third station, the head is broken down and chamfered with a double deck cutting off tool and forming tool holder, while at the fourth position, the shaft is cut off and the stock fed out 11½-in. A special stock stop and stock feed is provided in the equipment on this machine.

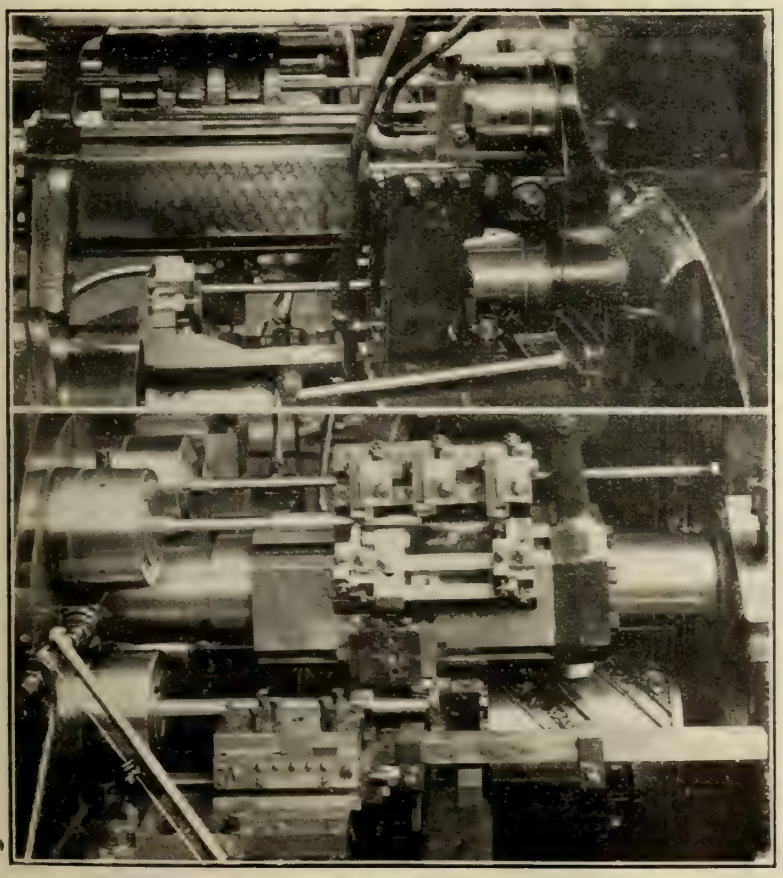


Fig. 4.—Automatic working on long shafts
Fig. 5.—Cutting-off side of machine

Milling Problems

The next two examples of parts completed are performed on the milling machine. Fig. 6 shows a steel gear held in a chuck on a dividing head, the teeth being rounded by means of the form cutter shown. This method of rounding teeth is out of the ordinary, yet it was found to save a lot of time and money for the firm using this method.

Another gear tooth rounding operation is shown in Fig. 7. In this case the gear is made of alloyed steel and it was found very inconvenient and costly to round the teeth on a regular gear tooth rounding machine. After adopting the plan shown in their own manufacturing plant, the firm allowing us the use of this photograph was able to save considerable time and money, and the time required to round each tooth is only four seconds. The gear is 8 pitch, and a regular 10½-in. dividing head was used in this case, as well as in the operation shown at Fig. 5. These two photographs prove conclusively that milling machines are exceedingly versatile, providing executives, give them a chance to show their versatibility.

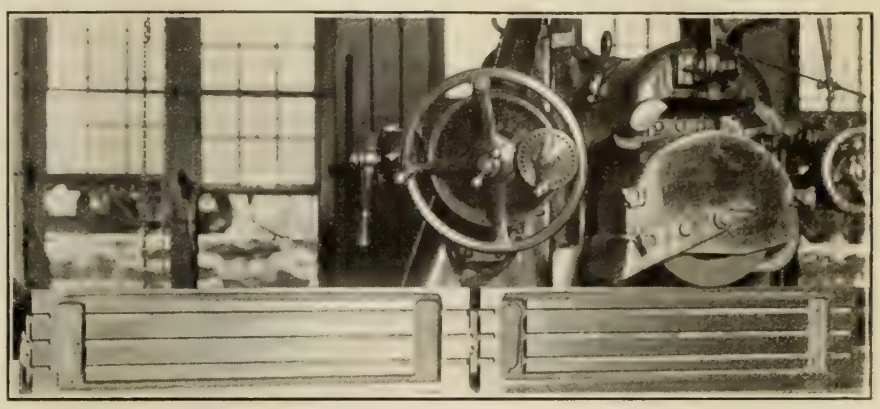


Fig. 8.—Surface grinding the sides of two milling machine tables

Grinding Tables

In going through a machine shop, there is perhaps no other work which impresses the casual visitor as more laborous or out of keeping with present day production methods than the scraping of ways of machine tools, or tables for the same. For some considerable time it was considered impossible to eliminate planing and scraping, but later, when grinding reached its present high state of perfection, this viewpoint was changed. Extremely accurate surfaces are now obtainable by means of grinding machines, and work is often completed in a fraction of the time necessary when planing and scraping is adopted. After the grinding no scraping is necessary unless the conventional frosted effect is wanted.

Fig. 8 shows a 10-ft. surface grinding machine surfacing the sides of two mil-

Continued on page 52

Students Visit Factories With Good Results

Academic and Practical Training Combined—Co-ordination and Co-operation Essential In Various Classes—Woodworking, Mechanical Drawing, Physics, Chemistry, Machine Shop Practice, and Many Other Lines Are Covered

By HARRY COLLINS
Principal Chatham Industrial School

AN ACCOUNT OF technical education in the City of Chatham may be accepted as a type of what perhaps with certain modifications and variations, is being accomplished in other cities with a population of about fifteen thousand and an average number of industries.

For the past four years what may be regarded as the nucleus of a technical school has been carried on in certain rooms of the Central (public) school, a building as its name implies, occupying a central position in the city, a factor of importance especially in connection with night school classes.

Conditions, as is the case with most beginnings on a small scale have not been ideal, but they have been sufficiently favorable to test out the general idea. We have gained much valuable experience and necessary information before launching out into larger expenditures required for more pretentious quarters and more varied equipment.

In brief, our experiment here has demonstrated the real need for training along technical lines, as well as the desire on the part of employees to take advantage of even the somewhat limited facilities so far provided.

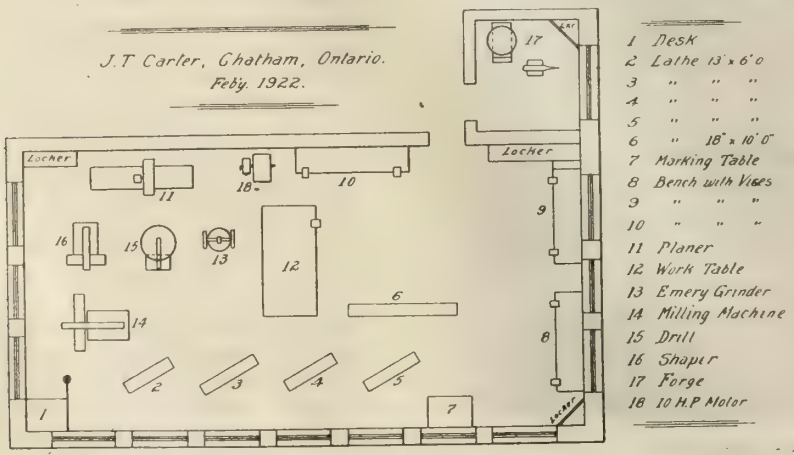
Thanks also to the splendid assistance rendered by the provincial and federal governments, both by way of substantial money grants, and by expert advice freely and cordially given by the Director of Technical Education and his able staff of assistants, the experiment in Chatham as elsewhere has not been a financial burden on the municipality, but has proceeded along safe and sane lines. In difficulties and discouragements incident to beginnings, the sympathetic and helpful attitude of the Deparment has been most timely.

Academic training goes hand in hand with the practical work of the shop. For example, when the student is using the micrometer and the vernier in the machine shop, the opportunity is seized to stress that department of the work in arithmetic, with a number of examples to be worked out by the pupil. Vice-versa, when the relation of temperature and pressure to the volume of a gas is being taught in physics, or the curve of solubility in chemistry, the good services of our mechanical drawing master are secured and accuratetly drawn graphs are made. Co-ordination and co-operation are essential in the various classes of a technical school, and they can be worked to advantage nowhere better than in the small school.

This account of technical education is necessarily limited to what is being done for the boy. The work for the girls proceeds along similar general lines based on the same general principles of co-operation.

The course at present is a three-years one, the first being of a preliminary nature, and omitted in the case of the more advanced student. The special subjects of the first year are woodworking and mechanical drawing. From the simple drawings made in class, the boys make models to scale in the woodworking shop, so that the drawing is a practical proposition from the beginning. These models are varnished and kept on exhibition, so that there is every incentive given to the boy to good workmanship right from the start. These models are also of assistance in our night drawing classes, where co-ordination of work is not so easy of attainment.

The advanced classes in drawing take up all branches of machine drawing, lettering, etc., and also have made industrial maps of the city and blue prints which have been used by the Chatham Chamber of Commerce as covering their requirements.



Showing Mr. Carter's conception of an ideal technical machine shop layout. Mr. Carter is a student in the school at Chatham.

The boys of the school, under supervision of the master, have also undertaken the installation of all machines, including line shafting, making of guards, work benches, and other accessories. In all cases where necessary or desirable, drawings of the work to be done have first been made, and the work has been thoroughly discussed in the class room in as informal a manner as possible. The boys are encouraged to express themselves freely without that stilted and formal style peculiar to some class rooms. Debates are also held at intervals on general as well as on special problems.

In the woodworking shop we have the following equipment:—

1 band saw motor driven direct; 1 small lathe motor driven direct; 1-9 in. x 10-ft. lathe run off line shaft; 1 disc sander; 1-12 in. jointer; and 1 combination rip and cross cut circular saw.

We require, but with our present accommodation have no room for, 1 emery grinder; 1 vertical sander; 1 tenon and mortise machine, and 1 medium sized lathe.

Besides the models already referred to, our boys have made very creditably a varied collection of table lamps, piano lamps, candlesticks, indian-clubs, rolling pins, wands, chisel-handles, book-racks, medicine cabinets, tables, a particularly fine office chair, and on one occasion during the Flu epidemic, to help out a local undertaker, the boys made fifty rough boxes. In the latter case, for obvious reasons we have not repeated the experiment. This work has been done in most cases from carefully sketched designs.

Machine Shop

Our machine shop equipment is as follows:—1-10 h.p. motor running line shaft; 1 Hendy milling machine; 1 Hendy shaper; 1-13 in. x 6 ft. South Bend lathe; 1-13 in. x 6 ft. Perfect lathe; 1-18 in. x 10 ft. C. M. C. quick change lathe; 1 London drill press; 1 double emery stone on stand; 1 power hack saw; 6 vises; 1-24 in. x 30 in. marking table; 3 work benches with vises; a collection of dies, etc.

We need another lathe, a grinding machine and other sundries, but shall probably not be in a position to handle these until we secure more commodious quarters. This question of a new building is our largest problem at the present time, and a special committee has the matter under serious consideration. Towards this end the Department of Technical Education has already made an exhaustive industrial survey of the City of

Chatham, and fifty copies of the same have been circulated among prominent parties and organizations.

The work done by the boys in the machine shop covers all forms of elementary machining, including bolts, spur and mitre gears, studs, etc. As in the case of woodworking, the work is done from drawings made in the drafting room and care is taken to see that the boys clearly understand each step of the process. During the past term, the workers in the night classes have turned out a very creditable single-cylinder gasoline engine, which ran without any trouble on the first attempt.

Visit Factories

Another phase of the work which we find valuable for many reasons is visiting the various factories in our district. Before visiting a factory we discuss what we are looking for. For instance, we visited the Dominion Sugar Company's plant to inspect among several other things, the practical application of a law in physics that we had studied in the class room, namely that a liquid boils under a vacuum at a much lower temperature than the ordinary boiling point. We have also visited in connection with other science lessons, such plants as acetylene welding, storage battery stations, garages, and spent considerable time on the open model of the Gray-Dort automobile at their sales room.

We also visited many other plants, large and small, and at a small electroplating plant the boys had that department of electricity clearly explained, and incidentally copper plated everything in their pockets that lent itself to that purpose. They have also visited the local hydro station several times and inspected the transformers and other equipment.

Our shop master has of course used this method considerably, visiting foundries, woodshops, machine shops, etc. We take care that time is not wasted in desultory wandering about a plant, which amounts to little more than idle dissipation. After a visit the various points of interest are discussed, and tests of observation given. Sometimes essays are assigned on various topics connected with the trip.

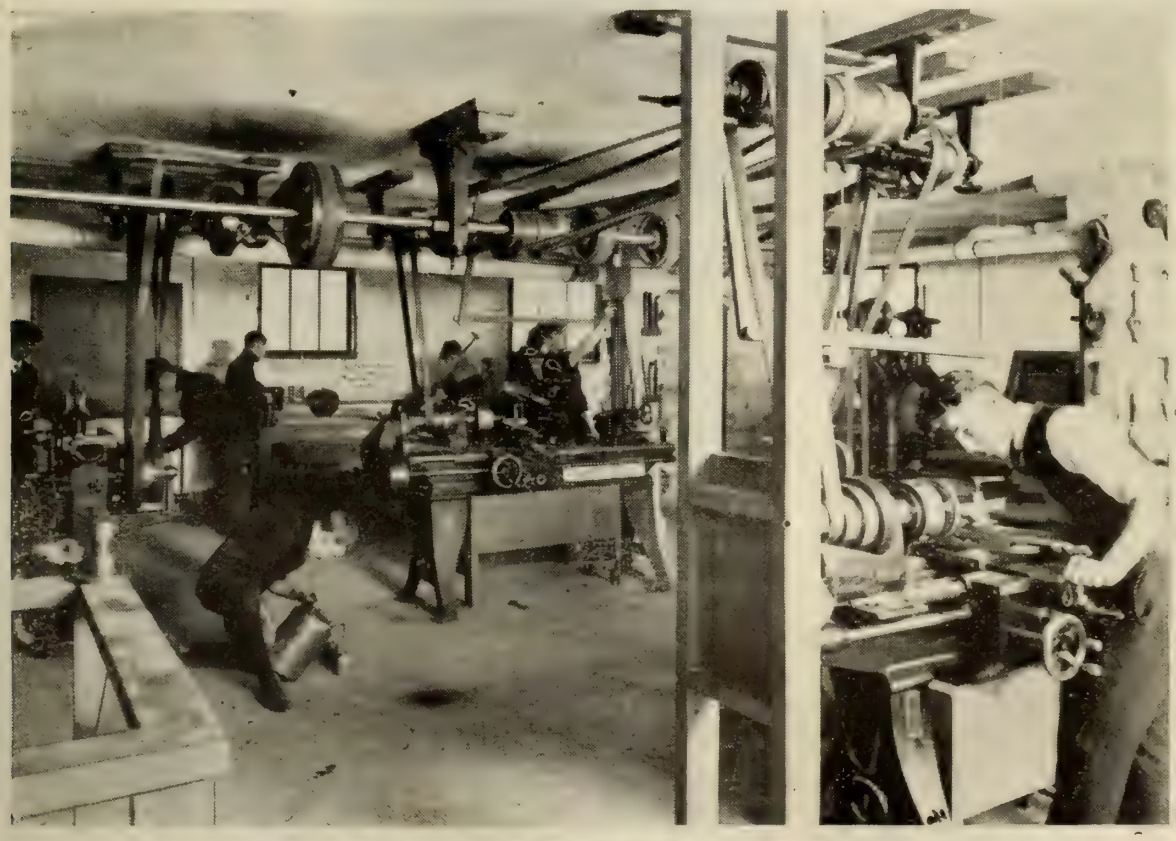
In technical education, as in fact in all kinds of education, much depends on the teacher. I know of no position demanding more exacting qualifications for a successful teacher than that of the shop master. In our school, the one teacher takes mechanical drawing, woodworking and machine shop practice. Fortunately we have a man who combines in a marked degree, the qualities of an excellent mechanic with that great quality of sympathy which wins at once the confidence and respect of the boys.

Our boys also take physical exercise but largely in the form of games. Baseball, basketball and football are the favorites. We have a team entered for showing. The industrial world needs and they have each year made a good showing. The indusrtial world needs good clean sports as much as it needs anything else, and our technical schools can do much in that direction.

Finally we need in our Technical school work, well balanced advisory committees. In Chatham we feel we have been singularly fortunate in securing right kind of men, our committee being well balanced between employer and employee. The members of the committee visit the day and night classes from time to time, and as a slight appreciation of their good work, the domestic science class puts on occasional luncheons which are declared to be unsurpassed by even the most exclusive chef service of our best hotels. Indeed one feels in writing an account like this that it is onesided in that it leaves out perhaps in some ways the better part of much of our work namely among our girls.

One of the members of our committee is this week entertaining a party of one hundred and twenty-five to an evening affair, that judging from past experience will be one of the real social affairs of the season. To get the general public interested in this training is an important part of the work of the principal and the advisory committee. Last year we had nearly fifteen hundred people visit our annual exhibition. Nearly one thousand dollars have been donated by various industries for scholarships for our day school classes and many prizes for night classes. We feel grateful to the public for many manifestations of interest in this important work of trying to help those who help themselves.

A descriptive booklet has just come to hand from the Bausch & Tomb Optical Co., Rochester, N.Y., covering their lines of metallographic equipment, featuring those outfits in which the inverted form of microscope is employed.



Partial view of machine shop in Chatham Industrial School

Wide Range of Instruction is Being Given

Subjects Cover Machine Shop Practice—Automobile Mechanics, Welding and Cutting, Mechanical, Structural and Mechanical Drafting, and Other Important Trades—Prizes Offered

By W. W. NICHOL, B.A.
Principal Ottawa Technical School

AN attendance of 5,000 students at the Ottawa Technical School being an increase of 1,000 over the year before and nearly 4% of the total population of the city is reported. This evidences, on the one hand, the very laudable ambition of the workers of the city for self-advancement along vocational lines, on the other, the fact that the school authorities have been leaving no stone unturned to provide the means by which this ambition may be realized.

The industrial vocational committee is to be congratulated on the results which have crowned their energetic endeavors. The new shops' building, which was completed last year, has accommodation for the following departments: machine shop practice, automobile mechanics, plumbing and steamfitting, building construction, painting and decoration, oxy-acetylene welding and cutting, electricity, chemistry, printing, mechanical, structural and architectural drafting. This with the accommodations already in use will give opportunity for imparting a very wide range of instruction in the practical arts. The committee has installed the most up-to-date approved educational equipment, and has provided instructors well known in the city as high grade master mechanics and experienced draftsmen.

Machine Shop

The machine shop is considered by experts to be particularly well equipped and laid out. The equipment comprises a Browne & Sharpe universal milling machine, a Ford-Smith plain miller, a planer, shaper, several different types of drills and grinders, an arbor press, hacksaws, vises, etc. There is a regular battery of lathes of the best commercial type. All the machinery is electrically driven from overhead motors on the group system. The tool room is fitted up in standard fashion, a place for everything, and everything in its place. Tools and other material in store checked out and in as required. Tool room management is part of every student's instruction. Adjoining the shop is a class room with equipment for special instruction in machine shop mathematics, calculations of speeds, feeds, etc. and for general instruction in the use of shop hand books, etc.

Besides the regular day pupils a large number of machinist apprentices attend special classes during each day. Their number has recently been augmented by some of the older men in the trade temporarily unemployed. The smithy which serves both the machine and automobile shops contains an electric forge and all necessary tools and accessories. An oxy-acetylene welding and cutting plant is installed and a Stewart triple-purpose furnace consisting of a No. 21 barium chloride furnace, a No. 28 oven furnace and No. 3 furnace for high speed steel complete with blower. The installation of an electric welding plant which is now contemplated, will make the department complete. Mr. J. D. Young, formerly of the International Marine Signal Co., and the department of marine is in charge.

Owing to the importance of the automotive industry and the popular interest taken in the subject the committee have spared no expense in fitting up the motor mechanics rooms. All the appliances used in the most up-to-date repair shops have been purchased and the students have a regular array of cars of



Machine Shop

the best known makes to work on. The instruction is most practical and no boy who goes through the course should have any difficulty afterwards locating a good situation. In the lecture room upstairs there are many pieces of sectionalized equipment, including an Armstrong Whitworth engine, Delco ignition and Stewart vacuum systems, Stromberg and Schebler carburetors, magnetos, etc., etc. No less than twelve evening class groups are enrolled in this department. The teachers are Messrs. T. C. Row and S. Clemens. The former is head of the department and regular day instructor. The value of the equipment in this and the machine shop will run very close to $20,000.

Woodworking Dept.

The woodworking shop is a large well lighted room equipped with 24 benches of newest design and sets of tools. The following electrically driven machines are installed: Five lathes, including a Preston patternmakers lathe, a 12 in. jointer, a 24 in. planer, a 36 in. bandsaw, one universal saw table, one wet tool grinder, one foot mitre machine and one wood trimmer. This is of course one of the main departments and is in constant use. It is in operation every evening in the week as well as Saturday afternoon. The courses are so popular that over 100 applicants had to be carried on a waiting list. The instructors are Messrs. W. S. Mann, head of the department, and Geo. Cole. Besides the millroom students also receive instruction in a large building construction room two stories high, building portable take-down garages, summer cottages, etc., all of which have a ready sale.

The plumbing and steamfitting department is in the capable hands of Messrs. S. Daughtry, chief city plumbing inspector, and Charles Fever. Last year the classes installed a modern five-fixture plumbing installation, some fourteen of the big supply houses donating the equipment and fixtures. Local No. 71, United Association of Plumbers and Steamfitters were so impressed with the good work done that they voted a large donation towards prizes. Another project which was well carried through was the installation of a full steam-fitting system, and much credit was reflected upon instructors and pupils. Both the plumbing and radiation systems referred to are in perfect working order. This season both have been completely dismantled and set up again, affording invaluable practice. The instruction consists of bench work, joint wiping, etc., shop drafting and calculations, etc.

Special provision has been made for instruction in mechanical and architectural drawing. Such drawing is an essential and fundamental qualification in mechanical and structural engineering. It is an indispensable accomplishment in a variety of occupations and often furnishes the key to promotion. This department is in charge of H. F. Ballantyne, B. Ss., and is carried on in a splendid large room, with a northern exposure, giving the best kind of natural illumination. Messrs. H. Etches, M. E., and C. E. Connell carry on large classes in the evenings in mechanical and sheet metal drawing and elementary machine design. Drafting is an obligatory sub-



Automobile Section

ject in the day school and is closely related to the work in the shops.

The science department is located on the second floor, a weighing room and a chemistry room and storerooms. The electrical laboratory contains a demonstrating switchboard of latest type with connection cables, field and charging rheostats, ammeters, voltmeters, etc. In addition there are stationary and portable motor-generator sets, various types of transformers and storage battery system. In fact there is every facility for individual experimentation with high power commercial current machinery. The chemistry room similarly contains, the very latest educational equipment, G. W. Bunton, B. A., specialist in science is in charge. Messrs. F. C. Mace, M. E., and A. B. Lambe, M. E., of the Dominion Power Board have charge of the evening classes in electricity.

The electrical construction shop has all the equipment necessary to give extended instruction in every kind of house installation. A skeleton two-storey, six-roomed house with only rafters and studding showing has been erected in the middle of the shop affording all the necessary practice in the various forms of house wiring. The shop is equipped with benches, etc., and is very busy night and day. The American Bank Note Co. donated the school their discarded telephone switchboard and phones and it is intended to work up instruction in day office installation and maintenance. Instruction in house wiring is in the hands of Mr. J. V. Cummings.

Printing Dept.

The latest department to be opened is that of Printing. This is under the direction of Mr. Wm. Lodge, for years an official in the government printing bureau and a well known labor leader. A splendid trade connection has been worked up and a class of 16 apprentices from outside the school are in daily attendance, besides the regular school classes. It is a model printing shop and splendid work is being done. The equipment cost in the neighborhood of $5,000. It is a matter of local pride that the type cabinets were built by an Ottawa firm, R. A. Sproule & Son, and are quite the equal of anything of the kind produced in America.

Last summer the school was greatly strengthened by the incorporation with it of the commercial department of the Ottawa Collegiate Institute. This enables the management to greatly extend its scope and usefulness and to offer a varied programme of a vocational character. I s aim is to provide a general academic education equal to that of the best high schools while at the same time providing that specialized training now so necessary if our Canadian youths are to be prepared for successful, useful and honored places in life.



Drafting Room

Besides the departments described above, in which the boys and men are specially interested, this article would be far from complete if reference were not made to the most remarkable enrolment of students in the department of home economics and household arts. Thirty class groups meet weekly for instruction in domestic science, 30 more in practical millinery and 50 in plain sewing and dressmaking of the first, second and third years. There are also classes in home nursing, conducted by the superintendent of the Victorian Order, and physical culture under competent instructors. Some 95 are enrolled in the former and 150 in the latter department. To accommodate the great number applying for the above subjects, it was found necessary to open classes at five other centres throughout the city.



Plumbing Shop

The whole system is under the management of the advisory vocational committee of the Ottawa Collegiate Institute Board of which Mr. A. A. Dion, superintendent of the Ottawa Gas and Electric Co., is chairman, and Mr. Cecil Bethune, vice-president of the Board of Trade is the energetic secretary. The other members of the committee are the following, all of whom have taken a very great interest in the cause of vocational education in Ottawa and are to be congratulated upon the success that has attended their indefatigable efforts: G. H. Bowie, who is also chairman of the Ottawa Collegiate Institute Board, J. McKinley, Geo. Patrick, A. E. Provost, J. Raitt, R. A. Sproule, Dr. S. J. McLean, Henry Watters, J. C. O'Connor, Jas. Watson, J. F. H. Laperriere, Allan Fleming. The principal, W. W. Nichol, B. A., who compiled this material, was formerly superintendent of education for returned soldiers under the Ontario Soldiers' Aid Commission, and says he has the able assistance of a staff of some 97 instructors in this most interesting work.



Building garage at Ottawa school

EDUCATION OF YOUTH IS MOST ESSENTIAL

(Continued from page 34)

The Industrial Education Act, under which the Provincial system of vocational schools was inaugurated, was passed in 1911. We have, therefore, reached the end of the first decade in the development of these schools. The growth during this period has been phenomenal. The number of schools has increased from one day school and eight evening schools with an enrolled attendance of 4,000 pupils in 1912 to thirteen day schools and fifty-one evening schools with an attendance of approximately 8,200. The growth has been stimulated by liberal grants for buildings, equipment, and maintenance from the Provincial and Dominion Governments.

The responsibility for taking the initiative in establishing a new school rests with the Continuation School Board, the High School Board, or the Board of Education, as the case may be, of the municipality in which the school is to be estab'ished.

Preparations Being Made for Greater Activity

Steel Corporation Sends Apprentices to School — Instruction Proves Beneficial—Advanced Pupils Study Industrial Work in Local Plants—Parents Interested

By G. W. RUDLEN, B.A.
Principal Sault Ste. Marie High School and Technical Institute

THE SUBJECT of industrial education in the day school for boys has occupied the attention of the High School Board of Sault Ste. Marie for a good many years. In the year 1912 an arrangement was made with the Algoma Steel corporation by which the apprentices in their machine shops should attend the high school on Friday afternoons from 2 p.m. until 5 p.m. at the company's expense, and should study those subjects, which along with the practical work they do in the machine shops, would best fit them for skilled mechanics.

The subjects studied are shop mathematics, machine drawing and elementary metallurgy. Although the boys receive instructions in these subjects for one half day a week, the company has found the plan so satisfactory that it has been continued to the satisfaction of all concerned.

About three years ago the principal of the school and the high school board began to realize that there were a number of boys coming to the school, who were spending a year or so in the first form, and because the subjects leading to matriculation or the teachers' examination did not seem to have any practical value to them, were leaving the high school, going to work in the industries of the city. I am not prepared to say that they were not getting something out of their high school course, because I believe that every boy who comes under the tuition of an enthusiastic and successful teacher of English literature, history, mathematics, and science, and who is induced to faithfully study these subjects in an earnest manner will be benefited. But they were spending a good deal of time on foreign languages, which did not appear to them to be of any practical value, hence they were becoming discouraged, and were leaving school sooner in life than was best for their own interests.

To meet this condition, a class was organized under the day industrial act, and these boys were entered in this course rather than in the regular high school course.

How They Spend Their Time

This is the third year of the experiment, and to-day we have twenty-six boys in these classes, seventeen in the first year, and nine in the second. These classes spend about half of their school time in the wood-working and iron working shops in the high school, and the other half they spend at mathematics, science, English and history. The second year students, this year, have begun to spend part of their time making investigations along various lines outside of the school. The last week in January, the class was divided into three groups, and sent out for an afternoon to make investigations on their own account. One group of three visited the water-works plant of Sault Ste. Marie, Mich., and another group visited the pumping station in our own city.

The third group visited the new court house buildings in the city and studied the heating system. Each group is expected to prepare a report of the visit which is to be presented to the class in a week or two. This programme has two purposes. It teaches the boys that what they are learning at school has a direct application in the industries in their own immediate vicinity, and shows them the application of the principles they are learning. By sending three of them together, and asking for a joint report it encourages them to discuss together what they have seen. Three boys will certainly not agree very long among themselves concerning what has happened in a two hour's visit to a plant, and the fact that they are led to discuss the matter among themselves, may possibly cause them to go back for further information which may be of the utmost value to them.

These classes are not as large in number as one might expect them to be in an industrial centre such as Sault Ste. Marie. The number of boys attending the high school is approximately two hundred, and of these, one in every eight is attending the day industrial classes, and the others are to be found in the regular matriculation courses. The reason for this I have not yet investigated far enough to be able to give a reasoned opinion concerning it.

Question of Opinion

Those who have been following the articles of Mr. A. Pound in the Atlantic Monthly will know that he takes the position that such education is not the best preparation for life spent in our industrial plants where mechanical machinery does so much of the work, and so powerfully regulates the lives of the worker, and that the greatest and best education which prepares him for a proper use of that part of his day which is devoted to leisure, rather than that which is devoted to labor. The report of the industrial education committee in England on the new education, points out the fact that industrial education will only intensify those class distinctions which in a democracy such as ours it should abolish.

We know that as a people we are naturally conservative in our tendencies, and that sudden change from the established order does not appeal to us. It may be for this reason that parents are not in a hurry to send their boys into a course of study which has not been thoroughly tried out, or it may be that somehow they have still somewhere in the back of their heads a feeling that literature and history and even languages are the subjects which will best prepare their boys for the sphere in life to which they hope they may attain.

The day industrial classes in the high school have been doing their work in the manual training department which is equipped with a drawing room, a wood room and a machine shop, and in the physical and chemical laboratories.



General view of machine shop at Saulte Ste. Marie Technical School.

Some of these rooms are not equipped satisfactorily for industrial classes, and so, accepting the grant of the Ontario the Dominion governments, the board decided to build an industrial and technical school in which all vocational training would be taken care of.

New Building

This building is being built at the present time in a location which is more centrally located than the present high school, and will provide accommodation for day industrial, household science, commercial and evening industrial classes.

The building has a frontage of 138 feet and it is 116 feet deep. The walls are of brick and cement, and the floor, mill construction. There are five regular class rooms, an assembly hall which will seat 600 people, chemical and physical laboratories. The household science department has a small home consisting of a living room, kitchen, bathroom and bed-room, with also a cooking and a sewing room. Iron and woodworking are taken care of in a machine shop, motor mechanics room, mill room, bench room and large draughting room.

We have not yet purchased the equipment for this school, but are at present working on it. We hope to open the school in September, 1922 and feel that it will ultimately fill a great need in enabling the school's of Sault Ste. Marie to meet the educational requirements of its future citizens. Following is the material we propose installing in the new school, and the information we regularly request when considering such equipment.

Machine Shop

Principal dimensions of all spindles, bearing sizes, belt widths and other particulars required for intelligent comparison of design of the various machines, must accompany the proposition, and sizes of all pulleys on countershafts and r.p.m. of same must be given for each machine.

One 24-in. metal working planer, single head, vertical and horizontal power feed table not to exceed 6 feet.

Five 12-in. engine lathes compound rests and power cross feed on all. Apron design such that power feed and lead screw cannot be simultaneously engaged. Drip pan preferred.

One lathe with quick change gears, and four without quick change gears, all to have hollow spindle and back gear.

One of the above lathes to be equipped with taper attachment, 6 ft. beds on all machines.

One 12-in. lathe cont. Prefer two different makes in this group of five.

One 16-in lathe, with quick change gear box, 6 foot bed, hollow spindle, drip pan, compound rest and power cross feed, apron design such that power feed and lead screw cannot be simultaneously engaged.

One 20-in. back geared drill, belt driven, upright wheel, lever and power feeds. Vertical adjustment of table only is required but no objection to vertical adjustment of head.

One belt driven sensitive drill, with one swing table, and one table adjustable for height preferred.

One 16-in. stroke belt driven shaper tool head with hand feed, with efficient chuck. Double backed geared.

One full universal milling machine complete with cutter arbor, etc., with dividing head.

Four jaw independent chucks.

Five for the 12-in. lathes, and one for the 16-in. lathes with plates threaded and fitted to the spindles.

One double end bench grinder for approx. 8 x 1 in. wheel.

One power hack saw, improved high-speed type.

20 vises, with parallel jaws, 10 solid, 5 rivol, and 5 adjustable jaws.

Tool Holders

Three straight ½ in. x 1⅛ in. x 6 in., three left hand offset ½ in. x 1⅛ in. x 6 in., and three right hand offset ½ in. x 1¼ in. x 6 in..

We also require several cutting-off tools, knurling tools, lathe dogs, cold chisels, scratch awls, boring tools, tap wrenches, taps and dies, monkey wrenches, stillson wrenches, drill chucks, dividers, calipers, surface gauges, combination squares, try squares, machinists' hammers, punches, steel rules, levels, drill gauges, thickness gauges and thread gauges.

Then we intend purchasing twist drills, countersinks, micrometers, reamers, bolts, sockets, pliers, twist drills, snips, soldering pots, depth gauges, and other kindred equipment.

We also require equipment for the forge shop, and this will include three 90 lb. steel anvils, three anvil blocks, three blacksmith racks, tongs, hardies, porkers, rakes, shovels, hammers, sledges, chisels, punches, etc., etc. In fact all equipment essential to a well conducted forge shop.

Wood-Working Dept.

In the wood-working room we will need the following machines, and in each case the principal dimensions of all spindles, bearing sizes, belt widths and other particulars required for intelligent comparison of design must accompany the proposition. Sizes of all pulleys on countershafts, and r.p.m. of same must also be given.

One 12-in. wood turning, manual training lathe, with outside face plate.

One 16-in. wood turning, manual training lathe.

One horizontal mortiser and relisher.

One swing arm tenoning machine with two coping heads.

One 10-in. buzz planer complete with guard.

One 24-in. pony planer.

One 8-in. four sided moulder.

One 36-in. band saw with full equipment of safety guards.

One universal variety double rip and cross cut saw.

One disc sander with drum.

Two wood trimmers, bench type.

We will also require twenty benches, a variety of planes, chisels, gauges, squares, levels, scales, saws, spoke shaves, hammers, mallets, clamps, scrapers, bradawls, carpenter bits, braces, screwdrivers, dividers, calipers, pliers, nail sets, and other miscellaneous woodworking tools.

In the drawing room we will need benches, tables, boards, instruments, tee squares, triangles, blackboards and similar equipment.

In the motor mechanic dept, we intend installing one complete vulcanizer for various tire sizes, the apparatus to be suitable for technical school instruction.

Four portable vulcanizers for quick road repairs.

One buffing machine.

One 1⅝ in. x 8 in. x 2 in. belt driven air compressor with suitable horizontal receiver equipped with air pressure gauge and safety valve, and three forges with water box.

SCHOOL IS RUN ON MODERN BUSINESS LINES

(Continued from page 42)

will try the examinations set by the department. The printing classes in the evening are composed of printers and printers' apprentices studying advertising design and linotype operation.

Large numbers from the trade attended the class in machine drawing, machine design, architectural drawing and design sheet metal drafting. Young men from the laboratories of various industries in the city attended the class in the fundamentals of chemistry or the advanced work in analytical chemistry.

The evening trade classes are serving a twofold purpose in Hamilton, first, in training workers to perform a more advanced class of work in their trade work, and opportunity to prepare themselves to find employment in a vocation for which they have some interest and aptitude. The value of evening class work, therefore, is to increase the skill of trade workers and to give other workers an opportunity to better their condition. This means much to the industries and to the workers.

All evening courses are definitely outlined and a prescribed amount of work covered in the fall and winter terms. All pupils who complete satisfactorily evening courses are granted certificates. Upon completing all the courses in a department, pupils are granted diplomas.

An interesting booklet has been received from the Kay Mfg. Co. of Norwalk, Conn., which describes the Whiting free floating coupling.

The Canadian Ingersoll-Rand Co., of Sherbrooke, Que., are distributing a new bulletin describing their Price-Rathburn type of oil engine. The booklet is well illustrated with photos and diagrams, showing all the important features of design and construction, also floor layouts for foundations and installation.

Many New Schools Are Being Considered

Vocational Education Surveys Have Been Made Recently—These Bring Out Varied and Valuable Information—Several Schools Now Being Erected—Others Will Follow

THE GROWTH of technical education in Ontario, in fact in Canada, during the past two years has been surprising. However, in the present material, we will confine our data to Ontario, and as Canadian Machinery obtained this information from an official source, it can be considered correct in every detail. There are at present 17 day technical schools in Ontario, and there are 57 centres wherein evening classes are operating.

The equipment used in these schools varies with the size of the school and the number of persons who are accommodated. It would be quite a task to state the number and kind of machines used in each school, but the various articles in the present issue will give readers some idea of the variety of equipment used. During the past two years vocational education surveys have been made in the following centres:— Arnprior, Belleville, Border Cities, Brantford, Chatham, Cobourg, Fort William, Galt, Guelph, Kenora, N. Bay, Oshawa, Owen Sound, Peterborough, Port Hope, St. Catharines, St. Thomas, Timmins and Weston. Since these surveys the following schools have been built, or are in course of erection at the present time:— Border Cities, Fort William, Hamilton, Niagara Falls, Sarnia, Sault Ste. Marie, Sudbury and Toronto.

The following places are considering plans and drawing up specifications with the hope of calling for tenders at an early date:—Kitchener, Guelph, Stamford, St. Catharines and St. Thomas and Renfrew.

Vocational Education

It is interesting to note that the question of providing vocational education has become a matter of serious consideration in each of the places which have asked for a vocational survey. In some of the places wherein surveys have been made it is not expected that this type of education will be provided for some time to come.

The vocational survey which has been made of these places provides such information as the following.—

1.—The types of industry found in the community.

2.—The attitude of the executive heads of these industries towards vocational education.

3.—The classification of employees—male and female.

4.—The classification of adolescents employed in industry.

5.—Courses which would be of assistance in training persons for industry—(a) before employment (b) during employment.

6.—Age, grade, classification of all schools.

7.—Number of adolescents not attending school.

8.—The possible attendance at a vocational school established in the community.

9.—Courses of study which should be organized to meet the vocations of the community.

10.—Accommodation necessary to house these courses of study.

11.—The locality in which the school should be located.

When the survey is completed the school board is provided with a copy of the report which contains not only the above information but the advice of the department of education as to what action should be taken.

The growing attendance in vocational schools which have been opened recently has dispelled any doubts as to the need of this type of education. The adolescent school attendance act is holding boys and girls in school until they have reached their 16th birthday. The greater majority of the boys and girls who left school at 14 years of age entered the industries as industrial workers. It would seem only fitting that these two years which have been added to the school life of these boys and girls should be made to mean as much as possible in knowledge and skill relating to their future occupation in industry.

GOOD WORK BEING ACCOMPLISHED HERE

By J. W. DAY

Principal Public School, Iroquois Falls, Ont.

IROQUOIS Falls, Ont., is very interested in technical education. J. W. Day, principal of the public school in that city sends Canadian Machinery the following information regarding their activities.

We have classes in English (for the non-English speaking), commercial French, electricity, mechanical drafting, mathematics, dress-making, and sewing (for girls).

We have 75 students enrolled in all, and the classes have maintained a good average since the opening in October. The classes are held in the public school on Tuesday and Thursday evenings of each week and continue each evening for two hours.

We have as yet, very little equipment, two sewing machines, drafting boards and drawing sets, drafting tables, tee squares, set squares, etc. We have also a small amount of very good equipment for the classes in electricity which is supplemented by equipment in the mill of the Abitibi Power and Paper Co., of which we have the use. We have been fortunate in securing well qualified and highly trained teachers for the instruction of the various classes, so that we are getting along very satisfactorily.



General view of Iroquois Falls school

CUTTING PRODUCTION TIME IN FOUR

(Continued from page 45)

ling machine tables, and in this case there are three operations, viz, grinding both sides and the top, from each end, of which .020-in must be removed. The tables shown is surface ground complete in one hour including time for handling.

Lathe carriages can also be ground without difficulty, and production time on 14-in carriages, 17-in. wide, ground in the manner shown at Fig. 8, and with .020-in stock removed three sides, is 6 every hour including handling.

Steel racks 4 ft. long, 1⅜-in wide, and ⅞-in thick, for a 14-in. lathe, were ground at the rate of 40 racks per ten-hour day. Four surfaces were ground, each to a limit of .001-in, and removing .020-in. stock from each side. This method reduced planer time 75 per cent., thus effecting considerable saving.

In grinding work of this nature it is impossible to lay down a hard and fast rule for the grain and grade of wheels to be used. The nature of the contact between wheel and work, and the nature of the material makes it practically necessary to experiment a little each time. The one precaution to observe is to be sure and have the wheel soft enough.

Student is Trained to Accept Responsibility

Bi-lingual Instruction Necessary in Montreal School—Separate Staff for Each Section—Age Limit of Fourteen Years for Beginners—Large Attendance at Evening Classes

By IAN McLEISH
Assistant Principal Montreal Technical School

THE MONTREAL Technical School was founded by the government of the province of Quebec and was incorporated by a special Act of Legislature on March 14th, 1907. In September 1911, the first buildings on the present site were opened for day classes, and in October of the same year evening classes were started. The school is bi-lingual and is open to all classes and creeds without distinction. Classes are given in both languages, each section having its own separate staff, so that to all intents and purposes there are two separate schools both using the same buildings and equipment.

The school is built on a lot of ground, over 150,000 sq. ft. in area, and the location is very central being almost equally easy of access from all parts of the city.

On the ground floor the building contains: the administrative offices and waiting room; the museum, where a permanent exhibition of the work done by pupils is displayed; a series of classrooms, forming a quadrangle around the large graded semi-circular amphitheatre which has a seating capacity of 600. On the first floor are located the teachers' rooms, library and classrooms. The second floor is devoted to two large bright drawing rooms.

The chemistry and physics laboratories and lecture theatres are located on the same floor as the basement, but owing to the slope of the land on which the school is built, they really are on the ground floor. Here also are located the locker rooms and dining rooms of the pupils. All the different sections of the main building offer the best conditions from the standpoint of comfort and hygiene. The class rooms are large and well lighted. A ventilation system of purified air provides a pleasant atmosphere at all seasons.

The heating system is through the medium of a forced hot water system, steam turbines producing the required pressure. The water is heated by exhaust steam from engines usually, but if necessary, live steam can be used. A modern electric lighting system is installed. Among the conveniences at the disposal of the pupils is a large waiting room with hygienic toilet rooms and shower baths. The very complete equipment of furniture was built especially for the institution. The apparatus and equipment originally installed has been augmented from time to time by direct purchasing and also by models, patterns, machines, and tools, made by the pupils.

The Mechanics Institute Library, situated in another section of the city, is open to the use of the students.



General view of foundry

The idea that imbues the staff of the school, is that students should not be taught only the elementary practical principles of a trade, but rather, they should be given as thorough and as wide a grasp of the practical problems of the respective branches they are studying as is possible, and in addition they should receive a good grounding in the theoretical and scientific knowledge of this same branch of engineering. The student then has a first class training, which, if he enters a shop as a skilled craftsman, will enable him to discharge his duties creditably from the beginning, and when vacancies higher up occur, he has had the training which, if it has been properly mastered, will permit him to take on added responsibilities. To those students more fortunately situated, a university course follows the technical school training, and it will be found that the duties at the university are considerably lightened, which fact enables them to go further into practical research, scientific reading, and to a fuller extent absorb the benefits of this latter course. Thus this school is not a trade school, but really a technical high school.

Behind the main wing of the building and extending almost to the rear of the lot, are located the workshops and the automobile school. These shops, which are laid out in much the same manner as the shops in industrial concerns, are provided with a complete equipment of modern machinery and resemble the layout of a large general contracting plant. Centrally located is the heating and power plant, which supplies light and power to all the buildings.

The Power House

This department contains two Babcock & Wilcox boilers, equipped with chain grates, and one De Launey-Belleville marine type boiler. The total boiler horsepower is about 500. Here also is installed the steam apparatus for the heating of the entire school. In the engine room there are installed four direct-connected electrical generators. These are:—

A duplex gas engine driving a Canadian General Electric 25 k.w. direct current generator.

A Robb-Armstrong horizontal engine driving a 125 k.w. Allis-Chalmers-Bullock direct current generator.

A compound vertical Bellis-Morcom engine driving a Westinghouse 75 k.w. direct current generator.

A Goldie-McCulough Corliss engine driving a 125 k. w. Allis-Chalmers-Bullock direct current generator.

In this department there is also located the air compressor for the foundry,

storage batteries with a 200 ampere-hour capacity, and the switchboard controlling high and power circuits.

Machine Shop

The area of the machine shop is 11,340 sq. ft. The machines are grouped in three sections, each section being driven by a 15 horse-power motor. A list of the machines is, ten plain 10-inch lathes; twelve screw cutting lathes made by various well known manufacturers, having swings from 12 to 18 inches; one tool room lathe; one geared head lathe; three screw machines, one of which is automatic; four shapers; two planers; one 7 inch slotting machine; nine drilling machines from 10 to 20 inches; one universal milling machine; one plain and one vertical milling machine; one profile milling machine; one pantograph milling machine; one universal grinding machine; one automatic gear cutter; five tool grinders; one buffer; two centering machines; two mandrel presses; a two ton portable crane.

In addition to the above there are the following large machines, each driven by its own electric motor:—six screw cutting lathes with attachments; one three foot radial drill; one horizontal boring mill; one three by four by eight foot planer; and tire lathe swinging 8 feet. The erecting bay is provided with a three-ton electric crane. The tool stores contain a full lin of hand tools, measuring and tracing instruments similar to those used in all modern shops.

The tempering equipment consists of two combination gas furnaces with pyrometers. There are eighty vises and 160 sets of individual tools. In addition to the above, a series of complete machines, including seven lathes, one power saw, one shaper, etc., have been made by the pupils and are now in operation.

The Smithy

The smithy has an area of 5,210 sq. ft. It comprises 24 forges, 24 anvils and one heating furnace. The draft is underground and is produced by a nine horse-power electric fan. A four horse-power electric motor drives a blower which furnishes the blast. The other equipment is a 170 lb. steam hammer, one 75 lb. belt driven hammer, an emery grinder,



View of machine shop looking down center aisle.

a bar shear, a post drill, two swage blocks, two blacksmiths' vises, and one tool bench vise. At the end is located the acetylene welding department, which is fully equipped with modern appartus for twenty students.

Foundry

The area of the foundry is 5,210 sq. ft. The equipment consists of:— one cupola with a capacity of two tons of iron per hour; one oil melting furnace; a combined cupola and a 200 pound crucible furnace. A two ton trolley installation completes the list. An underground installation for compressed air provides for the working of the elevator to the charging platform, and all the pneumatic tools and machines. There are two moulding presses. one core machine; one tenoning machine; one drill; ovens, one sand sifter, one sand mill, one sand mixer, two snagging wheels, one torch heater, and moulders' benches for 24 pupils.

The Woodworking Shop

The machinery of the wood working shop comprises eight belt driven wood lathes, four electric driven lathes of variable speed; one electric hand saw; one cicular saw; one gig saw; one buzz planer; one poney planer; one mortising machine; one tenoning machine; one drill; one shaper; two grindstones; one trimmer; one automatic band saw filing and setting machine; one knife grinder; and one band saw brazer. This shop includes thirty benches with separate sets of small tools for each.

Electrical Shop

The electrical shop of 2,714 sq. ft. area, adjoins the machine shop and thus students can make use of all the tools in





Left hand view shows woodworking department. Right hand view shows smithy room

the latter. The tools located in the electrical shop itself are:—one armature banding and heading machine; one notching press; one shear; one pair of smothing tools; and one buffer. Annexed to the electrical shop is a dynamo laboratory which contains the following machines:—one single phase synchronous motor coupled with a direct current generator; one direct current motor coupled with a three phase alternating current generator; one series wound direct current motor coupled with a shunt wound direct current generator; one rotary convertor; and one direct current motor coupled with an alternator giving single phase, or three phase current, as desired. A specially constructed switch board for experimental purposes provides for the making of any electrical connections or measurements as desired. Located in this shop is testing machine of 15,000 pounds capacity.

Day Courses

Industrial courses extending over three and one half years are provided. These day courses prepare boys and young men for the pursuits of industrial and commercial life. The work of the first year is of a general character. The work of the second and third years is specialized and provides definite training in various trade and callings. It is almost an unbreakable rule that boys under fourteen years of age are not admitted. However, in a very few special cases this rule has been inoperative. Students who can pass successfully an examination in the first year are admitted to the second year. The third year is devoted largely to practical work, fully fifty per cent. of the time being devoted to it.

The evening classes provide scientific and practical training for apprentices, journeymen, foremen, clerks, salesmen, and others who are engaged in industrial or commercial pursuits during the day; and who desire supplementary instruction in the application of science and mathematics to the trades, manufacturing problems, or other pursuits. Each student is permitted to select those subjects which will best help him to make progress in his particular trade or profession. All students are, however, recommended very strongly to precede their scientific courses with a good grounding in mathematics.

The basic idea behind the training in the Montreal Technical School is to train the boys to think for themselves, to use their own initiative. It is not a matter of memorizing a lot of data and formulae, so much as the understanding of the fundamental principles. Boys usually make their own choices as to the branch of studies they follow. The staff of the school assist them directly and indirectly all they can, to get positions or to arrange transfers to better positions. Full sized work is now standard practice as in some instances such product can be disposed of for sums that equal at least the cost of the raw materials.

Large Addition to School May Be Constructed Soon

By A. P. GUNDRY, B.A. Principal Collegiate Institute, Galt

TECHNICAL education is not being forgotten in Galt, although at present there is no machine shop section. Speaking to A. P. Gundy, principal of the Collegiate Institute, Galt, Canadian Machinery discussed present activities and future possibilities. Following is the result of the interview:—

Classes in shop mathematics are held, about 35 to 40 students attending. Some of the boys are further advanced than others and owing to this fact, no hard and fast rule of tuition is adopted. One might be studying long division, while another might be delving into problems in trigonometry. As much as possible the students are classified according to the extent of their previous knowledge of mathematics.

There is also a class of about 35 to 40 in mechanical drawing. Usually the students come from the apprentices in the various factories in Galt, thus adding to their mechanical knowledge. A three year course is adopted, and successful students receive a diploma at the end of each year. The classes run from October to April, and two nights every week are set aside for study.

The wood working department is devoted chiefly to cabinet and pattern making. Usually about twenty students attend, and the equipment consists of two wood lathes, one surfacer, one band saw and a C. M. C. variety saw with mortiser attachment.

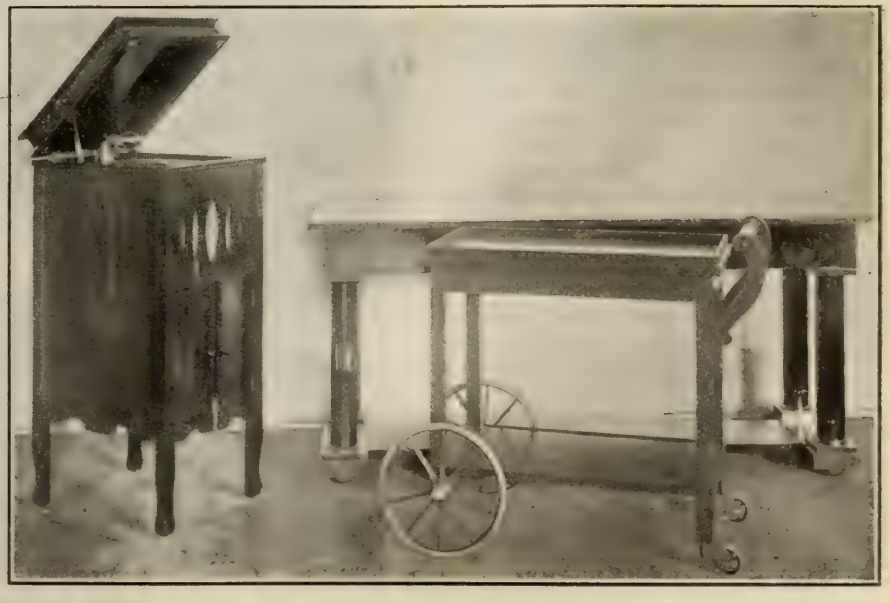
Classes have been held in automobile mechanics, although there is none this year. Prospects are bright however for a continuation of this subject. There is also a fifteen-week course in electricity, and about 20 students attend. This year, house wiring is being studied.

Then there is the regular day manual training classes, commercial work, home nursing, household science, etc., etc., but as the latter mentioned are not of special interest to readers we will not dwell on their activities.

The illustration shown with this article gives some idea of the class of cabinet and general woodwork being done by the students. These are only a few of many articles completed.

At present things are very congested. There is no space for many needed classes, and there is a strong possibility that a new wing will be added to the present school. In fact as time goes on, it is hoped that two wings will be built, as there is considerable ground surrounding the present site. The board are studying the problem of plans at present, and if this goes through satisfactorily, the first three floors will be devoted to industrial purposes, and the fourth to commercial classes. Mr. Gundry is an enthusiast, and there is no reason why Galt will not be able to do big things for technical education in the near future.

Tenders are being called for by the Guelph Board of Education for a new collegiate institute and vocational school combined, estimated to cost in the neighborhood of $320,000. The Department of Education will bear its share of the portion of the building devoted to vocational purposes. It will be erected on the present collegiate campus and besides supplying adequate class room for the overcrowded collegiate, which has been repeatedly scored by high school inspectors, will supply workshops for woodworking, machinery, motor mechanics as well as quarters for manual training, commercial work, etc.



Examples of Woodwork turned out by Galt Students

A Boy Must be Able to Use His Hands and Brain

Students Are Taught That the Fundamental Principles Must be Mastered Before Further Progress in Practical Work Can be Made—Ideas Regarding the Type of Equipment Necessary

By L. BISCAYART
Principal Three Rivers Technical School

THE THREE Rivers Technical School was opened September 18, 1920, and has been in operation since that time. Day c asses are planned for the boys who went through grammar school and who wish to acquire the technical knowledge, as well as the manual skill required for the formation of capable workmen, prospective foremen and superintendents.

The following trades are dealt with: joinery and pattern making, foundry, forging, machine work, tool making, and draughting. The instruction given is both theoretical and practical. The theoretical instruction has always a technical character and consists mainly in the study of arithmetic, algebra, geometry, trigonometry, physics, chemistry, applied mechanics, mechanical drawing, construction, technology, etc.

Practical instruction is given in four shops, namely the wood working shop, the foundry, the machine shop, and forge dept. During the first year, pupils are not specialized but spend a few months in each shop. These stages develop their manual skill and enable them to select with more certainty, the trade to which their talent or ability seems to be best fitted.

At the beginning of the second year, students select the trade they intend to learn, and devote all their time to that specialty until they graduate, at the end of the third year.

Wood Working Shop Equipment

The wood working machines actually installed are of standard make and include:—

Five high speed Blount lathes; one high speed Blount lathe with outer face plate for turning large diameters; one universal Crescent woodworker that is a compact combination of band saw, rip and cross cut saw table, boss planer, shaper, mortising machine, sand papering disc machine, grinder, borer, etc.

One pony planer that can handle material 24 in. wide by 8 in. thick; a dowel pin cutting machine; a saw filing machine; a saw setting machine; and a wet grindstone of large size.

The lathes, grindstone, dowel machine, saw filing and setting machine are driven by a 5 h.p. three phase induction motor. The universal woodworker has its own 5 h.p. motor. The pony planer is driven by a 10 h.p motor, and any further equipment installed will derive its power from this motor. The shop is equipped with eighteen stoutly built hardwood carpenter benches with grip and vise, with several drawers for the safe keeping of hand tools.

Each student is supplied with a cross cut and a rip saw, an 18 in. plane, a 14 in. plane, a jack plane, chisels of various size, divider, try square, gauges, wood turning chisels, mallet, etc. Step by step pupils are taught the use of all their tools. This is done by selecting exercises in which difficulties increase gradually. After having gone through about twenty-five exercises a student is able to plane, square, true up his work, to make tenon and mortise assemblies, dove-tails, framing, paneling and this at varying angles.

Special tools such as mitre box saws of Stanley make, Oliver wood trimmer, planes of all description, wood carving tools are available although not distributed to students as individual tools. An electric glue heater, a small veneer press, clamps of various description complete the wood working equipment.

Special students and night students that had previous experience, are trained in pattern making, carpenter work, stair building, etc. These are made at a reduced scale, but the same difficulties are to be found in their execution as if made full size.

The foundry has a cupola of Whitney make that can handle 500 lbs. of metal, a core oven, the necessary flasks, copes and molding tools to train twenty-four students on bench work.

Blacksmith Shop

This shop is equipped with eight Sturtevant underdraft forges, and as many anvils, one swage block, a 75 lb. belt driven hammer, and all necessary hand tools. A suction fan and a blower, built on a platform, are driven by a 10 h.p. motor.

Below this platform we have installed a Stewart oven furnace and a barium chloride furnace with the necessary fuel oil burning equipment, which is mainly a pressure blower driven by a 3 h.p. motor. Heat measurements are made with a pyroscope, one of the latest optical applications of photometry to the measure of high temperatures. In the forge are located five complete oxy-acetylene welding outfits of commercial size.

Machine Shop

The machine shop is equipped with the following:

Six South Bend 13 in. lathes; four



Views of heat treating department, automobile department, stair making and general wood working sections

South Bend 16 in. lathes; one Seneca Falls 16 in. lathe with backing and relieving attachment, tapering attachment, automatic gear shifting; one Preston 18 in. lathe; one universal turret lathe; one Rhodes slotter; one Rhodes shaper; two Whipp 16 in. shapers; one centering machine; one Springfield wet emery grinder; one Williams double head dry tool grinder; one wet stone grinder; one Greenfield universal grinder with internal grinding attachment and one Dumore tool post grinder.

One Bertram planer; one Racine high speed power saw; one Hendey universal milling machine with dividing head and all attachments for vertical milling.

The individual equipment includes, besides cold and cope chisels, files, hammers, punches, hack saws, dies and taps, reamers and drills. solid work benches with thirty-eight parallel vises. Needless to say such equipment can be used to make practically anything that can be turned, milled, shaped, planed, bored, or ground.

Students are first trained to chisel and file. This work is rather irksome to beginners, but we strongly believe that a mechanic, in the true sense of the word, should be able to use his hands skilfully, and nothing will reach that aim as well as filing. The various exercises are so designed as to increase the difficulty of the work, to match the rising skill of the pupils.

It requires a long training before a student is able to file and scrape a true surface and to make its sides square to dimensions. This is the "touch stone" by which we can gauge the mechanical instincts of our students. Those who understand our aim, will go doggedly through the hand blistering and tedious process of filing and make a success of it.

We want students to realize that before a boy can run, he must learn to walk, before he learns to write he must know his alphabet, and before he becomes a machinist he must know how to use his hands and his brain skilfully.

The machine shop has the use of the oil burning hardening oven furnace and barium chloride furnace for tool work, but for tempering smaller tools, we are equipping an electric muffle furnace of 3 k.w., that can handle all but the larger pieces and heat them to 1900 F., which is quite sufficient for all carbon steel tools. The pyroscope is also used for reading and controlling the temperature of this furnace.

Drafting Room

The drafting room is quite large, and can accommodate forty students without crowding. A Buckeye vertical arc printing machine is part of the equipment of this department. The physical and chemical laboratories are scarcely equipped, but all the instruments required to illustrate the fundamental principles have been selected. The same applies to the electrical laboratory.

Night classes are given in the automobile section. This includes one four cylinder, and a Ford chassis, in running order, a Pope four cylinder chassis, a Saxon six cylinder chassis. We also have two four cylinder engines, one large six cylinder Mitchel engine, a six cylinder Russell Knight engine, one eight cylinder Regal engine, one twelve cylinder engine, one single cylinder stationary engine, one 4 h.p. two-cycle marine engine, one 3 h.p. motor cycle engine, and a collection of dynamos, magnetos, carburetors, starters, coils of various description. This department will be improved with our financial condition.



Showing Machine Shop, forge and foundry of Three Rivers Technical School

Our stationary engineers' department is in an embryonic condition and includes for the present one vertical tubular 10 h.p. boiler, one 8 h.p. compound marine engine, one 2 h.p. horizontal engine, and one duplex feed water pump, one ¼ h.p. steam turbine.

Now we might draw a few conclusions from our experience in installing and equipping shops for industrial and technical schools. We will find people that will emit contradictory opinion with very good faith and great experience, but our conclusions might find favor with others, as they are based on sound common sense.

Some educators believe that a machine shop should be equipped with as many different types of lathes as possible, to give a chance to the student to vary his experience and to run any make of machine. The idea is a good one, and we accept it, but its realization is expensive for a school, and breakage will condemn a machine to idleness unless a stock of parts is carried for each one of them. By purchasing one type of lathe or perhaps two, spare parts required are fewer, and being interchangeable will make replacements a simple affair. We believe that working on one type of lathe, or on another is very much like driving different cars. An expert mechanic will not be long before he learns the secret of the automatic gear shifts, if he knows how to compound his gearing on the simpler lathe.

We have a universal woodworking machine that is giving us excellent service. It is well designed, well built, and while we do not intend to throw discredit to its makers, we feel that in a school where space is not an object, separate units are preferable. The reason is quite obvious. Woodworking machines are dangerous if carelessly operated. It is hard to watch a class of youngsters clustered around a universal machine, when the proximity of workers might cause accidents due to distraction, playfulness or carelessness. Besides, wood shavings and saw dust are thrown in between the frames, which make it hard to keep this type of machine as clean as school requirements demand. At the end of each period, the shops must be left in such a condition, that the next class will not be induced to leave them dirty.

(Continued on page 61.)

These Pupils are Classified in Order of Merit

Three Year Course—Examinations Three Times a Year—Tools and Materials Supplied by School—Registration Fees Paid in Advance—Skilled Mechanics Being Developed

By W. VAILLANCOURT
Principal Quebec Technical School.

THE QUEBEC Technical School was founded by the Government of the Province of Quebec and incorporated in March 1907. The present buildings were opened for day classes in September 1911 and for evening classes in October of the same year. The school is under the management of a board of directors whose appointments are indicated below:

Art. Picard, chairman; J. A. Marier, secretary-treasurer; G. E. Tanguay, and Hon. Frank Carrel, appointed by the Provincial Government; J. A. Lesage and Dr. V. Martin, appointed by the City of Quebec; J. H. Fortier, appointed by Board of Trade; Art. Paquet, M.P.P., by Provincial Government as Labor representative, and W. Vaillancourt, principal.

The teaching staff consists of the principal and the following professors: J. A. Buteau, B.S.A., C.E., mathematics and mechanics; J. R. A. Desy, drawing; M. Koetz, B.S.A., Ch. E., physics and chemistry; J. Thomas, mathematics; A. V. Dumas, El. Ch. E., mathematics, electricity and industrial technology. Shop work is carried on under the following instructors: M. Giauque, machine-shop; Jos. Gillaume, foundry; J. Halle, woodworking; A. Rousseau, smithy.

The Quebec Technical School is built on a lot of ground over 100,000 sq. ft. in area. The main building, 250 ft. x 50ft. contains the administration offices, the museum, the library, the class rooms, the laboratories, the locker rooms, the toilet rooms and an assembly hall.

The boiler-room contains two 100 h.p. Jenkes boilers and the heating force hot-water system apparatus. The engine-room contains three electrical groups with direct connections, viz:— 1. A 90 h.p. compound vertical Bellis-Morcom engine, direct connected to a D. C. generator. 2. A 35 h.p. Robb Armstrong horizontal engine direct connected to a D. C. generator. 3. A 30 k.w. motor generator set connected to the Quebec R. L. & P. Co. line. Since 1915, on account of the large demand on the coal market, our steam engines have operated only when the heating of the building can absorb the exhaust steam.

The machine shop has an area of 3,100 sq. ft. and contains the following machines: 16 lathes of different makes, 1 boring mill, 1 milling machine, 1 universal milling machine, 2 shapers, 1 slotting machine, 1 planer, 4 drills, 4 tool grinders, 1 centering machine, 1 mechanical saw, 1 mandrel. This equipment is installed on the group and motor drive principle. 1 Stewart gas furnace with an electric pyrometer is used for hardening and cementation of tools. 36 vises and 72 sets of individual tools complete the equipment.

The smithy has an area of 1,488 sq. ft. and is provided with 10 down draft Buffalo forges. An 18 h.p. electric motor is used to drive the blower, the fan and a 75 lb. hammer. One swage block, one blacksmith vise and one tool bench vise complete the equipment.

The foundry, having an area of 1488 sq. ft., is provided with one Whiting cupola of 1½ tons per hour; one 100 lb. crucible furnace, one molding press, one core machine, one sand mixer and 12 molders' benches.

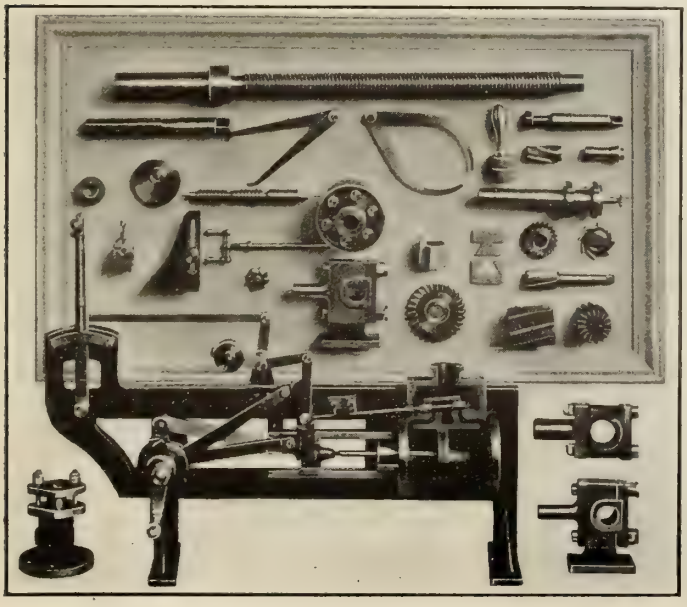
The wood-working shop has a floor area of 3100 sq. ft. and contains: 1 circular saw, 1 band saw, 1 jointer, 1 planer, 1 chain mortising machine, 1 tenoning machine, 1 boring machine, 1 shaper machine, 2 grind-stones, 1 automatic band saw filing and setting machine, 1 knife grinder, 6 wood lathes. These machines are of underground groups and motor drives. This shop includes 20 benches with 2 separate sets of tools each.

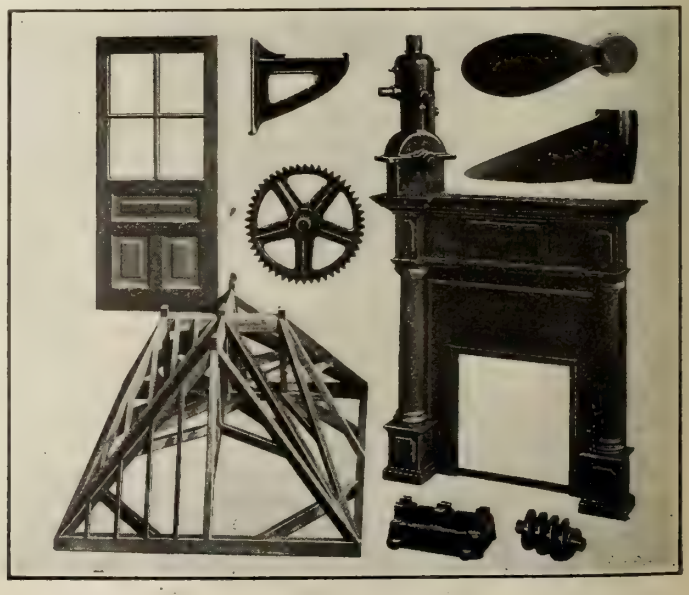
A two-story garage has just been erected with 6500 sq. ft. floor area and will be open soon as an auto school.

Day Courses

The day courses are organized for the benefit of young men who, having recently finished their elementary studies, are anxious to acquire the technical training and the manual proficiency necessary to become skilled mechanics, capable foremen or shop superintendents. These courses prepare for the following callings: pattern-maker, joiner, moulder, machinist, blacksmith, electrician, draughtsman.

The instruction is both theoretical and practical. The theoretical instruction is always of a technical nature and comprises the following subjects: arithmetic, algebra, geometry, trigonometry, physics, chemistry, electricity, general and applied mechanics, technical draw-





Showing samples of work constructed by students

ing, and industrial technology. Practical instruction is given in the following shops: wood-working department, foundry, smithy, machine-shop. These shops are provided with the best of material and equipment.

During the first year, students do not specialize; they spend four successive periods of about two months and a half in the machine-shop, smithy, foundry and wood-working department, in order to acquire the elementary technical points connected with each particular trade and to be in a position at the beginning of the second year, to specialize in one of the above shops. Draughtsmen specialize in the fourth year only, if graduated as machinist or pattern maker. Electricians specialize in the fourth year only, if graduated as machinist.

The day courses are given in the two languages. This is found necessary owing to the dual characteristics of the people in the Province of Quebec, and students, therefore, are divided into two distinct groups: the English section and the French section, according to their choice. Both sections however, are united for the drawing lessons and shop work. Home work comprises about 4 exercises per week.

To be admitted to the Quebec Technical School, candidates must pass an easy written examination on subjects selected from the programme of studies of the elementary schools. Applicants should be at least 14 years old. No one is admitted unless he has given satisfactory proofs as to morality, age, intellectual and physical fitness required by the regulations. The school keeps no boarders. Non-resident students must board in private families. A room is provided for boys who wish to bring their noon lunch to school.

The school is in session from the beginning of September to the end of June. It takes three years to go through the full course. No student may pass from one grade to the following one unless he has obtained the minimum number of obligatory marks. An examination is held three times during the year; and, as a result, pupils are classified in order of merit. A report giving the details of the standing is then mailed to the parents.

Official diplomas are awarded by the board of directors to students who pass a satisfactory examination at the end of their studies. The diploma specifies the course followed.

Tuition fees are fixed at $15.00 per annum for the first year, $40.00 for the second year, and $50.00 for the third year. They are payable in advance in ten equal instalments on the first of each month.

Copy-books, drawing materials, etc., are at the pupil's expense and may be bought at the school. Text books are furnished by the school; they may be purchased or hired; in the latter case, the charge is $1.00 per annum. Students should also be supplied with overalls for shop work. The school supplies free of charge all tools and material necessary to carry on practical work. Students are liable for the equipment in their possession. The school will not hold itself repsonsible for articles provided to students or belonging to them. A deposit of $2.00 is required of each student to cover breakage and loss of material. That deposit is not returned to students leaving the school during the year.

To receive full benefit of a shop technical education, the boys should be at least 16 years old and have completed their seventh year in the public schools. With such students, the weekly schedule could be as follows:

Subjects Taught	1st Yr. hrs.	2nd Yr. hrs.	3rd Yr. hrs.
Shop Work	24.	24.	32.
Industrial Drawing	6.	6.	6.
Technology	1.5	1.5	1.5
Mechanics	1.5	1.5	1.
Geometry	1.5	1.5	1.
Arithmetic	1.5	...	...
Algebra	1.5	1.5	1.
Physics	1.5	1.5	..
Chemistry	1.5	1.5	...
Electricity	...	1.5	1.5
Moral	.5	.5	.5
Totals	41.0	41.0	44.5

Scholarships covering the whole or part of tuition fees may be awarded by the directors to good students of first and second years when their family is deserving assistance. Scholarships are granted for one year only. They may be reduced or withdrawn entirely should circumstances warrant.

Evening Courses

The object of the evening courses is to give to workmen and apprentices theoretical and practical instruction to help them in the practice of their trades. Any applicant over 14 years of age and who possessses an elementary education is eligible for admission to the night courses. Fees are payable in full at the time of registration. A personal identification card is delivered to each student. Said card is to be shown when requested. No refund of tuition fee is made to any student who may leave during the term. Certificates are granted each year to pupils who successfully pass the final examinations or whose work, during the session, proves to be satisfactory.

Following is a schedule of the various courses:

Joiners:—Wednesday and Thursday, 7.30 to 9.30, 40 lessons, $6.00.

Pattern-Makers:— Wednesday and Thursday, 7.30 to 9.30, 40 lessons, $6.00.

Mechanics:—Beginners: Tuesday and Friday, 7.30 to 9.30; Trained pupils: Wednesday and Thursday, 7.30 to 9.30, 40 lessons, $8.00.

Blacksmiths:—Wednesday and Friday, 7.30 to 9.30, 40 lessons, $6.00.

Founders and Moulders:—Tuesday and Wednesday, 7.30 to 9.30, 40 lessons, $6.00

Firemen:—12 practical lessons: Friday, 7.30 to 9.30, 10 theoretical lessons: Wednesday, 8 to 9.30, 22 lessons, $5.00.

Stationary Engineer:—18 theoretical lessons: Tuesday, 8 to 9.30, 15 practical lessons: Thursday, 7.30 to 9.30, 33 lessons, $6.00.

The above two courses for firemen and engineers are organized in view of the examination to obtain a license.

Electricians:—15 practical lessons (wiring): Friday, 7.30 to 9.30, 30 theore-





Showing forge and machine shop

tical lessons: Wednesday, 8 to 9.30, 45 lessons, $8.00.

Mechanical Drawing:—Tuesday and Friday, 7.30 to 9.30, 40 lessons, $6.00.

Architecture, Drawing and Building Construction:—Tuesday and Friday, 7.30 to 9.30, 40 lessons, $6.00.

Automobile Chauffeurs:—Thursday, 8 to 9.30, 20 lessons, $8.00.

Applied Mechanics:—Monday and Friday, 8 to 9.30, 30 lessons, $6.00.

Ideal Machine Shop

To receive full benefit of a shop technical education, the boys should be at least 16 years old and have completed their seventh year in the public schools. With such students, the weekly schedule could be as follows:

	1st Year hrs.	2nd Year hrs.	3rd Year hrs.
Shop Work	17.5	20.	23.5
Industrial Drawing	6.	6.	6.
Technology	1.5	1.5	1.5
Mechanics	1.5	1.5	1.5
Geometry	1.5	1.5	1.5
Arithmetic	3.	1.5	1.5
Algebra	1.5	1.5	1.5
Physics	1.5	1.5	...
Chemistry	...	1.5	1.5
Electricity	...	1.5	1.5
Language	1.5	...	...
Moral	.5	.5	.5
Total	36.	38.5	40.5

Shop hours for the three years will amount to 3200 hours with 40 weeks in the school, or 400 8 hr. days (1 1-3 year.) One half of the first year machine shop time will be devoted to bench work and one fifth of that of the 2nd and 3rd years. For 100 students: 1st year 50; 2nd year 30; 3rd year 20; the machine shop should be provided with 100 individual sets of small tools: calipers, squares, chisels, hammer, files, vises' jaws (copper and lead), surface gage, punch. 50 bench vises, 3 emery wheels, 2 mandrel presses, 1 mechanical saw, 2 centering machines, 1 universal grinding machine, 2 universal milling machines, 1 vertical milling machine, 6 drills from 10 inch to 20 inch, 2 slotting machines, 1 planer, 5 shapers, 2 screw machines, 8 plain 10 inch lathes, 14 screw cutting lathes, 1 radial drill, 1 vertical boring machine, 1 horizontal boring machine.

If there is no smithy department the following should be added to the machine shop: 2 forges complete, 2 furnaces for tempering with baths, 2 welding outfits. Machine tools should be provided with attachments, at least some of each type. The tool store should be provided with all the modern tools used in the best shops.

The wood-working shop should be provided for 100 students with 100 individual sets of tools: chisels, try squares, bevels, gauges, tenon-saw, black plane, mallet, hammer, 75 joiner benches, 2 band saws, 1 automatic band saw and filing and setting machine, 2 combination saw tables, 2 shapers, 2 jointers, 1 knife grinder, 1 planer, 1 planer and matcher, 1 swing cut-off saw, 2 universal borers, 1 tenoning machine, 1 mortising machine, 20 lathes, 2 grinding wheels.

The pattern shop should be provided with a few moulders' outfits.

Students Bring Difficulties to School For Consideration

By J. DAVIES
Instructor in Shop Mathematics at Oshawa

OSHAWA evening schools commenced operations in the fall of 1919. The first machine shop practice class was held in the basement of the public library. The following year the class was held in the King Street school the accommodations being much better.

This year we have an enrollment of 18 in the class, and the ages of the students vary from 15 to 35. The majority are working at some branch of the machinist trade in Oshawa. We carry out the work as closely as possible to the following syllabus:—

1.—Measuring tools and how to use them—rule scale, micrometer, vernier, indicators. 2.—Tools usually found in machinist's tool kit—squares, combinations, bevels, protractors, calipers, etc. How to handle and test for accuracy. 3.—Drilling machine work. Setting up and holding all kinds of jobs—practical examples taken from the shop. How to select, use and grind— drills, cutters, reamers, boring bar tools, etc., feed and speeds with arithmetic for calculating same and time required for different jobs. 4.—Lathe work—centering, straightening and driving the work, thread cutting, turning cams, tapers, face plate and chuck work. Fractions, decimals, ratio and proportion will be taught in order to make the necessary calculations for thread cutting and taper work, etc., with many practical examples of running fits, drive fits, force fits and shrink fits. 5.—Milling machine work, gear cutting, plain, taper and spiral reamers and cutters. How to use the dividing head for spacing—calculate change wheels for gear cutting with the different angular calculations required to set different classes of work. 6.—Grinding on universal grinder, laying off and making templates bench work, shaper and planer work. The elements and application to workshop problems of trigonometry as far as the time and the progress of the class will permit. The class meets twice a week from 7.30 to 9.30 p.m.

We make the class as interesting as possible. Various tools, jigs, and machine parts are borrowed from local factories and the students are asked to describe how they would perform the various operations involved, care being taken to select some tool or operation which involves some mathematical calculation.

The students are also invited to bring any of their shop difficulties to school for consideration. Sometimes the programme is varied by asking them to write out in detail how a certain piece of work should be performed, with a description of tools and jigs required. The time required, with the probable cost of production is calculated and by this means we get quite a number of original ideas. Each of these ideas are carefully examined and without mentioning any names, the merits and demerits of proposed methods are freely discussed.

One of the greatest difficulties in a class of this kind, is the time it takes to teach the fundamentals of arithmetic before they can be applied to practical work. Some of the students are much more advanced than others, but the students show a fine spirit of co-operation and are willing to help each other and give and take a little.

The principal, Mr. A. E. Garbutt, and the board of education are doing all that is possible to make these classes a success.



Orillia school. Article appears on page 43.

Taught to Select Best Machine for Purpose

By J. D. DICKSON, B.A.
Principal Collegiate Institute, Niagara Falls

THE Niagara Falls Technical school which, with the present equipment, cost about $230,000.00 and was completed over a year ago. It contains a well equipped woodworking room, a fully equipped machine shop, an up-to-date household science room, with an electric range, electric ovens and twenty-two electric plates for the students, a dressmaking room, a draughting room, a typewriting room, three large class rooms and three laboratories viz. physical, chemical and electrical.

The day classes are provided with a three years' course in commercial work, technical work for boys, and homemakers' course for girls.

The evening classes have a wider range with less academic and more practical work. There are classes in all commercial departments, salesmanship, English, mathematics, cooking, dressmaking, millinery, mechanical and architectual drawing, woodworking, machine shop practice, oxy-acetyline gas welding, electro-plating and practical courses in electricity.

The woodworking room is 60 ft. x 32 ft. and the machinery in it consists of a circular variety saw, a band saw, a pony planer, a jointer, a hollow chisel mortiser, and three wood turning lathes all of which are run by individual motors except the lathes which are run on a line shaft.

These machines are arranged across the ends and down one side and the twenty-one work benches with a full set of tools for each fill up the rest of the room. The photograph shows how the machines and benches are arranged.

Methods of Tuition

In the woodworking room a student must learn to know the name of each tool, what kind of work it is best fitted to do, and how to use it. This takes some time. A good deal of practice in the use of tools takes place before one is allowed to use the machines. Further, a progressive system of mechanical and geometrical drawing has been co-related with his practical work from the very beginning.

In using the machines the same order is allowed viz. the name, its use, and how to use it. It requires a good deal of training and experience on the part of a student to select, in every case, the best tool or the right machine for doing a certain piece of work. The work in drawing is continued up to the point where the student can at least make and interpret ordinary blue prints.

The machine shop is 45 ft. x 32 ft. and is equipped with three lathes, two of them C. M. C. 16 in x 6 ft., and one a Walcott 14 in. x 6 ft., one Brown and Sharpe No. 2 universal milling machine, one No. 6 perfect grinder for tool grinding, one Champion drill press, one No. 4 arbor press, one Racine 6 in. high speed saw, one Globe universal tool and cutter grinder, one 16 in C.M.C. Shaper, one small hand forge with anvil, sledge and tongs and a bench eighteen feet long on which are placed five vises.

The motor which drives all these machines is a Crocker-Wheeler 7½ h.p. which runs at a speed of 750 r.p.m. Each machine is belt driven and the speed of the line shaft is 220 r.p.m.. The line shaft, 1 15-16 in. in diameter and 18 feet long, is supported by four hangers with S. K. F. ball bearings.

An outline of the course to be followed in the machine shop has been worked out and carefully arranged by the department of education and this has been found to be of the greatest service for the guidance of the teacher. It would be neither interesting nor profitable to list the apparatus in the different laboratories further than to say that the equipment in the electrical laboratory is considered to be the best that can be procured. Canadian Machinery has had an opportunity of looking over several of the drawings made by students in this school, and they are very well prepared indeed.

BOY MUST BE ABLE TO USE HIS HANDS

(Continued from page 57.)

Individual drive, for machines, has many points to its advantage in factories where production is the first aim. In a school the problem is not the same. We prefer to use small motors say 5 h.p. driving a few machines to its full capacity. This is more efficient, electrically, than the single unit that is not always working at full load. It is quite simple, and belt drive can stand more punishment and abuse than any other form of transmission without ill results. Machines should be arranged in such a way as to group them together so as to avoid running a motor for one machine only, for any length of time.

We feel that the time has come to make an appeal to manufacturers regarding our schools. We beg their indulgence for the youths that come out of them, their heads swollen with hopes and self-confidence, believing they "know it all."

Give them a chance to learn to work the way you want by applying what they have learned. Their first attempt may not prove a success, but the material for quick improvement has been drilled into them. They are like well trained soldiers who have not been to war. It takes time to turn the best soldiers into a mature veteran. Do not condemn technical education on the ground that the boys are not taught what they need, and remember your own past experience. You had to start at the bottom, struggle along the best you could, and find sometimes that you were handicapped for the lack of knowledge along some particular lines of your work.

Technical education, cannot turn out a ready-made perfect product. We aim to teach our students "to learn" to walk in life by showing them their first steps.



General view of woodworking department in Niagara Falls School

Practical Ideas for Shop Executives

HOW TO MAKE YOUR OWN ALUMINUM CASTINGS

By D. A. Hampson

The title does not imply that every shop ought to do that as standard practice but its purpose is to describe how any shop at a remote distance from an aluminum foundry or any small iron foundry may do this thing in emergencies. Not that such action has been impossible before but the average routine mind would put the job in the specialist's class.

Suppose a small casting is wanted in a hurry, or an aluminum pattern, or set of patterns for a gate is required for the foundry. If there is enough aluminum available and some sand, even though it be not molding sand, it is possible for the mechanic to get along with the job. Of course, a job of cored work or an intricate shape would be beyond the ability of anyone not a molder or, at least, with a thorough knowledge of molding practice. But the work we have in mind has one face nearly flat and the draft all one way, as a half pattern for a small iron pulley or a pattern for a pipe flange.

Having prepared the sand, a flask must be secured, and this may be an ordinary box into which the sand is dumped; the writer has seen larger castings made this way by bedding them in the floor, the "floor" being a pit dug out in the yard into which the sand was shovelled, and the furnace being a portable forge. Having prepared the mold, the aluminum scrap is heated in a cast iron babitt ladle in whatever means is available—a forge or furnace, as the case may be. Aluminum melts at 1,200 degrees F. and cast iron at 2,300 degrees, so there is little danger of injuring the ladle—hardly more so than with some babbitts. If the job was done in a foundry, heating would be done in one of the braziers used to warm the place and the fire would be of coke. A blacksmith's fire will do in other cases. As with all pouring, the furnace should be near the work and the workman should wear goggles—the latter being especially important in the case of an amateur.

The resultant casting may not be a work of art nor will it have been scientifically mixed but it fills the bill—and who can deny that good practice is anything else? In numerous cases, this method has supplied needed parts in two hours that otherwise would have entailed a week's delay. The writer has tried to have some molding sand about the shop at all times for the above purpose and for lead castings and for pattern makers' use. There are instances where a lead casting is wanted from an existing pattern; a box about 18 in. x 24 in. x 12 in. deep filled with sand answers the requirements for this work. Then, too, it is educational for a patternmaker to stick a pattern in the sand and try to draw it—he acquires respect for the molder then and there, and his patterns will be more workable from that minute. A little time spent in making a mold and placing a sand core therein will often show that the design is not what was intended and that alterations are necessary.

CUTTING LARGE THREAD

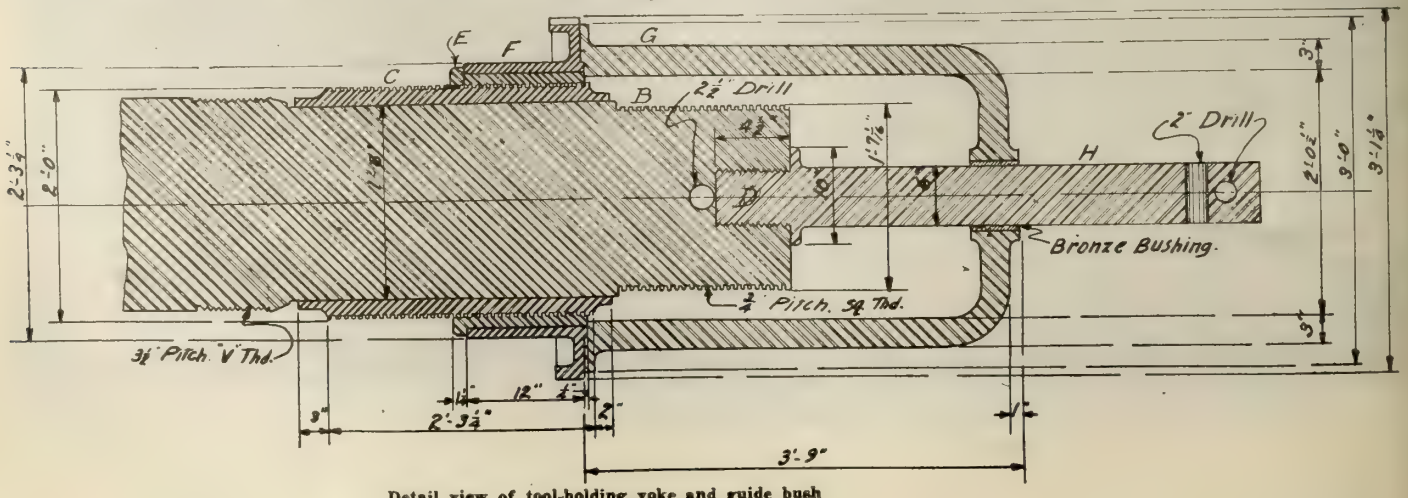
By G. F. Roberts

How would you cut a square thread on the end of a large shaft weighing approximately 25 tons? This was the proposition we ran up against a short time ago, and needless to state, we soon made up our mind that this was no ordinary lathe job. The shaft was 29¾ dia. at the largest point, and was 23 ft. 2 in. length over all. The thread required was ⅜ in. pitch for a distance of 18 inches.

We decided something special in the nature of threading apparatus was necessary, and luckily the construction of the shaft helped us out in this repect. Readers should refer to both Figs. 1 and 2 from time to time when following this description, but special attention is directed to Fig. 2, which shows the detailed sectional view.

Considering Fig. 2, we note a shaft or support H screwed into a central threaded hole O. Luckily this hole was already in the shaft, so all we had to do was fit the end to suit the hole. We next made a threaded bush C. to fit over the 20 in. portion of the crusher shaft, and fastened this bush to the shaft by means of suitable small screws. The thread on this bush was exactly the same pitch as we wanted at the portion B. Next we made a mit E. to suit the thread on bush C., and fastened to this mit the gear F. To this gear we attached the spider G. in the manner shown. Note that the guide shaft H. fits in a bush in spider G.

Before going further with the description of Fig. 2, let us revert to Fig. 1. Starting with the large gear F mentioned previously, we find that it meshes with a wide face pinion, which in turn drives a 30½ in. diameter gear. From this point, an 8¾ in. pinion meshes with a 30½ in. gear, the pinion being on the countershaft shown in sketch. Referring for a moment to the spider, G, we find that a tool is fastened in the block A, by means of two set screws. Now suppose we are ready to cut the thread at B, remembering, that the old thread was first turned off. We supported the shaft about 3 ft. from the floor, and of course, owing to its extreme weight it never moved. In other words, the cutting tool revolved in this case instead of the work. The main countershaft shown operates at 5 r.p.m. while in the cutting direction, and in backing, speeds up to 12 r.p.m. By the time the power reaches the gear attached to spider G, the speed is considerably reduced, so that there is not too high a



Detail view of tool-holding yoke and guide bush

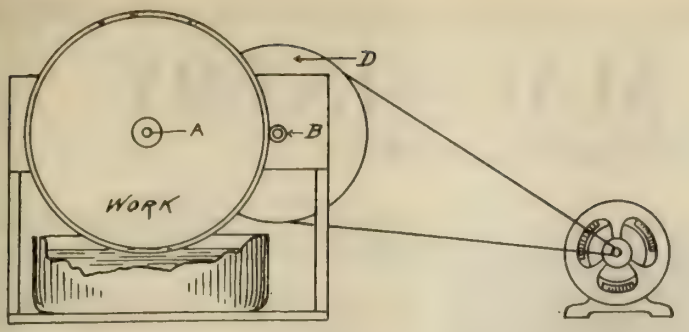


FIG. 1.

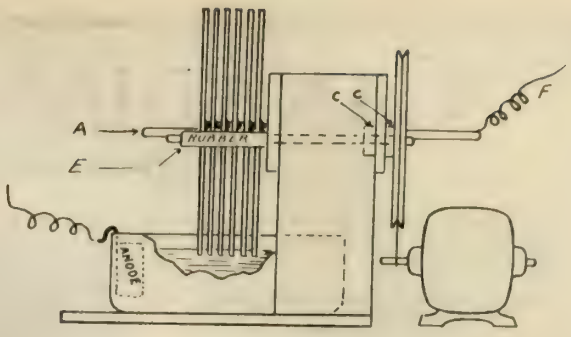


FIG. 2.

Showing method used in gold-plating edges of phonograph discs

speed when cutting such a large piece. Once the power reaches the gear F, it makes the spider G revolve carrying the square thread cutting tool with it. The mit E, moves up the thread on bush C at the proper speed and pitch thus cutting a perfect thread in a very simple manner. This same principle can be carried out on any work which is too big or heavy to swing in the machine.

GOLD PLATING PHONOGRAPH TURNTABLE EDGES

By CHAS. E. HALL

A makeshift arrangement for gold-plating the edges of phonograph turntables is shown in the accompanying sketches. As there happened to be quite a few required, and as gold plating is an expensive operation, only the exposed edge of the turntable, and about ¼ in. of the surface all round was to receive the plating. A wooden frame was made as shown, of suitable dimensions to take the dish containing the plating solution between the uprights. A hole was bored through the two side pieces of the frame, to take a brass rod A on which the work was to rotate, at a height which would just permit the edges of the turntables to dip the required distance in the bath, Figs. 1 and 2.

The brass rod was stationary, and a loose fit for the holes in the center of the work. A turntable was placed on the brass rod, and a ½ in. hole bored through the frame in line with the edge. B, Fig. 1.

A piece of ½ in. cold rolled steel was used for a shaft, and a rough turned wooden pulley with a grooved edge, forced on the end. A piece of soft rubber tubing about 6 in. long was slipped over the other end of the shaft, which was in contact with the edges of the work, and served as a driving medium, E—Fig. 2. Two wooden blocks c.c. Fig. 2, held in place by wood screws, acted as collars and prevented end play.

The whole contrivance was driven by a small motor, the cord belt running directly on the motor shaft, as shown, which did the work slowly, but constantly rotated in the plating solution at a given depth. The work could be slipped on and off the end of the brass rod without stopping the motor, which saved a lot of time when scratch-brushing the work, as another batch could be in the solution while this operation was being performed. The work was handled six at a time, the rubber sleeve on the shaft being long enough to drive that number. The current was conducted to the work through the brass rod F-Fig. 2. This arrangement proved to be highly satisfactory, and only took a couple of hours to rig up.

HANDY WHEEL PRESS

The placing of large spur wheels and pulleys on tightly-fitting shafts is a process which generally has to be done by hand and almost invariably involves very arduous labor. An ingenious press has been constructed in Great Britain for the purpose of performing the operation quickly and easily. The wheel is carried on a stand, the upper part of which can be moved under the action of a long vertical lever. When the lever is depressed it operates a pawl and ratchet wheel and thence through spur reduction gear to a rack which carries the wheel forward. The vertical lever is returned to its normal position by means of a balance weight, so that simply by a series of movements of the lever the wheel is forced steadily on to the shaft. This machine is very stoutly built and can be very easily operated.

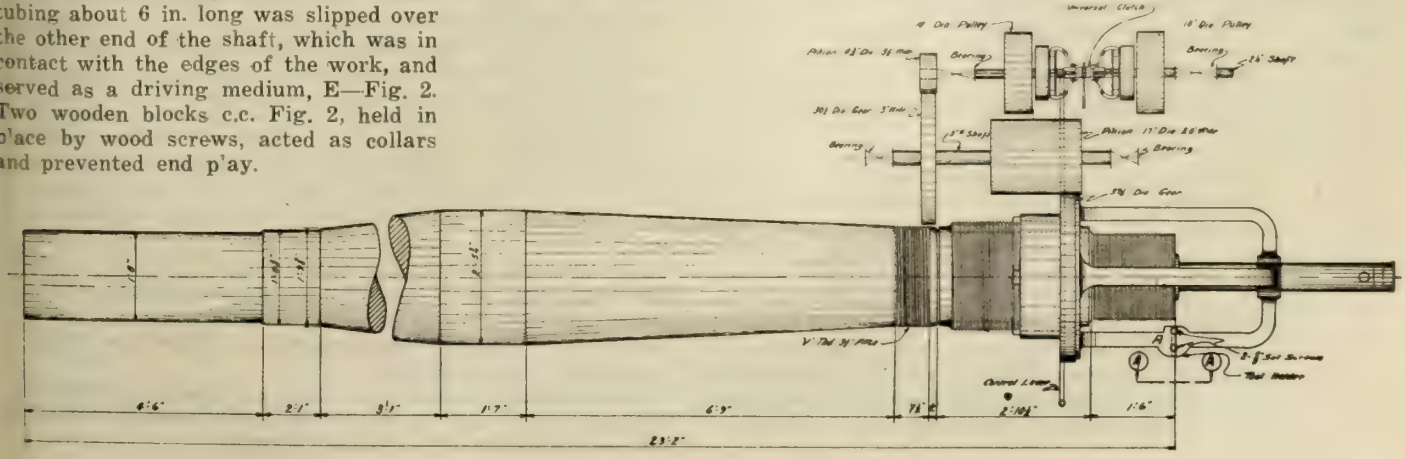
GUARD THE OIL CAN

It is doubtful if any single piece of shop equipment gets less consideration than the small oil can which is so often seen resting on or near every class of machine tool. Yet the efficiency of the mechanism depends in no small measure on the careful and judicious handling of this small can. The purpose of the oil can is to store small quantities of lubricating oil so that the same can be conveniently applied when occasion requires.

When oiling bearings or sliding surfaces it is important to guard against any foreign substance getting into the oil holes or passages that will destroy or interfere with the free movement of the parts; and yet how often will an observer see an oil can knocked off a machine into a pile of cuttings or dirt, and picked up and used without any attempt to clean the spout before inserting it in an oil cup or oil hole. This form of neglect or carelessness may not be a general one but it is common enough to bring to the attention of those readers who may be desirous of seeing the "insignificant oil can" given the attention it is duly entitled to.

Except when it is being used the oil can should be kept under cover and all surplus oil wiped from the outside to prevent dirt and grit clinging to it. Before placing the spout in an oil hole the end of the spout should be wiped clean. A small particle of grit going into a bearing may do more harm than a gallon of oil will remove.

Don't expect to be promoted unless you are educated for a better position.



General Arrangement of Threading Fixture

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Published in the Interests of the Machinery, Manufacturing, Iron Steel, and Metal Working Industries.

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Insist on Neatness

A WELL KEPT shop is always a pleasing sight, while on the other hand a poorly arranged plant repels. A factory superintendent who insists on his workmen keeping their benches and machines in orderly fashion, is usually orderly in character and methods himself.

While neatness or cleanliness are not always associated with expert workmanship, it will invariably be found that a man's immediate surroundings reflect the skill and efficiency with which his duties are performed. If a man is directly accountable for the condition of his machine or bench, the general appearance of such is a fair indication of his all-round ability.

Need of Co-ordination

EFFICIENCY is a term frequently used, but often misunderstood. We speak of efficiency in the manufacturing plant, yet in many cases find that while excellent production methods are adopted, there is a lack of co-ordination between the different departmental heads. In large establishments, requiring separate and distinct departments, the efficiency of each department may have attained the maximum, but the plant efficiency may fall short of possibilities owing to the lack of mutual understanding and co-ordination.

In the general run of engineering industries there are what might be termed five distinct sections in productive manufacture, namely, designing, pattern-making, moulding, machining and erection. Each is a tooth in a gear the harmonious and free operation of which requires the absolute absence of friction between any two, or all of the teeth. Where these departments are operated in complete accord with one another, with the various heads conversant with the requirements pertaining to operating details, the basis of production is pretty well established. However, in many plants contrary currents are often responsible for marked inefficiency. Designs are frequently developed and drawings made without due consideration to the economic production of pattern or casting, also the possible contingencies arising from molding, together with the difficulties incidental to machining.

The designer should be familiar with the working methods of the different departments and the facilities provided. He should consider more than appearance and weigh carefully the manufacturing cost.

The chief pattern-maker, molder, shop superintendent, and any other departmental head capable of giving good advice, should be consulted when planning a new machine or any improvement to an existing article, so that all needless expense can be eliminated. Many benefits will be derived from closer department co-operation, and the individual should replace petty personal ideas by the all-round experience of others, for once a department gets the notion that it is the fountain head of information the useful work of co-operation will soon cease to exist. Work together for the greatest possible good, and the finished article will soon give evidence of the beneficial results.

Increase Your Sales by Pictures

THE POPULAR appeal of pictures is a recognized psychological fact. We as publishers know the value of illustrations and sketches, using them wherever possible to explain the articles appearing within the covers of our journal. Do business men, however, make as much use of pictures as they might?

Recently a well known sales manager, noted for his constant search for new sales methods, asked himself why his salesmen could not take advantage of the public's appetite for pictures. He realized they had all sorts of pictures of the stereotyped advertising flavor in their bags, but felt sure this was not the sort of illustrations the public wanted. The result was that he prepared a few sketches showing the action of the product his firm handled, and every salesman reports excellent results from the use of these illustrations. All he did was to show the construction of the product and what it could actually accomplish.

Manufacturers can take a lesson from this, because unfortunately they are inclined to send out photographs showing only the machine standing by itself upon the conventional skids. Follow up your former sales, secure clear photographs of the machines in actual operation, then use these illustrations to close further sales. In addition, make sketches of parts completed, state operating time, type of tools used, etc. Speak the superintendent's language rather than the usual catalogue specification wording, and you will be agreeably surprised at the reception the information regarding your product will receive.

A Nation-Wide Swindle

A NATION-WIDE swindle involving over a million dollars and of which business men are the victims has just been brought to light by the National Vigilance Committee of the Associated Advertising Clubs of the World in New York. As it is possible that the large plunder secured may tempt others to try similar schemes in this country it is well that the trade should be made accquainted with the modus operandi adopted.

The operator, a well dressed businesslike man, calls upon a firm with a dummy directory, (which turns out to be a bogus one), in which appears an advertisement of the firm in question. He asks for payment. If the order is questioned a signed contract is produced, the signature to which has been obtained by one of several fraudulent methods. In most cases, however, the presentation of the printed advertisement is sufficient to lull the suspicion and the amount demanded is paid.

The scheme is not a new one; it was worked for a time in England some years ago, but for much smaller amounts—usually two or three dollars—on the pretense that the firm's name was to appear in larger type in a directory, which of course was a mythical one.

It should be borne in mind that no honest publisher of a directory will require payment without full investigation where any suspicion exists in a customer's mind.

Pig Iron Production in 1921 Lowest in 13 Years

Iron and Steel Market Shows Stiffening Tendency—Scrap Iron and Non-Ferrous Metals Weak—Machine Tools Show Slight Improvement. Small Tools and Supplies Holding Their Own

BELIEVES IMPROVEMENT IS COMING GRADUALLY

THE OFFICIAL figures showing pig iron production in the States for 1921, have just been issued and show the production rate was the lowest in 13 years. Consumption of pig iron, and articles made from pig iron was, however, greater last year than in 1920, as owing to the high prices prevailing in 1920, many concerns carried over their stocks into 1921, believing prices would go still higher. The reverse being the case, production suffered, and while prices of pig iron fell rapidly, it took longer for finished wares to decline. Today, the production rate is 30 per cent. above the average of 1921, although there is a long way to go before the pig iron industry is anything like normal. The market shows a stiffening in tone, but there have been no price changes.

Comparing the production rate of steel in the States from last autumn, the present rate is now 25 per cent. higher. Some question the wisdom of such a rapid gain, while others feel the improvement will still continue. Prices remain the same although there is a stiffening tendency in some quarters. Sheets continue firm, and the pipe market is fairly steady. Pipe mills are running at between 50 to 55 per cent. capacity, while sheet and tin plate mills are around the 57 per cent. mark.

Canadian markets show a slight improvement but this is to be expected with spring approaching. The good weather is helping matters and Montreal reports an increase in demand for iron and steel lines during the week. Boiler tubes, sheets and marine fittings are featured in the above mentioned locality. Toronto finds a good demand for sheets, tubes and shapes. Other lines are moving but slightly. The encouraging feature in this market is the scattered area from which orders are coming. This shows business is picking up in the smaller places, and while the orders are not large, they are more plentiful than a few weeks ago.

Machine tools are quiet, but not so dull as they were a month ago. Each week sees a little added interest, and from present outlook, the improvement in this line, while it is bound to be slow, will continue.

Small tools and supplies are holding their own, and although only a few orders have been closed during the week, prices remain firm.

Scrap metals are still dull and likely to remain so until general business picks up. Copper is quiet also white metals. Steel pipe, oils and greases, and waste is selling at a fair rate, prices on all these lines holding steady. Aluminum is down to 23 cents in Montreal, the former price being 24.50. The railways have not come into the market as yet, but something is expected within a short time.

Toronto

March 15

CONDITIONS locally remain very much the same as last week. Prices have not changed, and while the demand in several lines has improved, the added business is nothing but what was expected as the season advances.

Pig Iron.—Orders in this market are few and far between, and until general manufacturing business picks up, no improvement can be looked for. The quotation figure still remains $27.15, and it is mentioned quite freely that a large producer is considering the closing of his plant for an indefinite period. This of course does not help matters any.

Iron and Steel.—Business in this market is improving as the season advances. Sheets, boiler tubes, and shapes are brisk and other lines are moving at a fair rate. The best feature of all is the fact that orders received are coming in from all over the country, thus showing that things are picking up generally. Prices are inclined to be a little stiffer, although no movement has been made in sympathy with the small increase noted in the steel market in the States last week.

Manufacturers' stocks must be down very low, because the majority of orders received call for immediate delivery, and of course where building material is requested, it is always wanted within a very short time. As the year advances, a further improvement is bound to take place. Following are local quotations:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Non-Ferrous Metals.—Conditions remain dull in this market. Copper is weak, and red metal while plentiful, is not in much demand. A somewhat depressed feeling exists, and in many cases prices are well down to 1914 levels. Some claim that present quotations do not cover production costs. This seems almost too sweeping a statement, but from authentic sources we find that a very small margin exists when these metals are sold at present prices. Following are local quotations:

Lake copper	17 00
Electric copper	16 75
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	27 00

Machine Tools.—Every week sees a very slight improvement in this market. Not that business is anything like booming, but buyers are displaying interest in prices. Enquiries are more genuine, and on following these up, dealers report that a fair amount of business has been closed during the week. Usually these orders are secured by aggressive sales methods, and letter writing is only used as a means of interesting the prospect. Later on, the salesman, or in some cases the manager of the machine house calls on the prospective buyer, when prices are discussed in detail. Keen competition exists in all lines.

Small Tools and Supplies.—A spotty market exists at present in these lines, some dealers finding a slight improvement, while others again report a set back over the former week. Actually the market is holding its own and dealers after business, are finding it. Prices remain the same, and discounts are holding firm.

Scrap Metals.—Cast iron scrap is somewhat firmer, and the demand is a little brisker, but the copper scrap market is exceedingly dull. Dealers have large stocks on hand at present which they do want to sell at existing low values, and of course these stocks prevent the absorption of other material coming into the market except at a price lower than its intrinsic value. Red brass scrap is in somewhat better demand, but yellow brass and white metal are both dull. Steel scrap is also very quiet.

Copper, light per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	11 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	18 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	3 00

Miscellaneous.—The waste market is holding its own, quotations being the same, and oils and greases are feeling a slightly better demand although no price changes have occurred. Steel pipe is in fair demand.

Montreal

March 15

THE PAST WEEK has shown a very satisfactory increase in the volume of business moving in iron and steel lines, although no particular line has been the outstanding factor in this general improvement. Merchant bars are still very quiet, and the other quiet commodity in the steel market is structural steel. Apart from these two items the demand for practically all other lines has been gradually improving. There is an unusual volume of building going on at the moment, and a large number of new jobs have been started in the last few weeks. The open weather has been favorable to outside work, but the character of building operations is such that there is no large increase in the demand for steel.

Iron and Steel.—For the past few weeks there has been a good demand for boiler tubes, sheets, and marine fittings. Although this channel seems somewhat limited, it has been responsible for a very fair amount of business. Sheets and plates have been fairly active, the demand being for repair and replacement work. The increasing amount of work being done with reinforced concrete, as the weather moderates, is also responsible for the better demand for reinforcing bars. The railways have not come into the market for rails up to the present, although for some time past it has been expected that orders of some size would be placed. The material is wanted and it appears to be just a matter of time before these orders will be placed. Competition in all lines of steel is very keen, but prices are fairly firm with stocks rather low. As April approaches, the possibility of a coal miners' strike is being discussed. If transportation is tied up, the fact that present stocks in local warehouses are so low, will have a tendency to increase prices, temporarily at least. Inquiries for all lines are coming in much more freely, foreshadowing a further improvement, and a larger proportion of these inquiries are being converted into orders. There does not appear to be the same tendency to shade prices as there was some weeks ago. In fact orders were so eagerly sought in January that the inducements offered a prospective customer, were more than good business would warrant in many cases. Jobbers are doing business on a very small margin, and while some improvement has occurred it is really small, and has not gone far enough to warrant any predictions regarding the future. All signs point to a continued improvement, however.

Rolling mills have been figuring on a certain amount of business in structural steel coming from the railways, but it is not thought that any great volume of business in this line will be taken care of this year. However, enough of it may be offering to fill in some of the gaps that will probably exist between rail orders and other work. Local quotations are as follows:

Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00

Pig Iron.—There is not any improvement in the pig iron situation. Prices have not changed up to the present although there is a very persistent rumor that a revision will be made shortly. Little information is available outside of the fact that by the time this issue is in the hands of our readers the new quotations may have been given out. The factor that is holding up this department of the iron and steel business, is the situation in the States.

A price war is being waged, and at the moment, price cutting is much in evidence. In many instances the prices asked are far below production costs, and American furnaces are quoting a price delivered, which relieves the customer of all bother and trouble in connection, with payment of duty and clearing shipments. The condition is one that is of a temporary nature and cannot last a temporary nature and cannot last long. In the meantime our producers have been meeting the competition from the States, and in doing so have been forced into the position of having to take a loss in order to do business.

Machine Tools and Supplies.—The last few days have not shown any improvement in the machine tool situation. No changes in price have been reported, and sales have not materially improved. The week has not failed to bring in its quota of new machines offered to the public and of improvements made to standard machines. To one following this feature of the market, it is plain that the engineering departments of the machine tool builders are devoting every effort to improve their product. Probably no line will be better fitted to take care of the good times to come than the machine tool department.

Second in this connection is the machine shop supplies. In the term supplies, is included the line of portable tools, air and electric driven, and many of the new devices that are somewhat difficult to classify owing to their special design and uses. Many specialties are now being standardized and marketed along with standard machine shop supplies. Business in these departments has been good for some time past. Prices have undergone no changes during the week, and business has slightly improved.

Non-Ferrous Metals. — There have been no developments of any importance in the non-ferrous metal market for some time. Copper has been very weak, and it is now quoted at a figure lower than has been seen in the local market for several years. The other metals have not undergone any price changes but existing quotations are not firm. Aluminium has dropped to 23 cents. In spite of the apparent weakness all around, there has been a slightly better demand locally, and present local quotations are as follows:

Lake copper	16 75
Electric copper	16 50
Castings, copper	16 25
Tin	34 50
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	27 00

Scrap Metals.—Business in the scrap metal field remains very dull. Prices have not changed and only a very small volume of business is offering. Rumors of shortage of scrap metal have had no effect on the demand, which continues to be very poor. There is very little likelihood of any shortage developing, as the increase in demand will be so gradual that supplies will have an opportunity to accumulate. The demand is so slight that little effort is being made to collect the supply available. Local quotations are:

Copper, light	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 machine composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	1 0
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate	9 00
Heavy melting steel	12 00
Axles (wrought iron)	20 00
Rails (scrap)	12 00
Malleable Scrap	12 00
No. 1 machine cast iron	19 00
No. 1 machine cast iron	19 00
Pipe, wrought	6 00
Car wheel	18 00
Steel axles	18 00
Mach. shop turnings	6 00
Stove plate	16 00
Cast boring	6 00
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00

Pittsburg

March 15

PITTSBURG,—(Special to Canadian Machinery).—The official report of pig iron production in the United States in 1920 has just been issued, making the following comparison, in gross tons: 1913, 30,966,152; 1914, 23,332,244; 1915, 29,916,213; 1916, 39,434,797; 1917, 38,-621,216; 1918, 39,054,644; 1919, 31,015,-364; 1920, 36,925,987; 1921, 16,688,126.

The particular record made by the 1921 production was that it was the smallest in 13 years, this being by far the greatest backward step, in point of time, ever made. The 1908 production was the smallest in seven years, the 1894 the smallest in six and the 1876 production the smallest in five.

Consumption of pig iron and things made from pig iron was much greater in 1921, as compared with 1920, than indicated by the pig iron production figures. On account of the high prices in 1920, giving the impression that everything was very scarce and might remain scarce, men carried stocks over into 1921 which otherwise they would have made more effort to liquidate in 1920. The high prices tended to discourage consumption in 1921. While pig iron prices fell rapidly, it took more time for the finished wares such as the ultimate consumer buys, to decline.

The conclusion is unavoidable that pig iron production in 1921 was much below a normal relation to the general business conditions existing, even though those conditions were not good, and it seems to follow that it is entirely unlikely that there will be another year with as light production. Even at the present time pig iron is being produced at a rate 30 per cent. above the average rate in 1921.

Steel production.—From the monthly report of the American Iron and Steel Institute of the steel ingot production of 30 companies, it may be estimated that the steel industry as a whole produced steel ingots in February at the rate of about 26,850,000 gross tons a year, against a rate in January of 22,750,000 tons. There was continuous increase in the rate during the two months, from a rate well under 18,000,000 tons at the end of December to a rate of about 29,000,000 tons at the end of February. The 29,000,000 ton rate has remained practically unchanged to this date.

The only question about the steel market is whether the gain has not been too rapid, about 70 per cent. in two months, following the dip in production towards the close of the old year, a reflection of the season of year as well as the annual inventory taking. Compared with the production last autumn the present 29,000,000 ton rate is 25 per cent higher rather a sharp gain when spring has not yet really arrived. Here and there one encounters a prediction, made by men who do not seem to realize what has already occurred, that conditions in the steel industry are now about to improve, but the real point is whether all the gain already experienced can be held. While reports in the different branches of the steel market in the past couple weeks have as a whole been somewhat favorable, there is really some question whether the total of steel buying thus far in March has been at as heavy a rate as obtained in February. It is possible that purchases recently were being swelled by buyers anticipating trouble in getting deliveries after April 1, on account of the prospective suspension at the union bituminous coal mines. Some steel buyers seem to have been alarmed by the prospect, while steel producers are not. The latter have stocks of coal averaging fully one month's requirements and think this will be sufficient, in conjunction with such deliveries as they will still get, even at the worst, from the non-union fields, like the Connellsville region.

Steel Prices. — Bars, shapes and plates, which had reached relatively lower levels than other finished steel products, now face the possibility of a slight stiffening. The Jones & Laughlin Steel Company, which had been a particularly aggressive seller, has announced an advance in its price to 1.50c, and its competitors estimate that in its sales campaign it accumulated enough business to carry it for 60 days at its present rate of operation. The market remains quotable at 1.35c to 1.40c as formerly, and the advance by this large independent is therefore in essence a withdrawal from the market, but the removal of this particularly strenuous competition seems already to be exercising a somewhat stiffening effect on the market, and 1.40c is now a more common quotation than 1.35c. Other sellers, while very competitive, are indisposed to tie up much tonnage for forward delivery at extreme low prices, preferring, if possible, to work their prices up first.

Sheets continue firm at 3.00c for black and 4.00c for galvanized, where they have been for more than three months. Pipe is being shaded by a considerable margin in some districts, but the shading is not general, and on the whole the pipe market may be regarded as fairly steady.

Mill Operations.—As noted above, the general rate of steel mill operation, as shown by ingot production, has undergone no material change in the past couple of weeks or more. In individual mills there may be slight changes. The pipe mills are running a trifle slacker, at between 50 and 55 per cent. of capacity, while sheet and tin plate mills seem to have gained a little. The Steel Corporation's unfilled obligations at the end of February are reported at 4,141,069 tons, indicating a decrease during February of 100,069 tons, a favorable showing when properly considered as it suggests that some contract tonnage long on books came to life by being converted into actual shipping orders, for the corporation's shipments were about 57 per cent. of capacity in February against 47 per cent. in January. The unfilled obligations decreased by 26,736 tons in January. Comparing shipments and unfilled tonnage it appears that in January the new bookings amounted to about 45 per cent. of capacity while in February they amounted to about 49 per cent.

The various pig iron markets show, a more stiffening than declining tendency, as prices are quoted higher at both Philadelphia and Chicago, while Alabama iron is firmer if not actually higher. In the local market there have been no price changes, Bessemer being $19 to $19.50, basic $17.75 to $18 and foundry $18.75 to $19, f.o.b. valley furnaces, freight to Pittsburg being $1.96.

Connellsville coke for spot or prompt shipment remains quotable at $3.25 to $3.50 for furnace and $4.25 to $4.75 for foundry, thus holding the recent 50 cent advance.

Preliminary work on the plant of the Three Rivers Pulp and Paper Company, Three Rivers, Que., which is capitalized at $3,000,000 will be started in March, 1922.

The decrease of $699,882 in the net debt of Canada during the month of February, as compared with an increase of $4,290,143 in the same month last year, is shown from the financial statement issued from the Finance Department, Ottawa.

BELIEVES IMPROVEMENT TO BE COMING GRADUAL

Speaking of the recent improvement in business, Judge E. H. Gary, chairman of the United States Steel Corporation, says that although there has been a gradual improvement in business, he has not seen substantial evidence of a general and rapid recovery to normalcy. He believes, however, that business laws will sooner or later compel stability, progress and prosperity. He says that probably it is better so, for the natural laws applying to business are grinding slowly but surely and will compel, sooner or later, stability, progress and prosperity.

"If the laws of the country shall be sufficiently enforced to permit every individual to utilize his talent and energy without forcible interruption," says Judge Gary, "we shall soon see the prosperous conditions for which we have been anxiously and expectantly looking for many months. The sun of prosperity is still shining, though it has been unnecessarily obscured."

The Flexible Shaft Co., Canadian branch of the Chicago Flexible Shaft Co., are now manufacturing their line of Stewart industrial furnaces at their factory 349 Carlaw Ave., Toronto. The Canadian plant has been in operation for some months, but it was only recently that the manufacture of furnaces was commenced. L. E. Fitzpatrick is general manager.

With business in general still somewhat undergoing the process of reconstruction and with many reports of unfavorable conditions in various industries it is very reassuring to hear of an industry going at top speed, working overtime and then unable to fill the demand for their products in the Canadian and other export markets. This is the condition in which the General Motors of Canada find themselves. The plants at Oshawa and Walkerville are running full time and quite a number of the departments are working overtime. The daily output for the past three months has been 150 finished automobiles. The schedule for the next two months calls for a daily output of 175 to 200 finished automobiles. This will be a larger schedule than Canada's premier automobile manufacturers—the General Motors of Canada—have ever turned out in their history. The payroll of General Motors of Canada, Limited, for the month ending February 15th, was at the rate of $446,000 a month, showing the great strides this institution has made. It is estimated that at least 8 million feet of lumber will be used in this production. Huge quantities of leather trimming fabric, curled hair, brass, aluminum and malleable iron castings, springs, tires, sheet metal works, paint, varnishes, enamels and a hundred and one other commodities will be required. The list is so great that dozens of manufacturers will participate in this activity.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 40
Tank plates, Pittsburgh mill price	1 40
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 25
Castings, copper	16 25	17 00
Tin	34 00	34 50
Spelter	7 00	7 25
Lead	6 50	6 75
Antimony	6 50	8 00
Aluminum	23 00	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel		Gen. Wrot Iron	
	Blk.	Galv.	Blk.	Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

	Steel		Gen. Wrot Iron	
Size	Blk.	Galv.	Blk	Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 00	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 50	3 50
Medium brass	4 50	4 50
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00

	Per Ton	Gross
Boiler plate	$9 00	$9 00
Heavy melting steel	9 00	12 00
Axles (wrought iron)	17 00	20 00
Rails (scrap)	10 00	12 00
Malleable scrap	10 00	12 00
No. 1 machine cast iron	18 00	19 00
Pipe, wrought	7 00	6 00
Car wheel	18 00	18 00
Steel axles	16 00	18 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	16 00
Cast boring	3 00	6 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... Net

Solder, strictly	$0 24½
Solder, guaranteed	0 26
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 25	...
Galvanized sheets, No. 28		5 55
Queen's Head, 28 B.W.G.	7 00	....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	—
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	37 50
Black oil, per gal.	21 00
Cylinder oil, Capital	66 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 35
Linseed oil, raw, single bbls.	1 00

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 20 Dark colored. 13
Mixed colored. 14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, annhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver Chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

The province of Ontario is now producing 6 per cent. of the world's gold.

Annual General Meeting of the Canadian Manufacturers' Association will be held in the Algonquin Hotel, St. Andrew's by the Sea, N.B., on June 20, 21 and 22.

The Oakville town council has decidded on the installation of an auxiliary pump for emergency water works purposes. This will either be gasoline or steam driven.

The Brown, Boggs Co., Hamilton, Ont., have opened an office in the Holbrook Bldg., 77 Florence St., Toronto, and have appointed A. B. Walker as their Toronto representative.

The Toronto Transportation Commission is trying out a new double-decker bus, manufactured by the Eastern Canada Motor Truck Co., of Hull. The executive of this company is composed entirely of returned soldiers.

The work of rebuilding the Frankford canning factory at Frankford, Ont., which was destroyed by fire last year, has commenced and will be pushed forward with all possible speed so as to be ready for the season's work.

A contract said to value approximately $60,000,000 has recently been closed by the Saguenay Pulp and Power Co. The business includes an order for about one million tons of ground-wood pulp and 450,000 tons of sulphite pulp. The purchasers are a group of English newspapers including those owned by Lord Northcliffe and Lord Burnham.

The Standard Steel Construction Co., of Welland, Ont., has recently been appointed sole Canadian representative for the sale and distribution of the products of the Irwin Iron Works of New York City, consisting of steel floor gratings and safesteps. These floor gratings are used almost exclusively in the extensive subway work in the metropolitan district of New York.

The Canadian Government has appointed G. A. R. Emery, one of the officials of the Department of Commerce, to study the possibilities of reviving trade between Canada and Newfoundland. For the past few years this trade has fallen off about 50 per cent. It is hoped that Mr. Emery's trip will result in establishing renewed trade activities between the two countries.

Stabilization of the electric industry is reflected by the monthly business reports of the Packard Electric Co., of St. Catharines for February, which showed a 10 per cent. increase over any other February in the company's history. The shipments for the month were 90 per cent. of that of the banner year of 1920.

Gordon M. McGregor, vice-president and general manager of the Ford Motor Co., of Canada, passed away at the Royal Victoria Hospital in Montreal, last week, following an operation.

Statistics on the population of the state of New York issued by the Census Bureau, show that there are 99,792 natives of Canada in the State. There are 280,500 natives of Ireland; 120,299 from England and 34,155 from Scotland.

Figures of the operation of the pulp and paper industry in Canada during 1920, just issued by the Dominion Bureau of Statistics, set forth in a striking manner the rapid growth of this branch of industrial effort during recent years. There are 100 pulp and paper mills all told; capital investment is given as $347,553,000.

The Page-Hersey Co., Welland Ont., has announced that it is adding 250 men to its staff this week at the Welland plant and is resuming the old schedule of day and night operation. The pipe mills have been inactive in recent months but now business is being secured enabling the company to increase its working force.

Inquiries for steel on the part of manufacturers have been heavier in the last fortnight than for the earlier part of this year. This evidence, together with the actual business booked, indicates that there is a more lively interest in replacing stocks and preparing for the larger trade that is expected in the spring months.

Industrial circles generally are gratified at the increasing value of the Canadian dollar, which has almost reached par, and there is a general feeling in the Canadian coal trade that when the adverse exchange against Canadian money disappears, as it will soon, the American railways cannot with good grace continue to ask that freight be prepaid in United States funds.

F. C. Hart of the Department of Agriculture was in Cobourg, Ont., this last week and organized the Co-operative Dairy Co. Directors have been appointed and a charter has been applied for. It is stated that, it is the purpose of the new company to purchase the Cobourg Creamery Company's plant and carry it on as a co-operative concern.

Fire which threatened the entire plant of the Standard Steel Limited at Port Robinson was extinguished by the good work of the Welland Fire Department. It is believed that the fire started from an electric stove in a shanty at the foot of the tank. The tank was saved by water from a forty foot well which was practically dry when the fire was under control.

Peterborough's new $300,000 filtration plant is now in partial operation, and the improvement in the quality of water is distinctly noticeable. The plant is being tested out each night and the day requirements are taken from the two million gallon reservoir. This plan will continue until the tuning-up process has been completed to the satisfaction of the contractors and engineers.

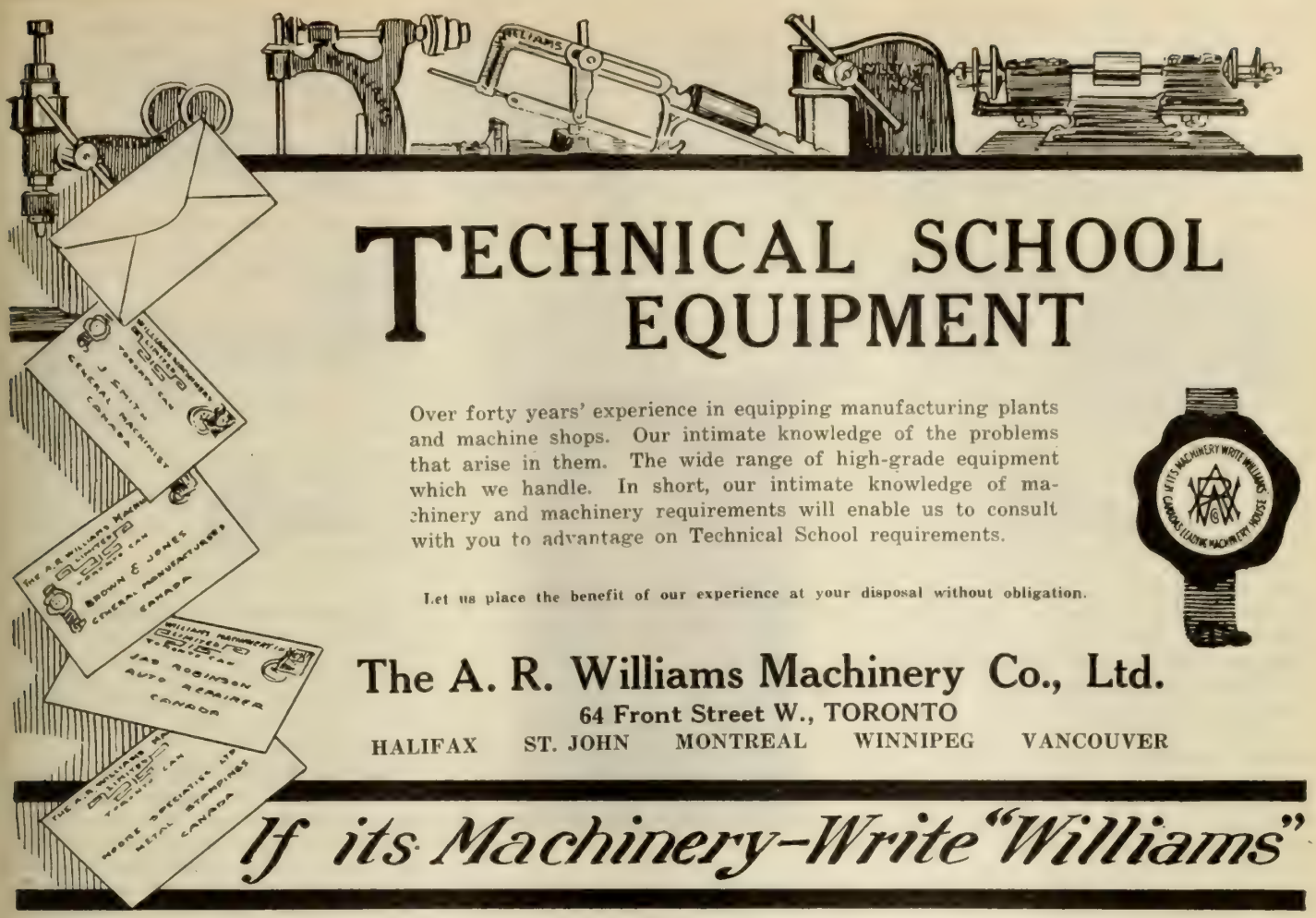
After a period of idleness for many months due to business depression the mechanics of the metal trades industry are beginning to return to work. This is according to a statement made by the Secretary of the Toronto local union. He also stated that a number of men are resuming their places in machine shops and this indicated to him a fairly prosperous season.

The general manager for Price Bros. Limited, of Quebec has stated that the first shipment of an order for 13,500 tons of newsprint which his company have contracted for supply to the London Daily Express, England, will be made this month. The first shipment will consist of 1000 tons and will be made through the Cunard-Donaldson line. The total value of the shipment is approximately $900,000.

Power to borrow several million dollars to build a new city hall in Montreal, Quebec, may be granted by the legislature when the Montreal bill comes for final consideration before the legislative council. The old city hall which has been in use for the past thirty years was burned down early this month and the building was completely demolished. No time will be wasted in getting the new plans under way for the erection of a new city hall.

The Oak Tire and Rubber Co., Oakville, Ont., is one of the companies who were not a party to any large contracts at the time the depression in prices of raw materials took place. It is indicative of an upward swing to better business conditions when manufacturers are working to the limit. This company's factory is working to full capacity, 22 hours per day, and the unfilled orders on the books amounts to over one hundred thousand dollars.

Thomas Southworth, managing director of the Deloro Smelting and Refining Co., has recently moved to Ottawa, to look after the interests of the company, the branch office having just been removed to that city. For the past twenty-five years Mr. Southworth has resided in Toronto, during which time he has occupied different important positions in Government service. He has been associated with the Deloro Smelting & Refining Co., for the past twelve years.



D. A. Campbell, B. A., director of technical education for Alberta, has resigned his position to accept the appointment of principal of Sarnia Collegiate Institute and technical school at a salary of $5,000 a year. Mr. Campbell will take up his new duties after Easter. For many years Mr. Campbell was head of the science department of Ottawa collegiate institute.

In the course of his address before the Canadian Institute of Mining and Metallurgy, C. D. Corless, president of the Institute, referred to the tremendous coal reserve in Canada, estimated at one thousand two hundred and thirty four billions of tons, or thirty-five thousand times the present annual consumption. He pointed out that although Canada was spoken of as an agricultural country only 15 per cent. of the area of the Dominion was suitable for cultivation, while 90 per cent. would undoubtedly produce great mineral wealth.

Another indication of the growth of the automotive industry in the Dominion of Canada is that prior to 1911 there were less than 10,000 motor vehicles of all types in the country, and at the end of 1921 over 460,000 cars, trucks and motorcycles were registered. The increase from year to year was gradual up to the end of 1916. During the following year registrations jumped from 120,000 to over 198,000. In 1918 the registrations jumped from 270,000 to 330,000. In 1920 the yearly increase was over 70,000 and last year it was more than 66,000.

As the result of prospect of a big building boom which is expected to take place in Toronto and other cities and towns in Ontario within a few weeks, all the brick making plants near Milton, Ont., are engaging more men and have started on a 10-hour day. The woollen mills and foundry company are both working day and night and other industries in the town are showing signs of improved activity.

Large dealers in the Canadian textile trade seen at Ottawa quite recently report that the woollen mills in the Ottawa valley and elsewhere in Canada are booming. They report that practically all the woollen mills of Canada are working at 100 per cent. capacity with at least three months orders ahead. Rapid improvement has been made in the preparation of dye stuffs and the method of manufacture are said to be so superior that they are rapidly sending out imported goods on a business of quality rather than tariff protection.

The Aluminum Steel Products Co, one of Owen Sound's latest industries, reports a fair demand for small aluminum castings. They have installed two casting machines, on which high production is possible, and their dies are made in their own machine shop. A large order was recently received from the Ford Motor Co., on a small engine accessory.

Thos. Barber of Barber & Son. Meaford, manufacturers of hydraulic machinery, has returned from Holyoke, Mass., where he had tested, in the experimental flumes there, two water turbines of a new type. This Meaford industry reports that while actual activities in the hydraulic field have eased off considerably an exceptional number of enquiries calling for estimates, have been coming through. This, at least, is encouraging.

The D. McKenzie Machinery Co., Guelph, manufacturers of metal and woodworking machinery recently shipped a carload to eastern points. They report a very encouraging development in the machinery market and consider it indicative of a much better buying feeling generally.

The Preston Woodworking Machinery Co., Preston, recently shipped two woodworking lathes to the technical school at Prince Rupert, B. C. They have also equipped the vocational department at Chilliwack, B. C., and have installed three motor-driven lathes in the new London collegiate.

The Sandwich Foundry Co., Limited, Sandwich, Ont., are exceptionally busy on contracts for the Ford Motor Co., and Canadian Products, Walkerville. Their foundry was formerly known as International Castings, Limited. This concern passed out and the plant was taken over by seven practical foundrymen who have been quite successful.

The R. H. Cunningham Co., Walkerville, electrical engineers, are moving to London, where they will occupy a building at the corner of Glebe street. Before leaving Walkerville, they will install at the plant of the Postum Cereal Co., Windsor, an electric oven for cook-

ing cereal, a process in which gas has been used heretofore.

The Canadian Detroit Twist Drill Co., Walkerville, Ont., report an improvement in the demand for drills and small tools, especially from the motor car industry. This company recently increased their equipment and extended their plant for the manufacture of motor valves.

The dry dock, ship building and repair plants owned and controlled by the Grand Trunk Pacific Railway, have been taken over by the Canadian Government. The apparent intention is to operate them in connection with the Grand Trunk Pacific Railway and the Grand Trunk Pacific Steamship Company, both of which are now under control of the Canadian National Railway. Prince Rupert, B. C. is to be made a terminal point. The ship repair plant is as complete as any on the Pacific Coast and includes a machine shop, two covered shipbuilding sheds, a foundry, blacksmith shop and power house. The ship-building plant is equipped with two ways, of sufficient size to permit construction of large vessels.

Bridge construction is being undertaken by the T. & N. O. Railway Commission and by the Hydro-Electric Commission of Ontario. This will involve the use of more than 3,000 tons of steel. A hydro transformer station is to be erected at the western portion of Toronto that will require about 500 tons of structural steel. The structural steel trade looks much better than it did a fortnight ago. Certain firms that had little business ahead no more than two weeks ago have since been in the market for fair sized tonnages of steel. Inquiries for steel on the part of manufacturers have been heavier in the last two weeks than for the earlier part of this year. Evidence together with actual business booked, indicates that there is a more lively interest in replacing stocks preparing for the larger trade that is expected in the spring months.

With the powers recently granted to the Montreal Service Corporation and the Canadian Light and Power Co., the development of the Ottawa River at Carillon will be proceeded with as soon as weather conditions will permit, a considerable portion of preliminary work having been already accomplished. It is further claimed that the consolidation will finally result in the production of upwards of 300,000 h.p., much of which has already been contracted for. To carry the work to completion, a total of $40,000,000 will be required, it is claimed, all of which will be expended during the next two years.

Speaking recently on the possible trend of business this year, Robert Hobson, president of the Steel Co. of Canada, expressed the opinion that conditions should be nearly normal by autumn of this year, according to present indications. He stated that although Canadian firms are not overwhelmed with orders, he had received reports which justified his belief that there is a great cause for optimism in the immediate future. People may look for a marked increase in Canada's trade, both export and domestic, within the next few months, according to Mr. Hobson's view. This is believed to be particularly the case in the steel industry. The evidence of recovery of activity in the steel business is not merely local or Provincial. Reports from the leading production and distribution centres of the continent show a widespread increase of activity.



H. GRAHAM

H. Graham has been appointed general manager of the Bond Engineering Works, Limited, of Toronto. For the past six years Mr. Graham has been purchasing agent of the Canadian Vickers Ltd., of Montreal.

Owing to space not being available we are holding over articles on several schools in Ontario. These will appear in later issues.

J. Blair, of the Alfred Herbert Co., Toronto, is making a business tour of Western Ontario.

The Standard Stone Co., Windsor, Ont., intends to erect a modern factory building and to install machinery for the milling of stone.

The governors of the General Hospital Brantford, Ont., are considering the installation of an auxiliary power plant to provide against the possibility of inconvenience such as they experienced during a severe ice storm when power and light was off for many hours.

A considerable amount of construction work is in prospect in Kitchener and Waterloo for the coming building season. A new city hall is planned for Kitchener and a collegiate institute and technical school for Kitchener and Waterloo jointly. In cluded in the Industrial buildings projected are the following: an addition to the Greb Shoe Company premises, erection of a new factory for the Dominion Skirt Co., Ltd. 2 automobile sales rooms and garages are proposed in the business section of Kitchener.

BOWMANVILLE BUSY

The town of Bowmanville, Ont., has recently completed concrete sewer and pavement work costing $78,000.

Ross Can Co., of Bowmanville, have enlarged their premises and report an improvement of business over last year of about 65 per cent.

The brick works of Bowmanville are adding a pottery to their plant. Machinery is already delivered and installation is under way.

The Thompson Knitting Co., has recently purchased a building from the town of Bowmanville, at a price of $20,000. The firm has just contracted for an order of $60,000 worth of hosiery and is employing 115 hands.

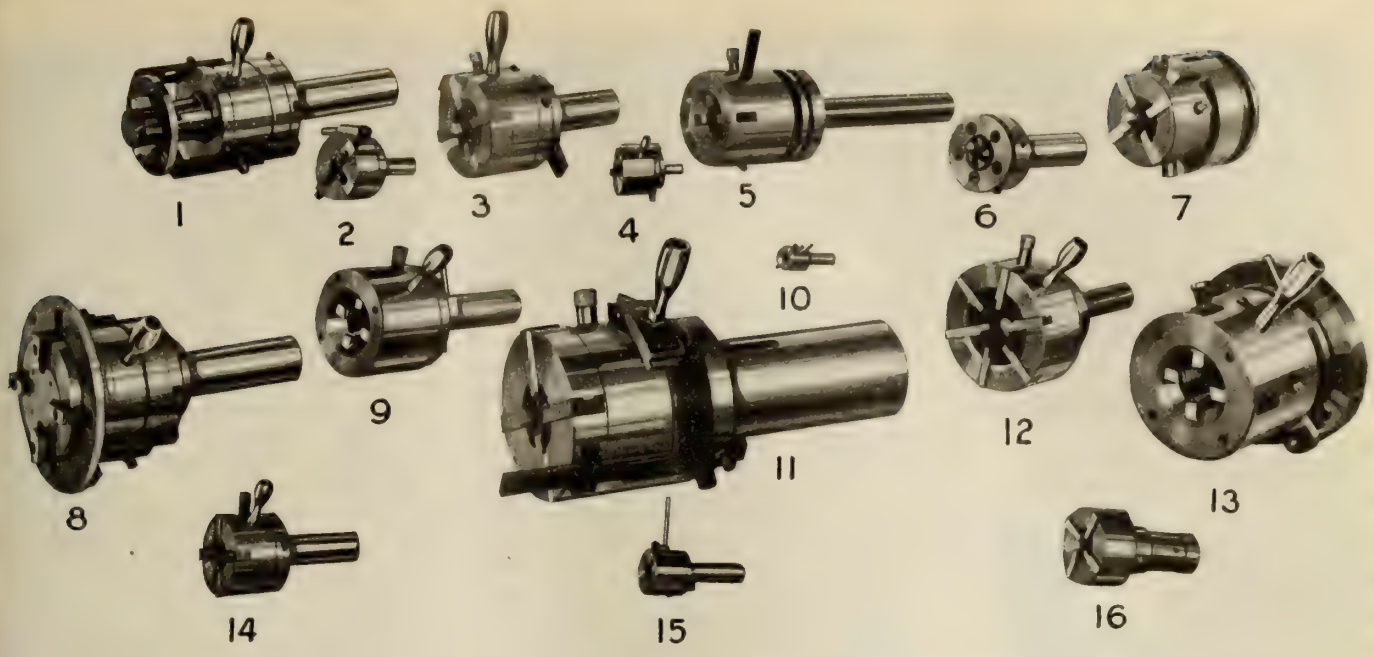
The Bowmanville Foundry, under the management of R. H. Rehder & Co., has just completed extensions to the plant costing about $40,000. Eighty men are employed.

The Notre Dame Investment Co., Montreal, Que., is now forming a separate corporation for the erection of a 130 suite apartment block on the north side of Broadway, Winnipeg, Man. Work will start in the spring. Approximate cost $1,000,000.

The Detroit and Windsor Ferry Co., Windsor, Ont., is asking permission from the city to build their new docks forty feet farther into the river than the present docks. More than $300,000 will be spent this summer, according to the present condition of the company, if satisfactory arrangements can be made with the city.

A report issued by the Newsprint Service Bureau of New York, available, carries an interesting supplementary message to the Canadian Government figures. Of the Canadian mills that belong to the "Service," production during January was 81,418 tons as compared with 71,518 tons January one year ago. This represents 92 per cent of maximum for the month of January this year. In the United States the mills produced 93,389 as against 101,292 one year ago, a decline of nearly 8,000 tons.

Tenders for construction of the new east end technical school in Toronto will not be called for until after the signing of the agreement between the provincial government and the city, by which the government will undertake a portion of the expense, it was decided by the advisory industrial committee of the board of education last week. Efforts are being made to divert certain non-technical and academic subjects from the Central Technical School to the different branches, so that more time may be devoted to practical instruction. Principal McKay predicted an increase of 500 to 600 in the number of pupils by next fall. It was decided to advertise for a "vocational advisor" whose duties would consist in advising school children as to their life work. The high qualifications required in such an officer were emphasized by members of the committee.



—AND OTHERS

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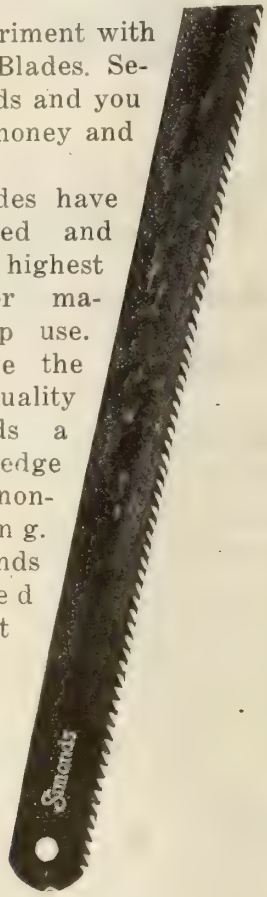
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HAS MADE A SUCCESS BY GOOD MANAGEMENT

Guilio Gatti-Casazza, who began life as an engineer in the Italian Navy, is now the world's greatest operatic director. He has just renewed his contract with the Metropolitan Opera Company in New York, which will give him, at the end of three years, eighteen years' service. He has reduced the whole opera and its management to a business basis, no doubt as a result of his training as an engineer. Formerly people attended operatic performances because of the appearance of this or that individual singer. To-day they go on account of the Opera as a whole. This condition could be brought about only by raising every detail of each production to a uniform high plane of merit. The orchestra and chorus have been trained to an equally high degree of skill. The scenery surpasses in beauty and appropriateness the settings used in any other opera house in the world. Canadians have an interest in Mr. Gatti-Casazza because his wife, the prima donna—Madame Alda—is British, being a native of New Zealand and very popular before Canadian audiences.

The Northern Ontario Light and Power Co., Cobalt, Ont., is considering the development of the Sturgeon Falls project. There will be approximately 7,000 Horse power. The cost will be between $350,000 and $600,000.

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BELTING
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CONDITIONS SHOW DECIDED IMPROVEMENT

PEAKING of business conditions in the States, Mr. Eisenman, national secretary of the American Society for Steel Treating, told Canadian Machinery that he has recently traveled from New York as far west as Chicago, visiting the important industrial centers en route. In these places he has found a very optimistic attitude and trend, which is not a result of a condition of the mind, but an actual added interest in business.

He claims that people are realizing that prices have dropped to the lowest minimum in some cases, and that they are again beginning to buy. "They do not expect revival overnight," remarked Mr. Eisenman, "but they do look for a gradual increase in business."

The production of the steel mills in the States has increased 10 per cent. during the past month, according to his statement, and now shows a 50 per cent rate. "To reach normal they only require 80 per cent. production," remarked our informant, "because such a rate was normal before the war. In other words," concluded Mr. Eisenman, "the steel game was over-expanded during the war, but if we get back to 80 per cent. of war time activities, we will have reached 100 per cent. of normal times. There is no need to worry about the other side of the line. We have passed the worst, and are now on a steady upgrade."

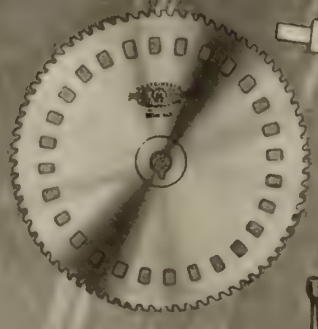
In connection with the proposed operation of one-man cars on the Pt. Arthur Civic Railway, we understand that the city Public Utilities Commission is awaiting the hearing of its application to the board of Railway Commissioners to operate such cars in that city. Pending a decision in this matter, which will have considerable bearing on whether or not one-man car operation will be extended to the entire system, instructions have been issued to fully equip one of the existing cars with safety devices, which will include pneumatic door and safety devices in order to demonstrate the safey and reliability of the car and the one-man operation. An order has been given the Canadian Westinghouse Co., Hamilton, Ont., for the safety devices and the car will be equipped as soon as they are delivered. It is hoped that by the time this is done the Board of Railway Commissioners will have made such a decision as will enable the extension of one-man car operation to the entire car system.

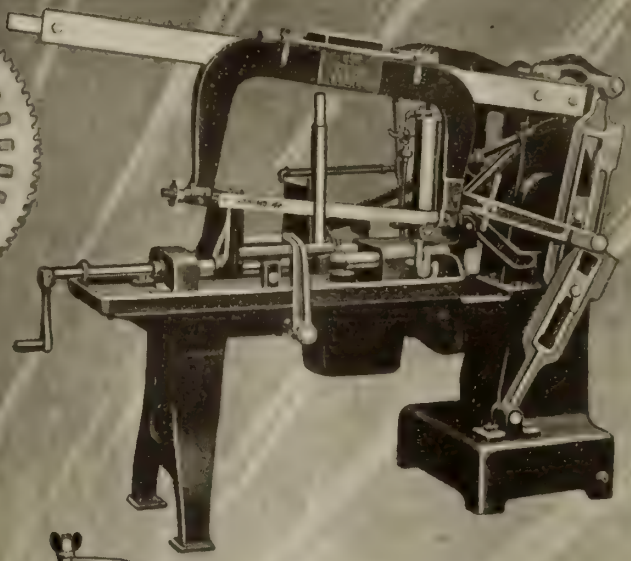
The Western University London, Ont. is having plans prepared for a two-storey University building including steam heating system. The approximate cost will be about $1,000,000.

The America Swiss File and Tool Co., of New York, are issuing a descriptive folder in connection with their various types of files.

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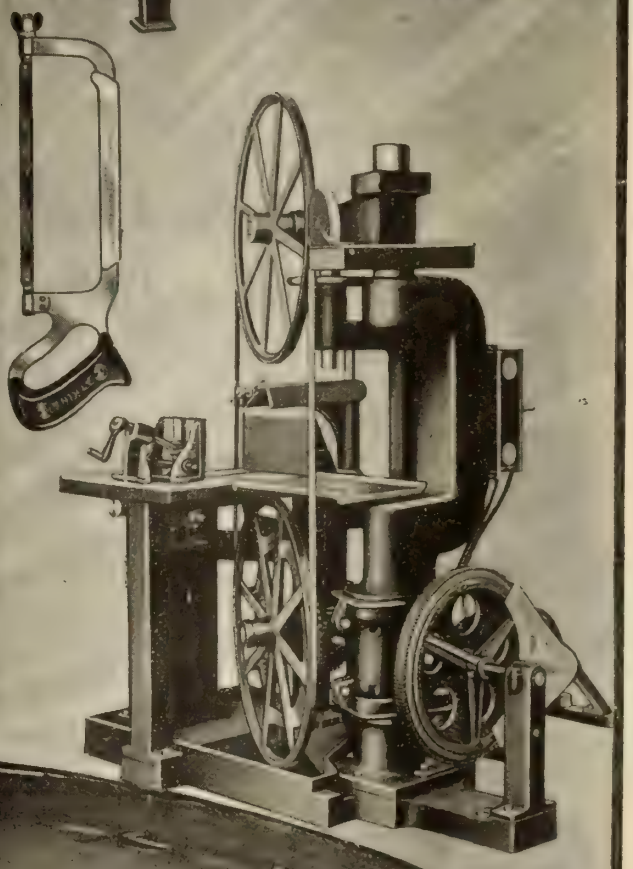
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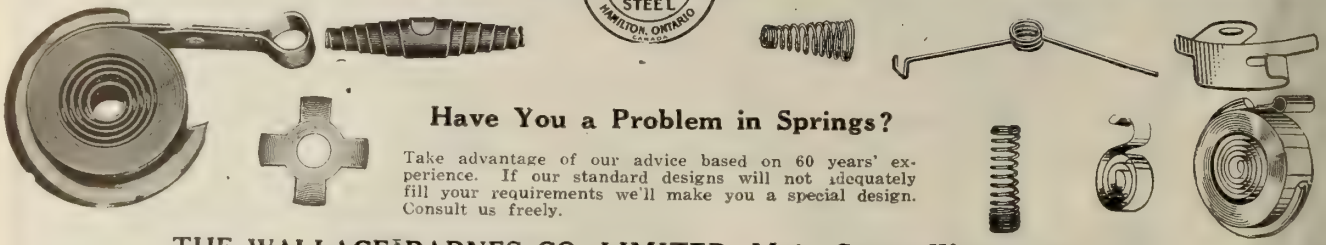
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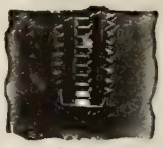


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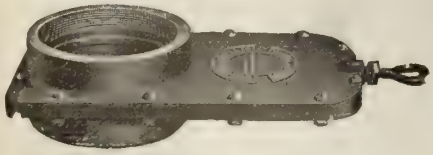
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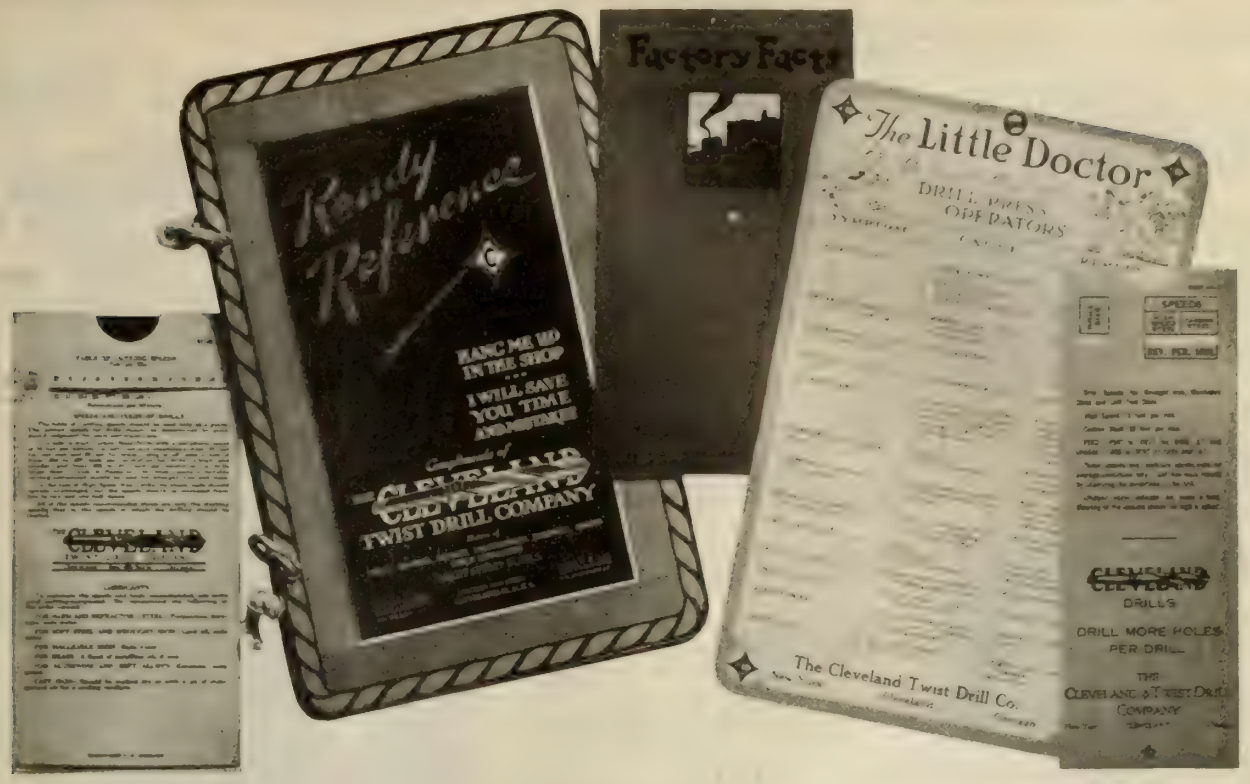
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BRITISH REPRESENTATIVE: Gibbons Bros., Ltd., Dudley, Worcester, England.



LET US HELP YOU.

The above pictured helps are the result of a constant effort to help drill users drill more holes per drill. The suggestion regarding drill use and abuse set forth in these helps has been gained from almost 48 years of actual drill manufacturing experience.

The "Little Doctor" card tells the drill press operator the symptoms of drill abuse, its cause and remedy.

The "Ready Reference" Charts give information on decimal equivalents, speeds and feeds, lubricants and tap drill sizes especially for the New National Thread system.

The "Yellow Slide" gives you a table of cutting speeds for drills 1/16″ to 3″ and a fund of useful information on drill abuses, its cause and remedy.

The "Red Slide" quickly gives you speeds and feeds of drills, taper drill sizes and decimal equivalents.

"Factory Facts" is a condensed catalog of the more widely used "Cleveland" Tools and contains some factory facts for the up-to-date shop.

We will be glad to furnish this material in reasonable quantities to those who request it and of course free of charge.

The CLEVELAND TWIST DRILL COMPANY CLEVELAND
NEW YORK - CHICAGO - LONDON

TRADE MARK REG. IN U. S. AND FOREIGN COUNTRIES

Sheer oversight is sometimes responsible for a file being kept in use after its keen-cutting edge is gone.

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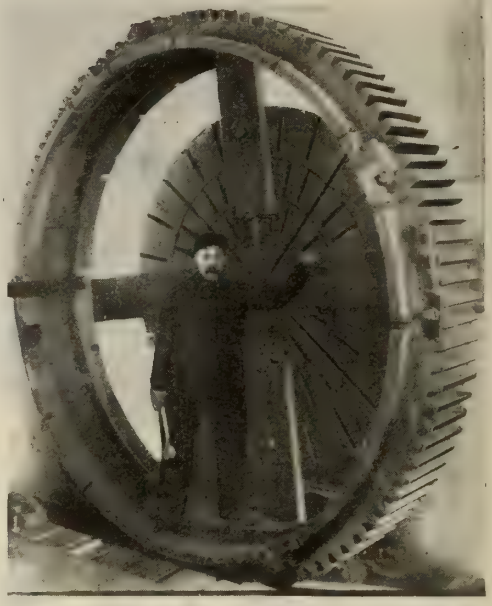
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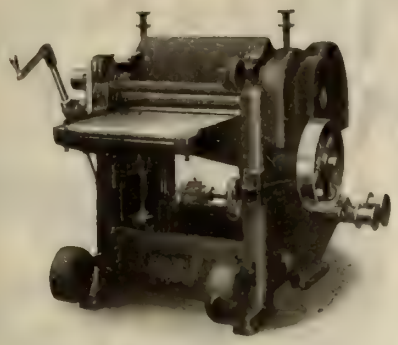
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"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber and labor is something to be considered.



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16″, 20″, 24″ wide



No. 168, Buzz Planer
12″, 16″, 20″, 24″ wide

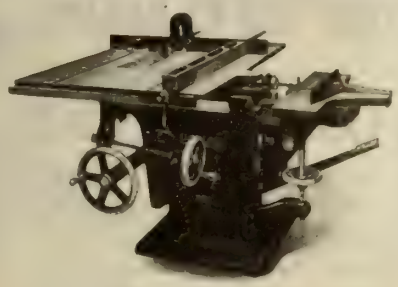


No. 140D, Disc and Drum Sander
Disc 18″, Drum 12″ x 12″

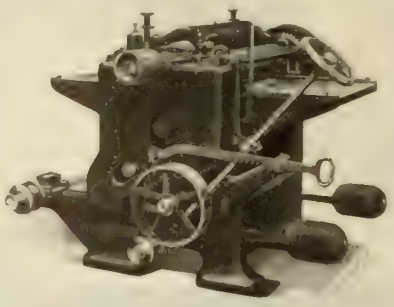
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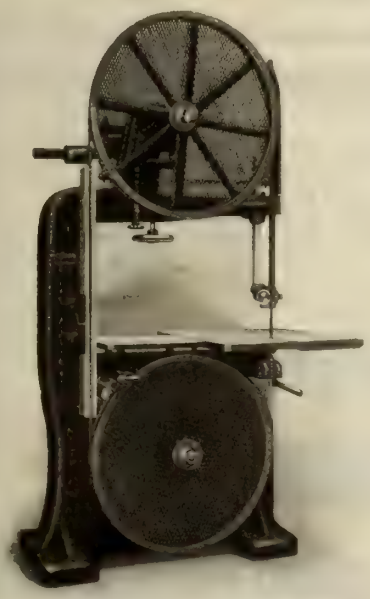
Ball Bearings and Motor Drive as required. Full particulars and prices on request.



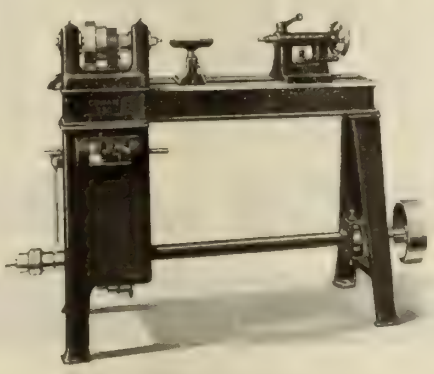
No. 230, Variety Saw
With or without Boring and Mortising Attachment



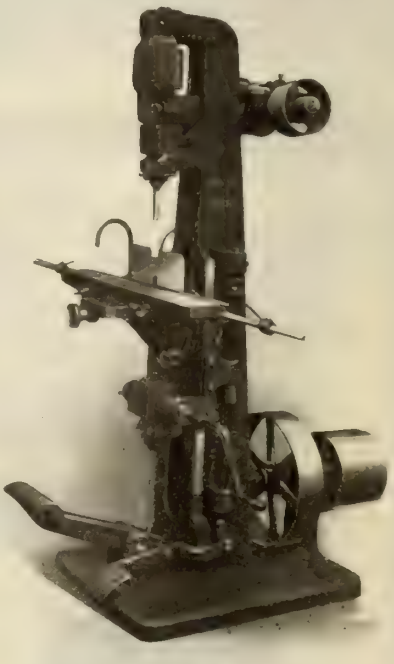
No. 141, Surface Planer
20″, 24″, 26″ wide



No. 311, 36″ Band Saw
Fully guarded
Also 30″, 26″, 20″



No. 330, Speed Lathe
Ball bearing, 12″, 14″ and 16″ swing; 4′, 5′ or 6′ bed



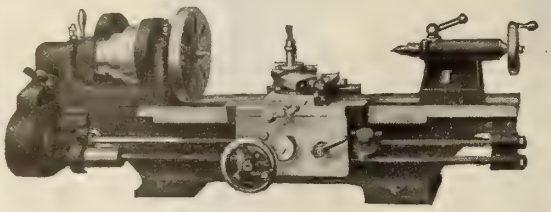
No. 288, Hollow Chisel Mortiser
Capacity ¼″ to ¾″ x 4″ deep

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Type B-6



"The Small Lathe for the Big Job"

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Between Centers - -	18½ inches
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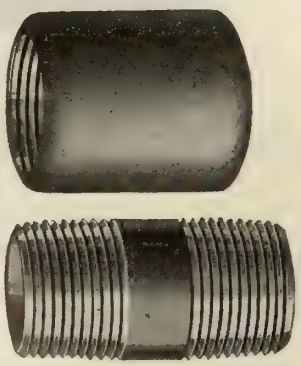
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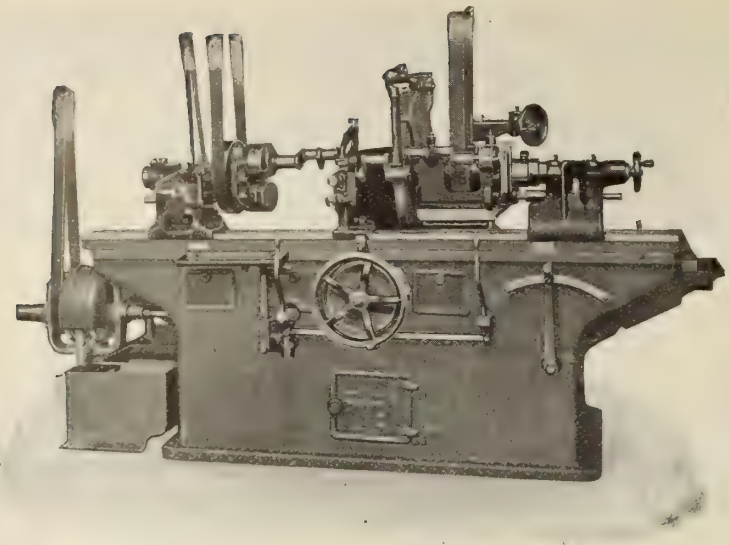
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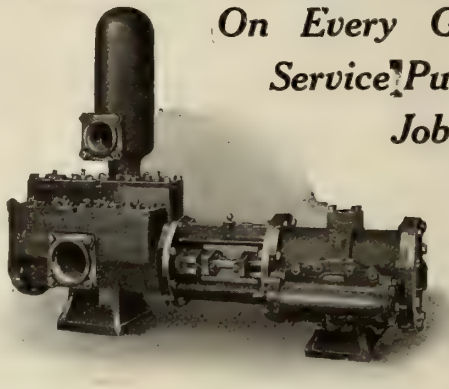
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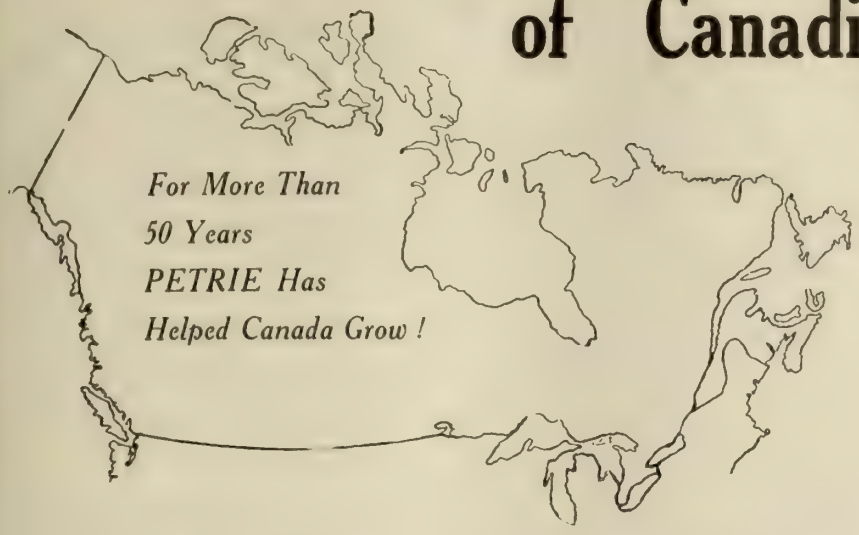
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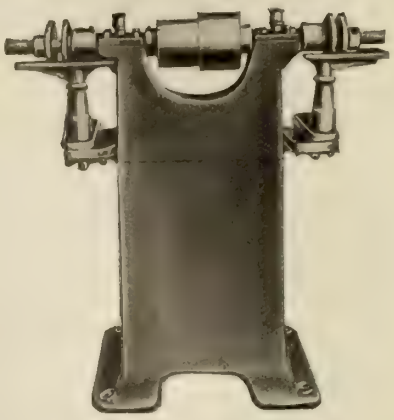
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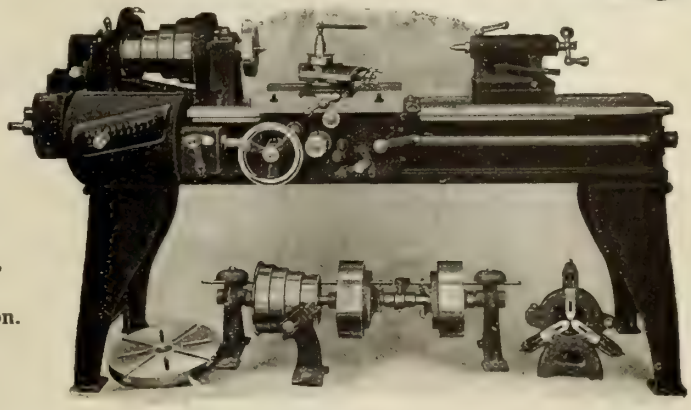


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ASK US.
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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

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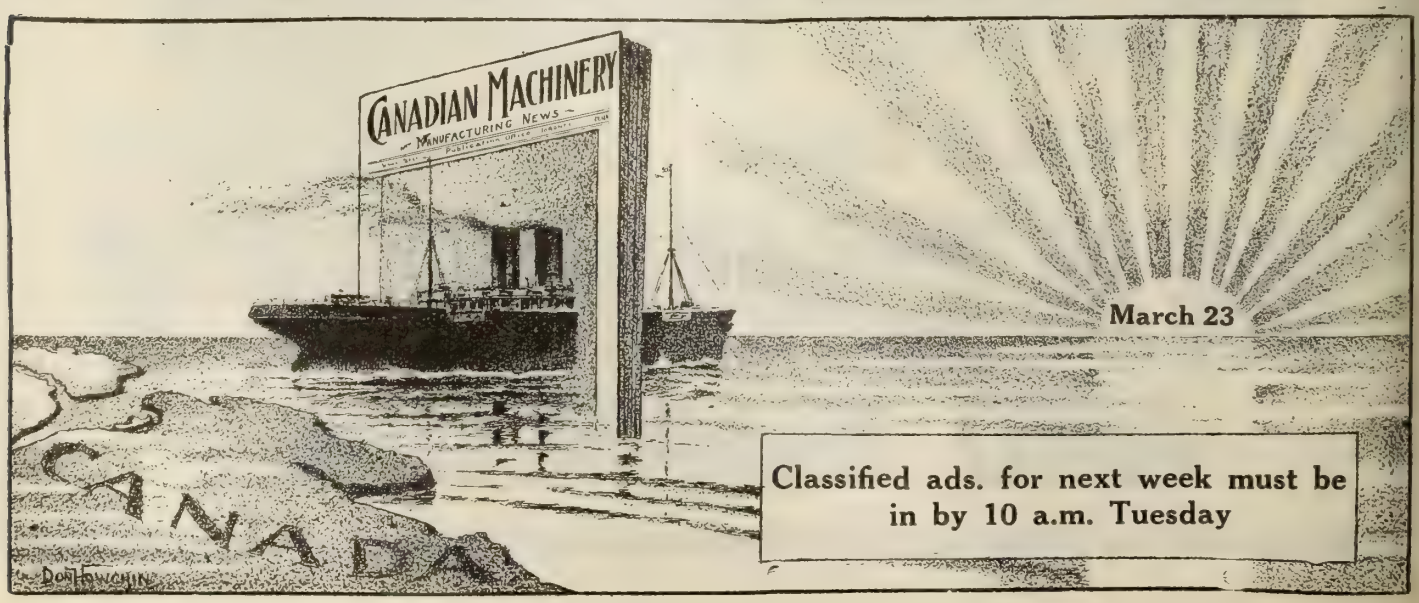
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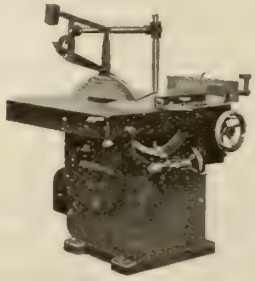


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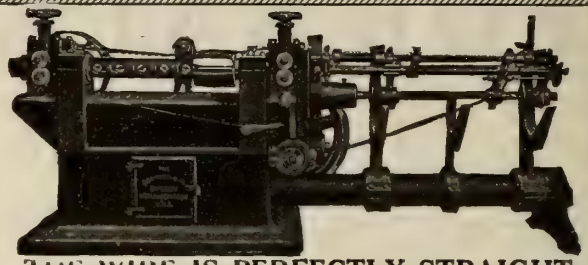
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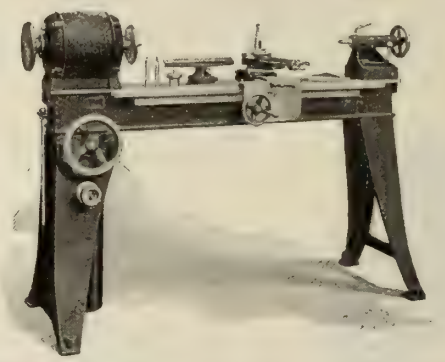
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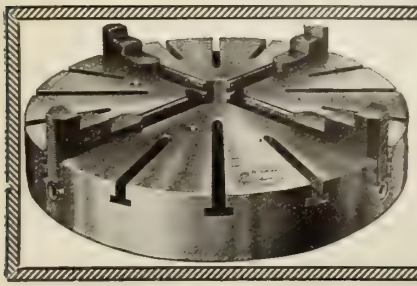
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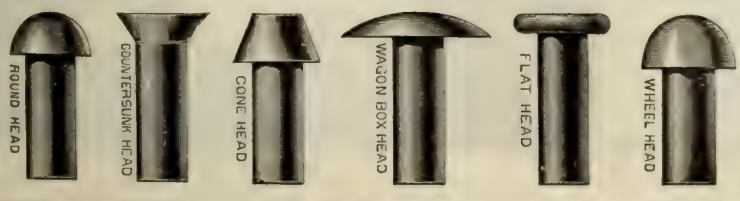
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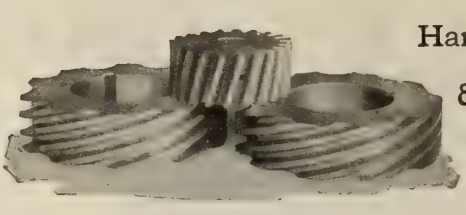
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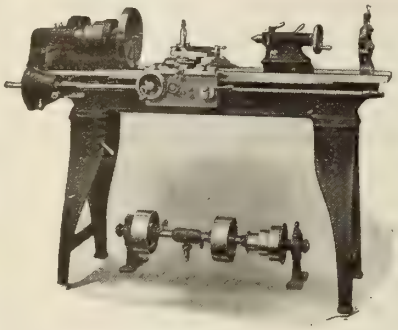
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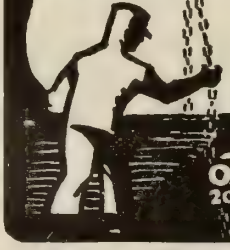
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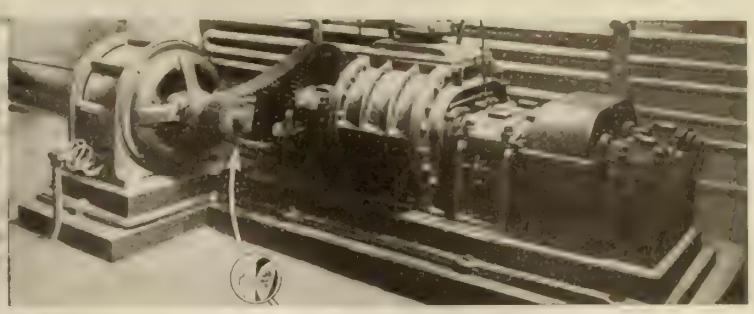
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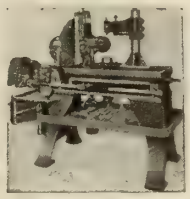
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Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.
Goldie & McCulloch Co., Ltd., Galt, Ont.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Ltd., Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

For list of Dealers see the last page of This Buyers' Directory

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Boring, Drilling and Milling Mach., Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Heads
Aikenhead Hardware Ltd., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont

Castings, Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Brass and Bronze
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Metal Co., Ltd., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Langley & Austin, Galt, Ont.

Castings, Copper
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Marine
Can. Steel Foundries, Montreal, Que

Castings, Die Molded
Banfield & Sons, Ltd., W. H., Toronto.
Fisher Motor Co., Ltd., Orillia, Ont.
Katie Foundry Co., Galt, Ont.

Castings, Ferro-Alloy
Can. Steel Foundries, Montreal, Que.

Castings, Grey Iron
Fittings, Limited, Oshawa, Ont.

Castings, Iron
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Bilton Machine Co., Bridgeport, Conn.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hanna & Co., M. A., Cleveland, Ohio
Hepburn Ltd., John T., Toronto, Ont.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Castings, Hyd. Press
Can. Steel Foundries, Montreal, Que
International Malleable Iron Co., Guelph, Ont.
Kennedy & Sons, Ltd., Wm., Owen Sound, Ont.

BUYERS' DIRECTORY

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Combination Centre.
Prestoa & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
Northern Electric Co., Montreal, Que.
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan
Goldie & McCulloch Co., Ltd., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Williams Machinery & Supply Co., A. R., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass
Volta Mfg. Co., Welland, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Ford-Smith Machine Co., Hamilton, Ont.
Gardner & Son, Robt., Montreal, Que
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Company, Wallace, Hamilton,
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal,

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Corp'n, Sound Beach, Conn.
Perfect Machine Co., Ltd., Galt, Ont.
McKenzie Machinery Co., The, Ltd., Guelph, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McKenzie Machinery Co., The, Ltd., Guelph, Ont.
McDougall Co., Ltd., R., Galt, Ont
Perfect Machine Co., Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto
Williams Machinery & Supply Co., A. R., Montreal, Que

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Cowan Co. of Galt, Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Oliver Machinery Co., Grand Rapids, Mich.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto. Ont.
Ltd.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Fairbanks-Morse Ltd., Montreal. Q
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto Ont.

Monel Metal
International Nickel Co. of Can., Ltd Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal
Northern Electric Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.
Quaker City Rubber Co., Philadelphia, Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont

Pans, Wet and Dry
Frost Mfg. Co., Chicago, Ill

Pattern Shop Equipment
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd Montreal
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston, Mass
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa.

Williams Machinery Co., A. R., Toronto,

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cowan Co. of Galt, Ltd., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shi
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Teol Co., Toronto, Ont.

Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited. Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.

BUYERS' DIRECTORY

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Schuster Co., F. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto,

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.

Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Cowan Co. of Galt, Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Preston Woodworking Machinery Co.,

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Fairbanks Morse Ltd., Montreal. Q
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg Co., Providence, R I

Screw Machines, Automatic
National Acme Co , Cleveland, Ohio

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Company, Wallace, Hamilton,

Springs
Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O
Steele Ltd., James, Guelph, Ont
Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Company, Wallace, Hamilton.

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

BUYERS' DIRECTORY

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Company, Wallace, Hamilton,
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Aikenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Preston & Schwartz, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis.
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Wheel Truing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Tool Work
Brown Engineering Corp., Ltd., Toronto
Crescent Machine Co., Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transformers
Northern Electric Co., Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Ltd., Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

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Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

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Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Crane Ltd., Montreal, Que.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
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Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

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Northern Electric Co., Montreal, Que.

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Barnes Company, Wallace, Hamilton,

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L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
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Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
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Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

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American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wiping Cloths
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Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

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Barnes Company, Wallace, Hamilton,

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Sleeper & Hartley, Inc., Worcester, Mass.

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Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
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Schuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass.

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L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Preston Woodworking Machinery Co., Ltd., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

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Yeates Machinery Co., London, Ont.

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H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co Montreal, Que.

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The Canadian Fairbanks-Morse Co., Montreal, Que.

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H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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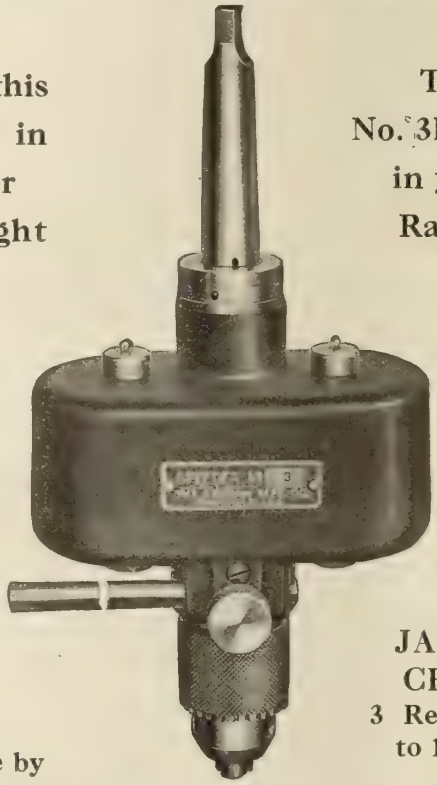
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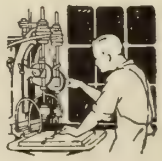
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CANADIAN MACHINERY
MANUFACTURING NEWS

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READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

ANNOUNCEMENT

THE International Business Machines Company Limited, takes pleasure in introducing to the Canadian public an important new invention, the Electrical Recording Door Lock.

The recording Door Lock is a superb piece of mechanical equipment for which we are in a position to say positively, there will be an instant and widespread demand.

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The International Recording Door Lock

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The BERTRAM Page

MACHINE TOOLS

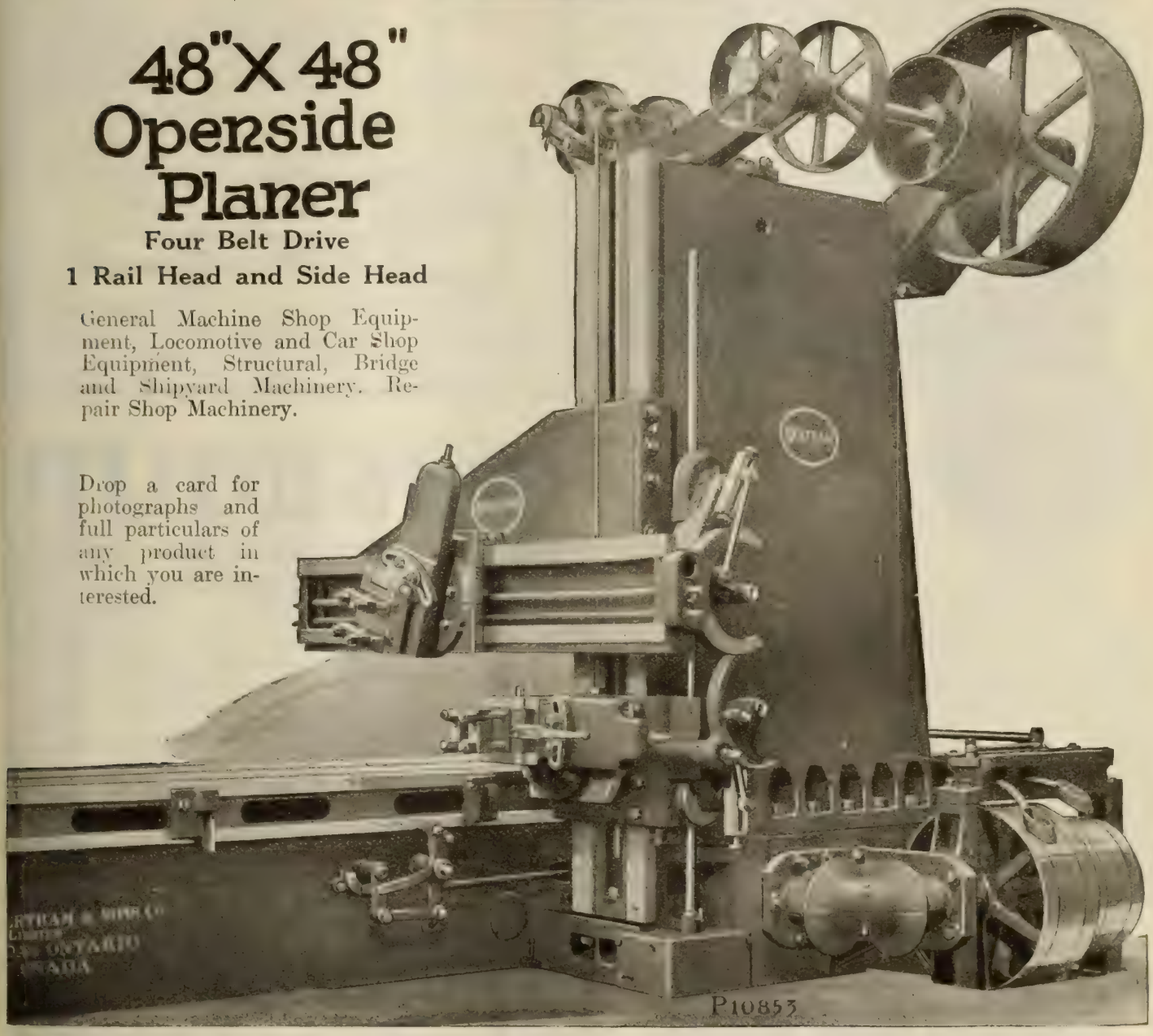
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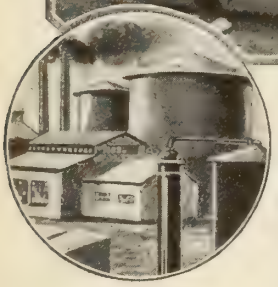
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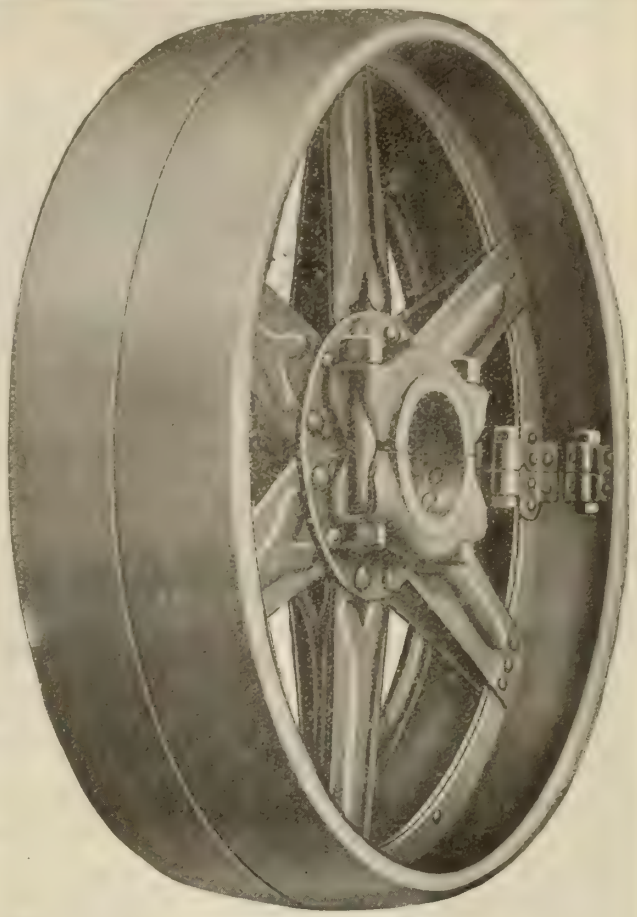
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Philadelphia, Pa.

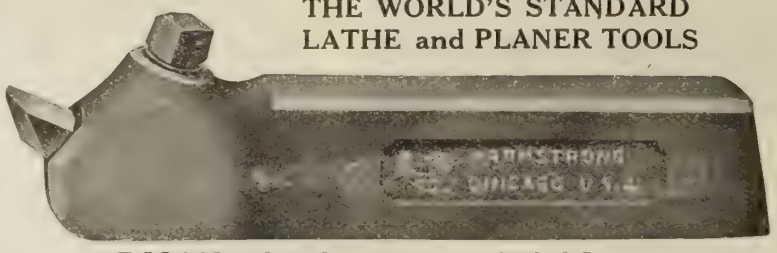
AMERICAN STEEL SPLIT PULLEYS

ARMSTRONG TOOL HOLDERS

Machine shops the world over, for more than a quarter of a century, have recognized Armstrong Lathe Tools to be by far the Best in lathe tool equipment.

Refuse to use imitations. Insist upon being supplied with "Armstrong."

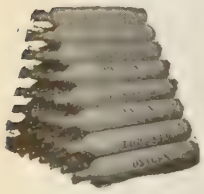
THE WORLD'S STANDARD LATHE and PLANER TOOLS

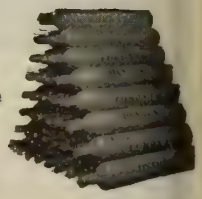


By using Armstrong Tool Holders in your shop you will make one pound of High Speed Steel do the work of ten pounds in forged tools, save all forging and 70% of grinding.

Write for our catalog.

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
306 N. FRANCISCO AVE. CHICAGO, U.S.A.





OXYGEN AND HYDROGEN
(ELECTROLYTIC)

National Electro Products Limited is the largest manufacturer of Electrolytic (pure) Oxygen and Hydrogen in Canada.

WE PRODUCE GASES EXCLUSIVELY BY ELECTROLYTIC DECOMPOSITION OF WATER. We are, therefore, in a position to furnish Oxygen and Hydrogen far superior to like gases made by any other process.

After Exhaustive Tests We Have Decided to Handle The Well-Known

The Torch for Welders OXYGEN PUROX HYDROGEN Who Want the Best!

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Our entire organization—technical and sales—is always at your service.

NATIONAL ELECTRO PRODUCTS
LIMITED

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TORONTO SALES OFFICE
80 Adelaide Steet East
Main 3167

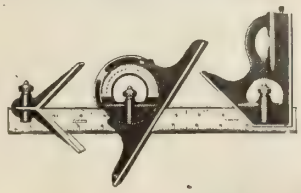
MONTREAL SALES OFFICE AND FACTORY
149 Moreau Street
Lasalle 508

TORONTO FACTORY
295 Dufferin Street
Park 7656

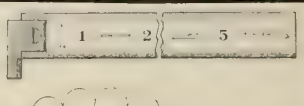


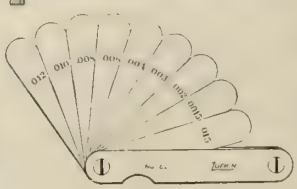


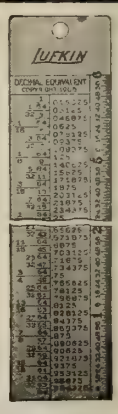




LUFKIN
RELIABLE
MECHANICS' TOOLS
APPEAL TO EVERY PROGRESSIVE MECHANIC







Accurate, and having all the other essential qualities of precision tools; also many improvements which mean better work, easier done.

Their nicety of design and finish appeal to the eye. Their performance day in and day out will hold your approval.

Ask your dealer to show you a LUFKIN Send for Catalogue of Mechanics' Tools.

THE LUFKIN RULE CO. OF CANADA, LTD. WINDSOR, ONT.


L'AIR LIQUIDE SOCIETY
OXYGEN
L'AIR LIQUIDE SOCIETY
Facilities for Service that are unassailable
When you order "Liquid Air" Oxygen or Dissolved Acetylene it is delivered to you at the very time you want it delivered, with no exorbitant costs added for freight or long distance haulage. This is only made possible by "Liquid Air" chain of factories situated at convenient centres all over Canada, operating in conjunction with service stations situated at a point in your own immediate neighborhood.
Wherever your plant or workshop is situated you have a constant supply of Oxygen and Acetylene immediately available and Liquid Air service demonstrators are at your disposal at all times to help and advise you on all matters pertaining to the Oxy-Acetylene Process.
L'AIR LIQUIDE
A Coast wide Service
Halifax
Three Rivers
Montreal
Toronto
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Winnipeg
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LIQUID AIR Co
CANADA

"CANADIAN"
HAND POWER PUNCHES AND SHEARS

All Canadian hand power Punches and Shears are made with "Armor Plate" frames.

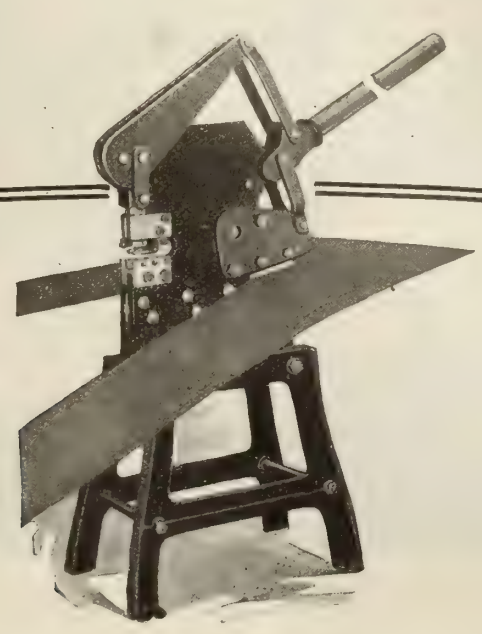
This frame construction consists of a rolled steel plate having a tensile strength 7½ times that of cast iron. This strength permits of a machine much lighter and more compact than is possible with either cast iron or cast steel.

Let us know what your punching and shearing requirements are. We have an "Armor Plate" machine for the service. Remember our Armor Plate Air comprises power operated machines as well as hand power.

CANADIAN BLOWER AND FORGE COMPANY LTD.

KITCHENER, ONT.

Toronto **Montreal** **Calgary**
Vancouver **St. John** **Winnipeg**



TOOL GRINDING CHART

Showing clearance and rake angles for cutting tools. 17 x 27½ inches, printed in two colors on heavy manilla stock.

A splendid thing for any tool room. One large engineering firm, in acknowledging this chart, stated that they would like two additional copies as they intended adopting it as standard in their tool room.

We would like these charts placed in every shop in the Dominion and if there is not one in YOUR tool room, write for your copy at once. IT'S FREE.

CANADIAN MACHINERY,
153 University Avenue, Toronto.

Please send me / us free, one of your tool grinding charts.

Signed .....

Firm Name .....

St. Address .....

City .....

Prov. .....

Examine your files carefully each day for signs of wear.

The proper time to discard a file is when the teeth have become just a tiny bit "dull".

The slightest loss of keenness means reduced efficiency—and a trifling sum buys a new one.

Our famous five brands of files, specially hardened, stay keen and efficient for the longest possible time.

They are:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario



The Perfect Grip

An ordinary hammer will slice the head off a nail, because it gets a grip on the head and not on the nail. With the head off, it's all off.

Williams' perfectly balanced Hammers will grip the *body* of a nail and pull it, head and all, clear through a plank. All nails are trailers to Williams' hammers.

Heads on or heads off, for drive or pull, Williams' Superior Drop-Forged Hammers are the bosses in the nail world. Good workmen want them because they fit the hand, are perfectly balanced and are good all through.

Literature?

J. H. WILLIAMS & CO., Limited

"The Drop-Forging People"

30 Thorold Rd., St. Catharines, Ontario



THE JOHNSON FRICTION CLUTCH

Friction Clutches From Stock

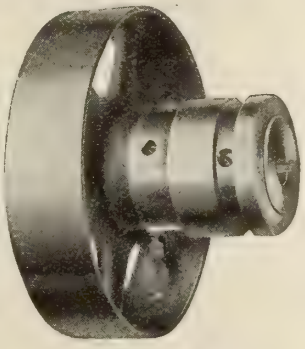
Johnson Clutches, both single and double, can now be obtained from stock in our standard slow speed type to fit all common shaft diameters and all standard pulley bores, within the range of light and medium horse powers that we cover.

State definitely —

Just what the clutch must drive.
Actual maximum horse power.
Speed of clutch shaft.
Diameter of shaft.
Diameter, width and bore of pulley.

We Will Select the Proper Clutch and Make Immediate Shipment on All Ordinary Requirements.

Friction Control Means Better Machinery



And the Johnson Clutch is supreme among friction clutches. Adopt it as your standard — always dependable and always promptly obtained.

Complete engineering service to consult on your problems and to handle special installations of any kind.

Write for our stock list and Yellow Catalogue

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

STEEL CASTINGS

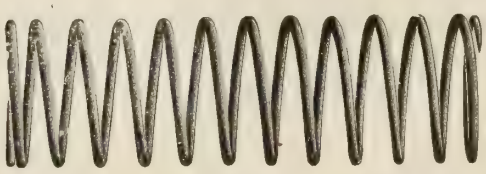
QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860



Manufacturers of

HIGH GRADE SPRINGS, CARBON OR VANADIUM STEEL, BRASS OR BRONZE.

Our excellent facilities for the production and heat treating of Springs insure accuracy and durability.

Write for catalogue, also free engineering service on your spring problems.

Raymond Mfg. Co., Ltd.

Corry, Pa., U. S. A.



Don't Keep It--Sell It!

If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
an engine
a compressor

or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

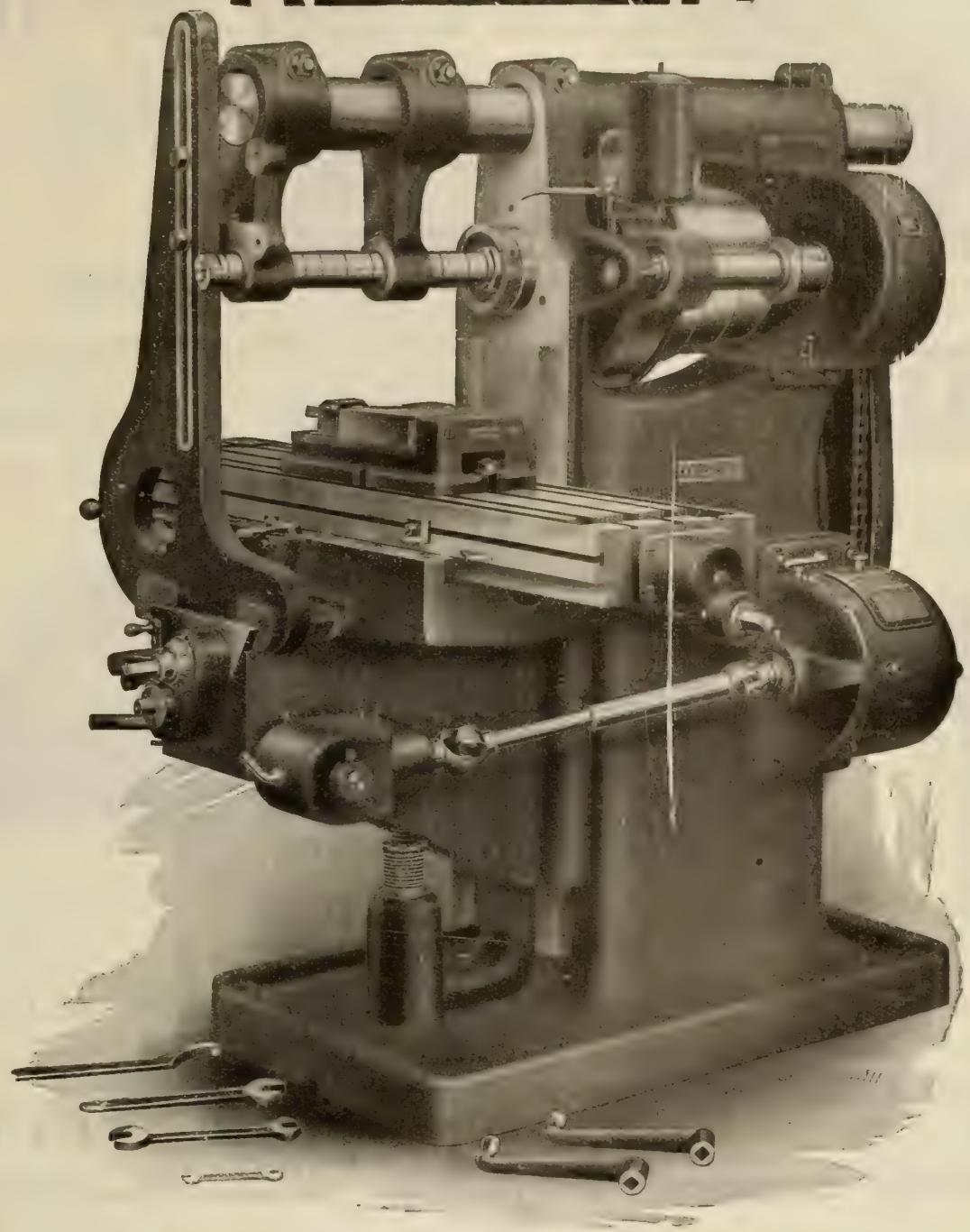
Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

CANADIAN MACHINERY
Classified Advertising Section
143-153 University Avenue TORONTO, ONT.

KEMPSMITH



KEMPSMITH No. 3 Plain Milling Machine

Double Back Geared

A heavy, powerful tool with double back gears and wide driving belt running on a three-step cone of large diameter. Our catalogue "B" describes and illustrates many notable features of the Kempsmith Miller. Write for a copy today.

THE KEMPSMITH MANUFACTURING CO.

MILWAUKEE, WIS., U. S. A.

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CANADIAN DEALERS:—The Geo. F. Foss Machinery & Supply Co., Limited, 305 St. James St., Montreal, Canada; General Supply Co., 38 Toronto St., Toronto, Canada.

Three Generations of Experience

In the Hanna organization you will find not only an intimacy with the best modern practice in the selection and use of pig iron, but also that practical, first-hand knowledge of past methods which makes the soundest basis for the thorough understanding of modern developments.

For three generations the Hanna organization has been an important factor in the progress of the iron and steel industry.

M. A. HANNA & CO.

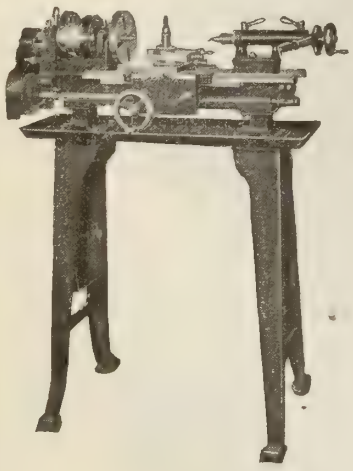
HANNA

M. A. HANNA & CO.

Cleveland Toronto Cincinnati
Pittsburgh Buffalo Detroit

"DALTON SIX"

"The Small Lathe for the Big Job"



Type B-4

—

Actual Swing 7¼ inches

Made with 30" and 36" Length of Bed

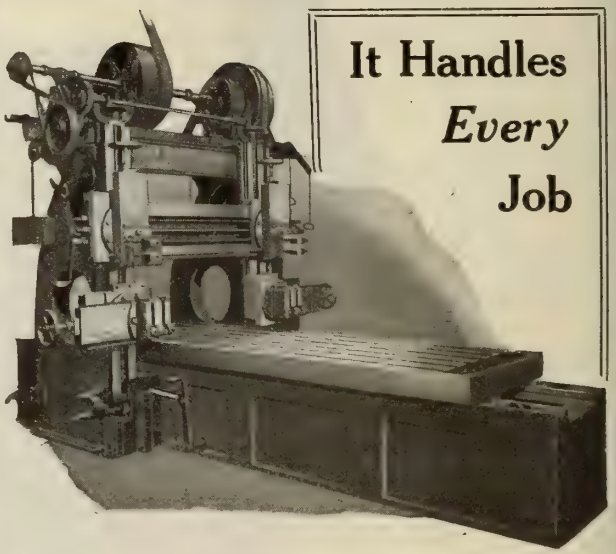
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Write for Bulletin BC-650

Also Manufacturers of Type B-6 Lathes

Dalton Manufacturing Corporation
Sound Beach, Connecticut, U. S. A.
Cable Address "ALEDAL Stamford"

It Handles *Every* Job



THE man who chooses a Hepburn 42" x 42" x 10'0" High Speed Planer does so with the assurance that he is getting the power, rigidity and accuracy required to handle the heaviest work rapidly. As to materials ad workmanship—the Hepburn name means the best obtainable. We are also makers of Engines, Steam Pumps, Cranes, Spinning Lathes, Castings, etc.

JOHN T. HEPBURN, LIMITED
ENGINEERS and IRON FOUNDERS
18-60 VAN HORNE STREET, TORONTO, CANADA

HEPBURN PLANERS

DO YOU MISS IMPORTANT NEWS?

WE read the newspapers of Canada and the United States as a business. We can supply you with valuable news on any subject, whether you are interested as a manufacturer, wholesaler, retailer, advertiser, editor, farmer, or politician. We send you these original clippings, which keep you posted on current events, changes in business, prices, construction news or any special information you wish us to gather. This service costs you little and is valuable to any business. Write for prices and name your subject. Canadian Press Clipping Service, 143-153 University Ave., Toronto.

"I Wish I Had Fixed Those Belts Before The Rush Started"

Just as sure as "eggs is eggs," factories will be struck with a sudden batch of orders to fill starved store-shelves, and the orders will be marked RUSH.

If you neglect fixing up Belts on your machinery, and put off buying new ones where needed, you are going to get into trouble with the production end of your plant. Don't take chances; get fixed up NOW with—



This Belting made in all sizes, for the biggest mill on the continent to small machine Belts, in the littlest factory. Wet-proof, Dry-proof, Heat-proof, Cold-proof. For efficient transmission use "P.M.S" Belting.

" Quality all Through "

Gutta Percha & Rubber, Limited

Head Office and Factory, Toronto

BRANCHES IN ALL LEADING CITIES OF CANADA

Increase the Consumer's Interest

Create a Livelier Demand for Machine Shop, Power House and Foundry Equipment

ARE you manufacturing equipment for Machine Shops, Metal Working Plants, Power Plants and Foundries? Does the consumer know your products? Does he know their quality sufficiently to insist upon getting them when he places an order with his hardware dealer? Carefully weigh these questions. Then consider the advisability of reaching the consumer through the columns of MacLean Technical Newspapers. You can probably use one of the following group.

CANADIAN MACHINERY AND MANUFACTURING NEWS—issued weekly, serving the Canadian Machinery, iron, steel and general metal-working industries: it is read by the men who buy equipment, proprietors, purchasing agents and other executives: its editorial contents are authoritative and comprehensive.

POWER HOUSE—published twice a month, serving steam, electrical, water and gas power plants, in addition to refrigeration plants, in all parts of Canada. It, too, reaches the men who buy equipment; it, too, is the leading authority of the Dominion in things pertaining to its field.

CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS—published monthly, rendering indispensable service to the grey iron, steel and non-ferrous foundries of the country. Proprietors, executives and foremen read it diligently.

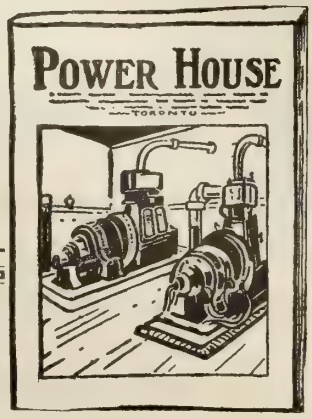
You can awaken new interest in your products by advertising them to the consumer through MacLean Technical Newspapers. Write for complete information.

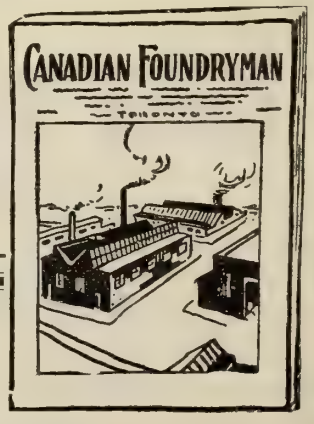
MacLean Technical Newspapers

153 University Avenue
TORONTO

Montreal **Winnipeg** **Vancouver**







CLECO PRESSURE SEATED AIR VALVES



Style PO

Style PO: Parallel Valve has "waste port" to bleed the air from hose after valve is shut off, sizes ¼" ⅜" ½" ¾" 1" 1¼" 1½" and 2" Standard Pipe Thread Inlets and Outlets.



Style A

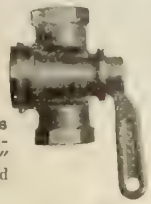
Style A: 30-degree Angle Valve, sizes: ½" and ¾". Inlets and Outlets are Standard Pipe Thread.

Style RA: 90 degree Angle Valve sizes ¼" ⅜" ½" and ¾". Inlets and outlets are standard pipe thread.



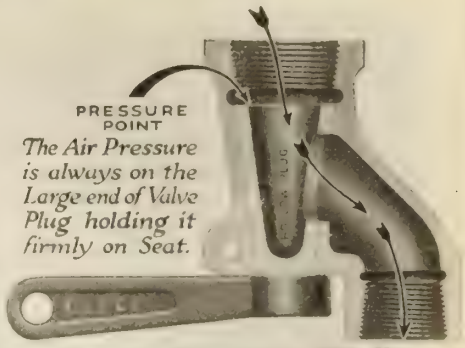
Style RA

Styles A, RA and SL have waste-ports to bleed air from hose.



Style SL

Style SL: The inlets and outlets are the same size and in alignment. Sizes ¼" ⅜" ½" ¾" 1" 1¼", 1½" and 2" standard pipe thread.



The Valve That Improves With Use
Requires no attention after installation.

IN STOCK

Riveting Hammers, Chipping Hammers, Sand Rammers, Air Drills, Grinders, Corner Drills, Bowes Hose Couplings, Cleco Air Valves, etc.



Style FWL

Style F.W.L.: Four-way valve controls the supply and exhaust from both ends of a double acting piston. Sizes: ⅜" ½" ¾" and 1" outlets.



Style LW

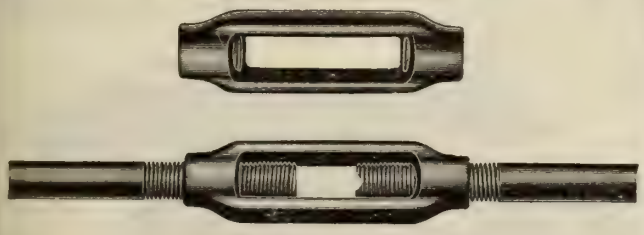
Style LW: Three way valve sizes ½" ¾" and 1" Outlets standard thread.

Write for Illustrated Bulletin No. 50

CLEVELAND PNEUMATIC TOOL CO., of Canada Ltd.
84 Chestnut Street, Toronto **337 Craig Street, Montreal**

CANADA FOUNDRIES & FORGINGS LIMITED

Drop Forged Steel



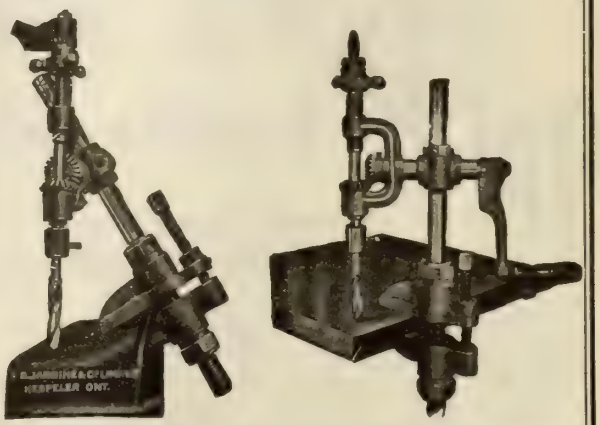
SOLID—NOT WELDED

16 Sizes with / without } Stubs

Canada Foundries & Forgings
Welland, Ont.

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



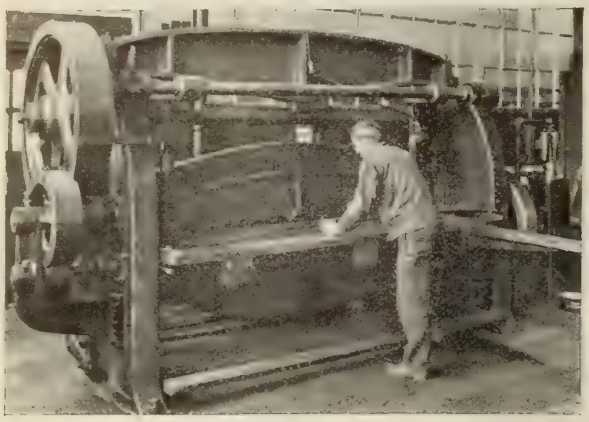
On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.
Weight, 40 lbs. Price, $26.50 net.
Sold by all Machinery and Supply Houses.

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

PRESSES—DIES and SPECIAL MACHINERY

BLISS

SHEARS — SQUARING — CIRCLE — SLITTING



Bliss No. 435 Squaring Shear operating in a large electrical factory

Squaring Shears—for shearing taggers' tin 20 in. wide up to those for shearing 20 ft. wide and ½ in. thick. Weights 450 to 105,000 lbs.

Circle Shears—for cutting circles 3 in. diameter of taggers' tin up to machines for cutting 72 in. diameter circles from 3/16 in. stock. Weights 90 to 7,200 lbs.

Slitting Shears—built in many standard sizes up to machines for slitting ¼ in. stock. Weights 800 to 9,000 lbs.

Gang Slitters—from machines for 32 in. wide stock, capable of 12 slits in I.C. tin up to those for 54 in. sheets and capable of ten slits in ¼ in. stock. Weights 1,900 to 25,000 lbs. Also special machines to meet individual requirements.

"For Efficiency and Economy"
"SPECIFY BLISS PRESSES"
"Standard the World Over"

E. W. BLISS CO. MAIN OFFICE AND WORKS **BROOKLYN, N.Y., U. S. A.**

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No. 194

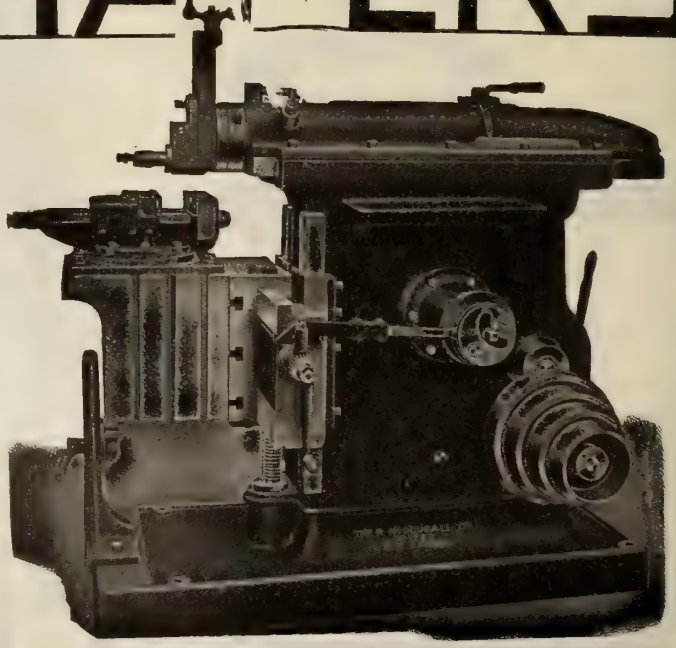
McDougall SHAPERS

Rigidity Plus

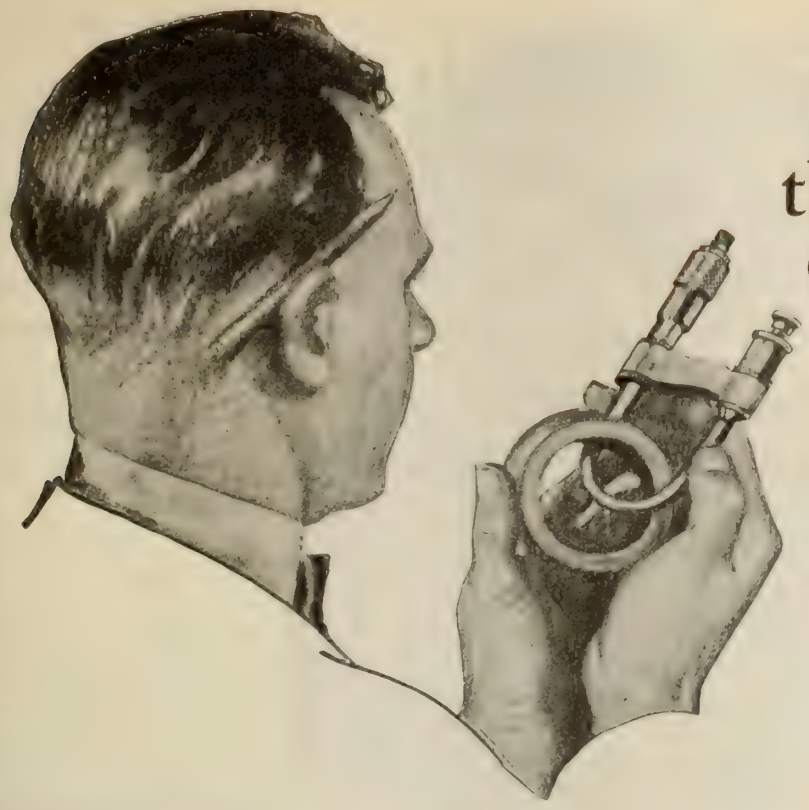
Simple Design and Convenience of Adjustments

give operator every facility for ease of operation and Accuracy in Production

Our circulars, containing complete specifications and descriptions, are ready. Write us for one.



The R. McDougall Co., Limited
Galt, Ontario
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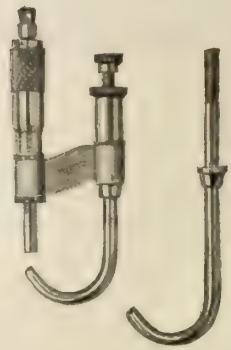


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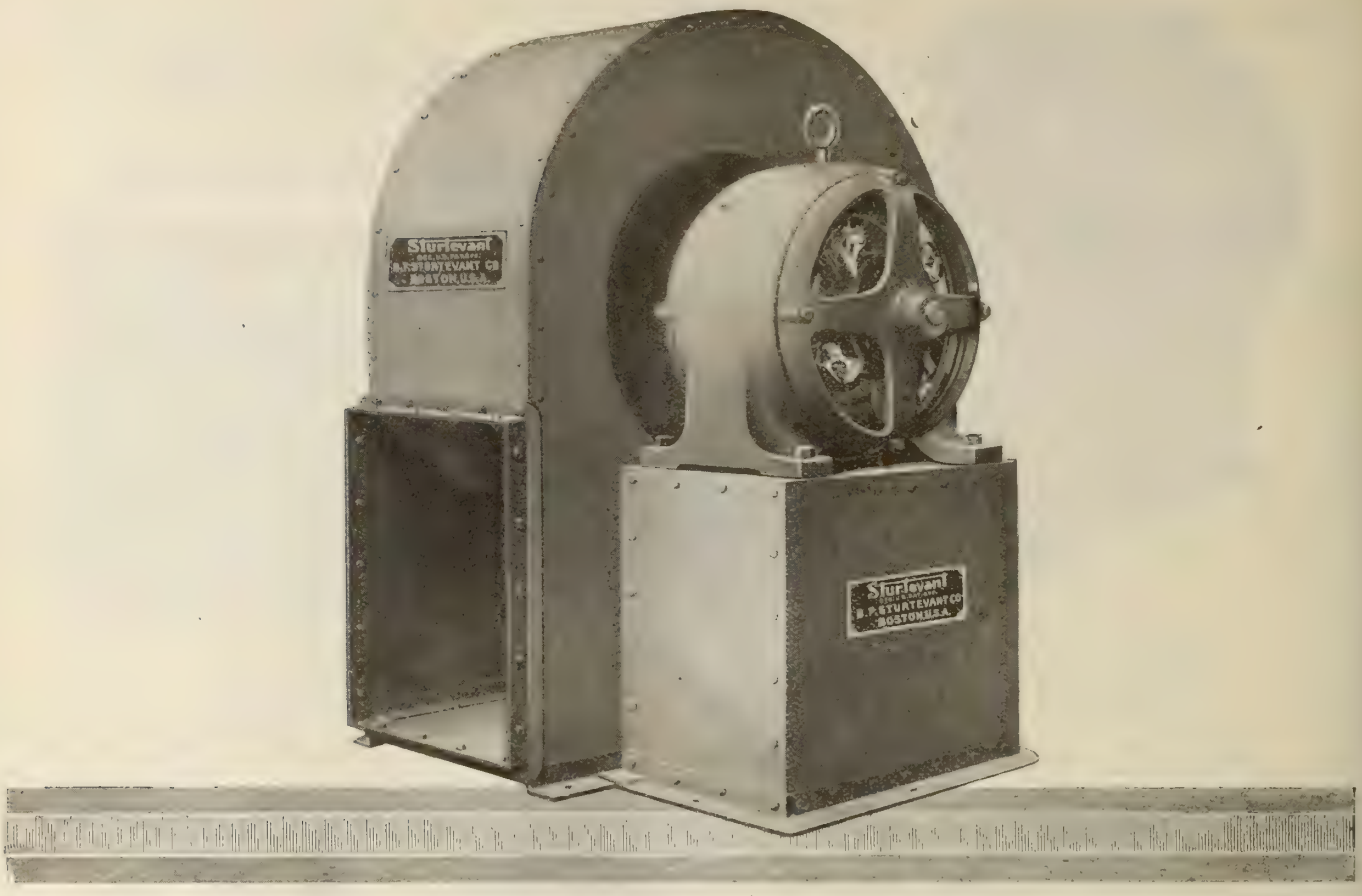
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII, No. 12 MARCH 23, 1922

Executives Should Consider Grinding of Parts

Rapid Development of Grinding Machine—Greater Degree of Accuracy Possible—Type of Grinder Depends on Class of Work —Machine Parts Now Made of Harder Materials

By J. H. RODGERS

THE field of commercial grinding is becoming larger every day. Primarily intended for the reduction of tempered parts and for the correction of slight errors due to warping in hardening, the grinding machine, as an economic manufacturing precision tool, has established itself in the front ranks of production equipment in metal working industries. Work that formerly was taken care of on lathes, planers, millers, and other machine tools, has been turned over to the grinder, and the latter is performing the task at considerably less expense and producing a better quality of product.

Interchangeability has become more universal as a result of the development of grinding machinery, and accuracy, to-day, is qualified in millionths of an inch, where a few years ago thousandths were considered very close measurements. Not only is this true where very fine tools are the lines manufactured, but in every branch of industry the grinding machine in some form or other is proving itself one of the most useful, as well as one of the best time and money saving tools among the many metal working machines now in operation.

In the selection of a grinding machine many factors must be considered, as a machine suitable for work in the tool room, would, in many cases, be entirely unsatisfactory for producing parts on a quantity basis. The character of the work is the main essential. If the range of work is limited a specially constructed machine would probably be more suitable than if the class of work was varied.

The wider application of grinding equipment to general manufacturing has made possible the use of harder materials in machine parts that previously had to be avoided owing to the great difficulty of machining and necessity of subsequent hardening or heat treatment.

Grinding machines are rapidly approaching the semi and full-automatic stage. Precision work is now accom-

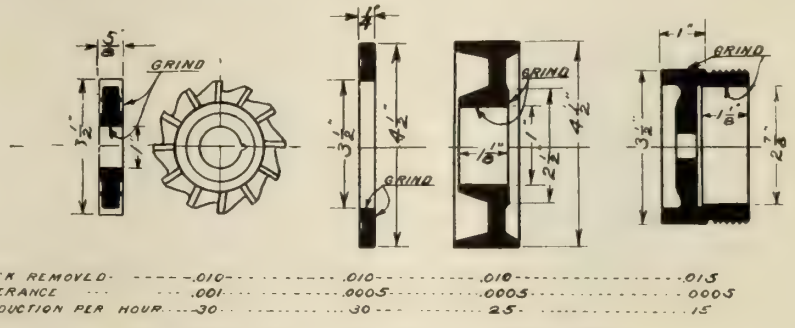


Fig. 1.—Examples of work done on 2 spindle machine.

Cuts and information by courtesy of the Bryant Chucking Grinder Co., of Springfield, Vt.

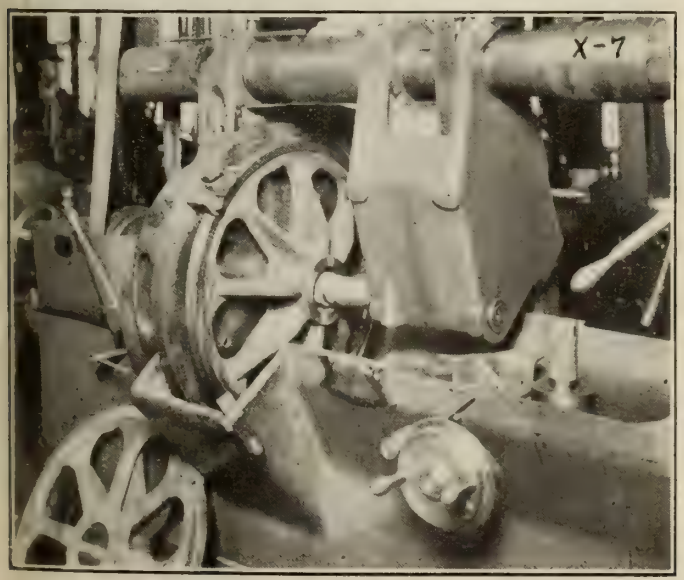


Fig. 2.—Grinding bore of gear shaper index wheel.

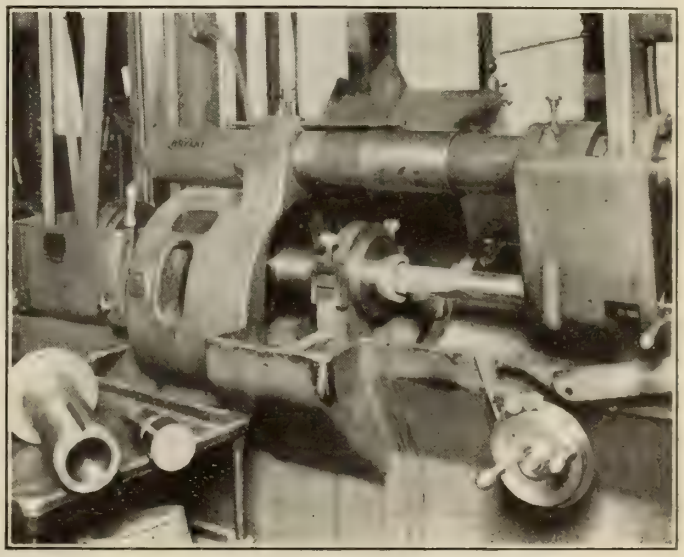


Fig. 4.—Example of deep hole grinding.

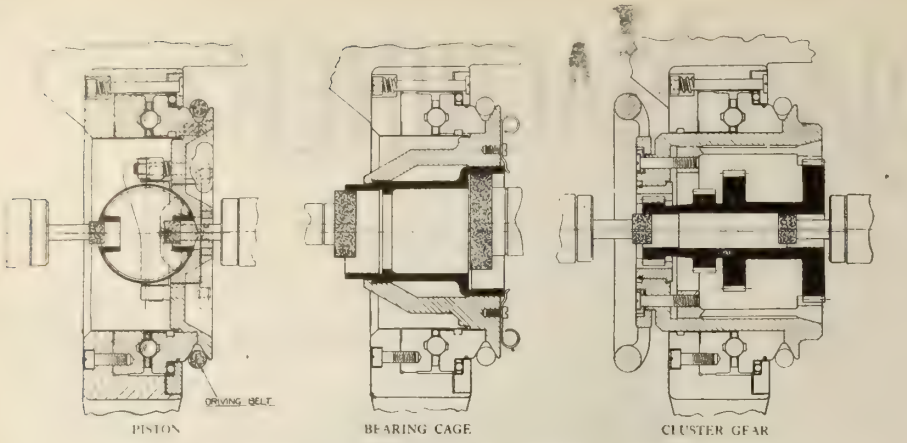


Fig. 6.—Showing work set up on two-spindle machine.

plished on parts where two wheels are operating on different portions of the one piece, thereby cutting the production time almost in half. The accompanying brief article describes a few examples of grinding that have been successfully accomplished.

Fig. 1 shows several examples of work ground on a two-spindle machine, one spindle working on the bore and the other facing the hub or end. The piece to the extreme right shows a part for the Rio Motor Co. The 2⅞ in. hole is finished and the 3½ in. outside diameter is ground with the larger wheel at the same chucking. Not only is the time of re-chucking saved, but finishing the two surfaces at the one setting insures their being absolutely concentric

The illustration Fig. 2 shows a large heavy piece which it is necessary to grind internally. This part is the lower index wheel or worm gear of the Fellows gear shaper. The rim of the work is set back against the face plate, the locating surface being previously ground on a surface grinder. The grinding wheel recommended for this work is a crystolon 24 grain, grade J, operating at 5,500 r. p. m. The size of the wheel is 3½ in. diameter by ¾ in. face. A Bryant No. 30 internal grinder is used for this operation, the production rate being approximately four pieces per hour, removing about .015 in. of stock to a tolerance of .0003 in.

It is becoming more and more a standard practice among automobile engine manufacturers to grind both the crank and wrist-pin holes in connecting rods. Fig. 3 shows a semi-automatic hole grinder working on this operation of grinding the wrist-pin hole in Franklin connecting rods. The rod is located from the crank-pin hole, which has been ground at a previous operation. This wrist-pin end is centred from the hole by a flat hand plug and clamped in position free from any strain. Removing .010 in. of stock to a tolerance of .0005 in., the production obtained is about 25 per hour. Morton alundum, grade L, grain 50 wheel is used, 1 in. by ⅝ in.

A good example of deep hole grinding is shown in Fig. 4. A quill is being ground internally on a special deep hole grinder. This machine was used extensively during the war for grinding airplane cylinders. One end of the quill is centered and driven by face plate on work spindle. The outer end is supported as shown in a steady rest. The part is made of chrome nickel steel, averaging .60 per cent. carbon. The hole is 2⅞ in. diameter and is ground to a depth of 10 in. Approximately .015 in. of the material is removed from the diameter and the tolerances are from .00025 in. to .0005 in. oversize. The production is about two holes per hour. The wheel used on this operation is alundum 2½ by ¾ inches, 38-36 grain, grade J, operating at a speed of 7,500 r. p. m. The work rotates at 200 r.p.m.

The view shown in Fig. 5 illustrates a machine grinding the bore of a Fellows gear shaper cutter. Previously the holes in these cutters were ground and lapped to size, but it has been found possible to eliminate the lapping operation, grinding to a tolerance of .0001 in. This operation is performed before the teeth are ground and accordingly the cutter is centered from the rough hole, being held on a magnetic chuck. Best results are obtained by using two wheels of different grade on the same spindle, one particularly adapted for roughing and the other for finishing. The wheel used for roughing is alundum, 38-50 grain, grade H. The finishing wheel is also alundum, 38-90 grain, grade J. It has been found that the mirror-like finish is produced by using a cutting lubricant

(Continued on page 26)

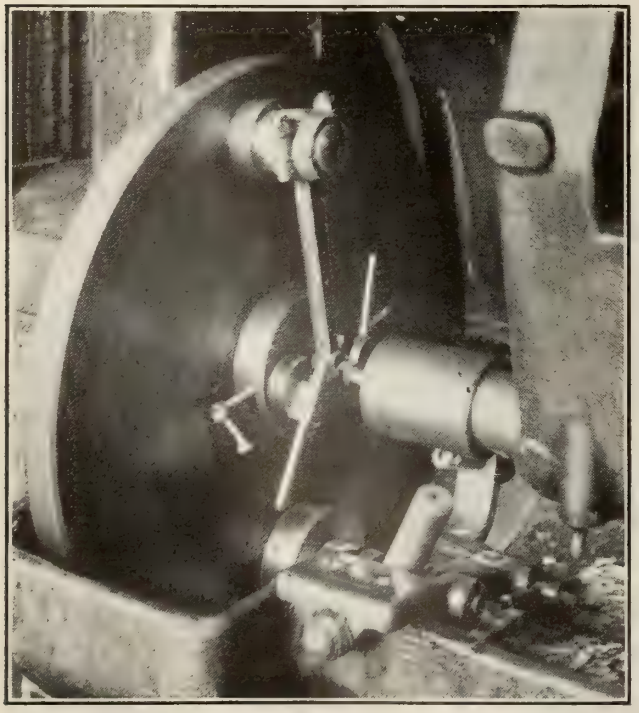


Fig. 3.—Grinding wrist-pin hole in connecting rod.

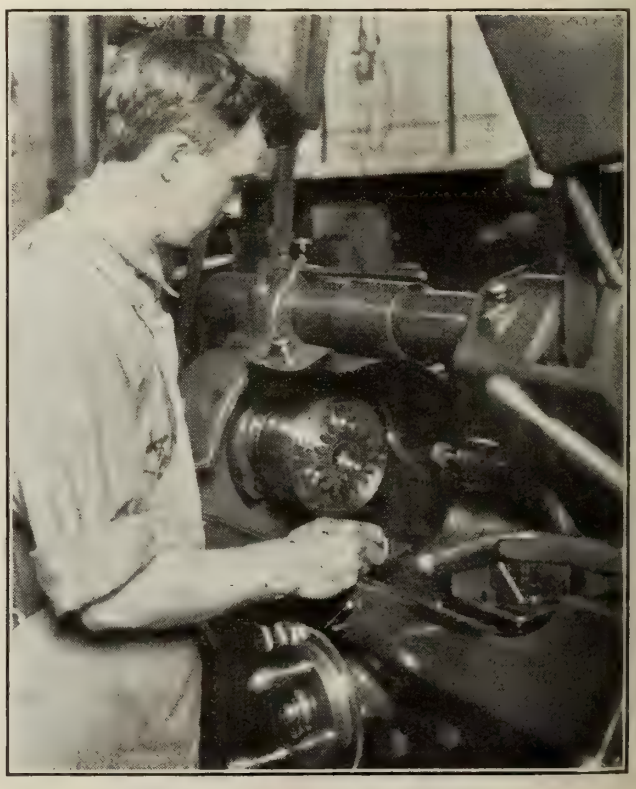


Fig. 5.—Grinding bore of gear shaper cutter.

Controlling the Cost of Labor and Output

Getting Full Value From Workmen—Rating of Labor—Accurate Cost System—Material a Known Factor—Non-Productive Periods—Time Servers—Individual Job Records

By J. H. MOORE

HOW can I increase production? How can I prevent time loss? How can I obtain the actual time spent on every job? These three questions are of paramount importance to every executive, especially at the present time when they must stop all leaks in order to show a profit.

There are various time and labor saving devices and systems in operation throughout factories today, but for the purpose of this article we will consider only one. Before touching on the system itself, let us view the necessity of a close check on labor costs.

Any manufacturer would be highly indignant were he to see one of his employees walk into the main office, open up the safe, take out some money from the cash drawer, calmly place it in his pocket and walk out to some store and spend the pilfered cash. At first sight this appears a rediculous situation, but the same thing is happening in plants all over the world today, in as deliberate, but slightly different manner.

Instead of coming into the office and pilfering the cash, the worker is content to stay in the factory and take it away from the firm in the shape of lost time, that is, except you have close check on his activities. Were he to come to the office and steal the cash, for stealing it is, you would have him arrested. On the other hand you cannot bring him to a court of law for stealing your time, which you pay him for, but you can arrest his time-pilfering methods by insisting on his using some sort of a time and labor checking system.

Time, like any other commodity, is bought to be sold at a profit. You employ a man at so much an hour, expecting him to give you sixty minutes service for one hour's pay, but do you follow the matter up to see if you are securing full payment, or are you content to trust to the man's honor to turn in an honest day's work.

Human nature is much the same all the world over. Where you find one honest and conscientious worker, you will discover a dozen or more, who feel they are equally as honest, but their idea of a full day's work is nothing to boast about. The really honest worker does not object to his employer keeping track of his time, for he has nothing to fear. Therefore, to make sure that the dullards turn in full value for money received, you require some time and labor checking system.

One of the most important yet perplexing subjects has always been that of accurate costs. In rating the value of labor we must start at the cost, and what it returns in profit is based solely on what it has produced over and above its cost. An accurate cost system, irrespective of its style, must consider three basic principles as its foundation, viz., labor, material, and overhead expense, usually termed burden. We know, or at least should know, the cost of all material entering a product, therefore material can be said to be a known item of expense. It is purchased in specific quantities, so that the problem of keeping costs resolves itself to the keeping of simple records in the office purchase ledger.

Overhead expense is taken care of by the regular accounting methods, the rate depending upon the nature and size of the plant. But how about labor, or to put it in another way, job time?

Variable Factor

Labor is a most expensive item, and varies more than any other factor in business. When a plant owner buys labor, he is, or at least is supposed to be, paying for time, and what it produces. If a workman spends a non-productive hour, it will not show up on the books unless some method of checking is followed out. Nevertheless, the lost time is there, and it is the avoidance of such loss which should interest every plant manager.

To gain control of your labor costs, you must know exactly the extent of your production in return for your labor expense. In other words you must know productive from non-productive time. To do this you must have some system whereby an accurate record can be kept of the time spent by each employee on each job.

The value of having employees punch cards as they come and go from their work is now established. It is a rare exception where you do not see time clocks



of some kind installed for this purpose, but what happens after the worker rings in his time card? From practical experience in the shop, I draw this little word picture, with which many plant owners are no doubt familiar.

Around about 5.50 p.m. every night there is a glance at the clock, a wiping of the hands, a searching for time cards and pencils, then a lapse on the part of the workers into deep thought. Suddenly some one will say to his mate on the next machine, "Say Bill, did you notice when I started on that A 2 job." "Somewhere around 2 o'clock I think," comes back the reply, and down it goes as 2 p.m., irrespective of the actual starting time. Strange to say, (or is it strange?) all the cards total up to 10 hrs. actual time, but are they mythical hours, or productive hours? Common sense provides the correct answer.

Pencil Marks can be Altered

Let us go a step further with this shop picture. The cards reach the foreman before going up to the main office. On looking them over he discovers Bill Jones was 5 1-2 hrs. on the B 6 job. "That's too long," he mutters, "I'll speak to him about that," so with the aid of the little rubber tip on his pencil, he changes the figure to perhaps 3½ hrs. and adds two hours to general maintenance, in order to bring the grand total up to ten. Impossible? If any executive thinks so, let him study the matter

NO. 26 NAME R. Devitt
I.B.M. 682

Job No. 23 Part No. 6 Date March 8th 1922
Part Name Pack Frame
For B. L. Blank Co.
Operation Profiling

STOPPED	21125
STARTED	23800
TOTAL TIME	3.25

Quant. Started 5 Quant. Fin. 4
No. Spoiled 1
Reason Bad Casting
(See blowhole to left of R.H. Boss

Inspector J. Jones Foreman P. L. Smith

Sample card used for daily job record.

closely, and he is due for a disagreeable surprise. Of course every foreman is not addicted to this habit, for which we are duly thankful, but so long as the danger and temptation exists, a certain percentage are bound to fall from grace. They feel they must protect themselves, and that Bill Jones is not going to get them up on the carpet owing to his slowness at times.

A job-time record-keeping system eliminates any such danger. It guarantees that every employee gives an account of his work. The foreman cannot change the records, the executive in the main office secures a true story of activity in the shop, and thus the deadwood is soon weeded out.

The time spent by the foreman looking over the cards as formerly, is cut down considerably, as they are all legible if stamped, so that the time saved in this way can be devoted to seeing that Bill Jones and other employees are doing their proper share of work.

If the foreman himself is to blame, the cards will show it, so that naturally he sees the workers do a fair day's work, in order that his production cards will show up to good advantage.

Suppose we have a department containing 20 men. This means that purchased labor for the week is 1,000 hours. Suppose at the end of the week, taking it for granted some record keeping system is installed, only 900 hours productive time shows on the cards, what then?

Must Explain Loss

Naturally the foreman must explain the loss of 100 hours, and in chasing up this loss, he may discover that the operator on machine No. 10 waited 15 minutes for material. Immediately he finds out who was responsible for this condition, and so on he goes, operation to operation, until he finds the cause.

Another workman may blame his machine for being out of order. Suppose this to be true, and imagine this has been happening week in and week out for some time. What is the answer? It means that the machine will be closely examined, and if it cannot be repaired satisfactorily, a new one will be installed in its place. Better spend a little money to stop a leak, than let a small amount of actual cash drop away every day, the amount of which will soon total up to the price of a new machine.

Rather than keep on pointing out benefits which accrue from proper job time recording, we will discuss briefly one system which has been adopted in many plants with good success. A recorder is arranged to receive cards, which when placed in position, are printed as regards the time of starting and stopping a job, simply by the pressing of a lever.

Depending upon the nature of the work, and the wishes of the management, one card for every job can be used, or a daily card covering all the work completed each day. For example Fig. 1 shows what is known as a daily cost card. As will be noted, the time started and stopped on each job is recorded, the elapsed time, the rate, the cost, the number of pieces, the order number, and the operation. Thus, at the end of the day the time clerk has a definite record of the workers' activities during the day.

As the card is self-explanatory, we will pass on to Fig. 2, which shows the style used when there is a card for every job. Many plants favor the latter method, this allowing them to keep all the cards on the one job together. It will be noted on this type, that we have the job number, the part number, date, name, what it's for, operation, quantity started, quantity finished number spoiled, the reason, when started and stopped, and the inspector and foreman's name. Thus, we have a very careful check on the piece all the way through.

Fig. 3 shows another form of card which has proved satisfactory, and in this case we have practically the same information in Fig. 1, but in somewhat different style. It is a question of arranging the card to suit the class of work, but the type shown at Fig. 2, is almost universal, and can be used on any product.

When using a system of this kind, racks should be provided to hold the job time cards, and every worker should be given a certain number. It should be the foreman's duty to see that these racks are kept supplied with cards, so that no one will be waiting to secure orders for the next job. The old story of looking for the foreman is thrown in the discard, for his presence is unnecessary, so far as handing out the next order is concerned. The machine operator knows he must account for every minute of his time, and he also realizes that he cannot waste time on any job, for it will show up on the card.

You get maximum efficiency with least effort. It does not matter whether you use a recorder which is spring or electrically driven, the principle is the same. The operator takes his card, places it in proper location, presses a lever, and a printed record is automatically recorded in the proper place. The recorder can be arranged and equipped with the regular hour and minute printing wheels, or with decimal minute wheels printing in tenths or hundredths, or in any period desired. Every recorder has in addition a wheel which prints in either the day of the week or the date of the month.

The time registered on the job time card is checked with the time clock card, so that immediately the cost clerk knows whether employee No. 23 has done a fair day's work or not. Every worker is his own time keeper, and helped by mechanical means, he cannot make an error. You take the pencil out of his hands, and give him instead a mechanical method of recording his activities. You prevent disputes between the foreman and men, you soon find out the intelligent workers, you prevent a false balance of cost records, you reduce the expense in the cost department, and you furnish a double check on the pay roll.

Practically every business office today has its check protector, and naturally feel more safe than they ever did before. Why? Simply because they know the figures on the check cannot be altered. The same principle applies to cost recording. Make sure you adopt a system which guarantees that the true story of the cost cannot be changed. Adopt such a policy, and you will be mastering a grave industrial leak.

Don't rub your greasy fingers on a piece of work that you are filing.

No. 32

NAME F. N. Martin

JOB NO.	CLOCK RECORD			ELAPSED TIME	RATE	COST
2681	1917 FEB 26	11 .5	STOP	2.5	60	1.50
	1917 FEB 26	9 .0	START			
2681	1917 FEB 26	9 .0	STOP	3.3	40	1.32
	1917 FEB 26	5 .7	START			
2371	1917 FEB 26	5 .7	STOP	3.1	40	1.24
	1917 FEB 26	2 .6	START			
3168	1917 FEB 26	2 .6	STOP	1.2	40	48
	1917 FEB 26	1 .4	START			
3351	1917 FEB 26	1 .4	STOP	1.4	40	56
	1917 FEB 26	0 .0	START			
	TOTALS			11½		5.10

Showing how various jobs can be placed on one card

DAILY COST CARD

NO 82 NAME Jos. Purcel DEPT Woodmarking

	TIME RECORD			ELAPSED TIME	RATE	COST	PIECES	ORDER NO	OPERATION
8	MAR 27	5 00	F	1.36	56	90	75	2124	Polishing
7	MAR 27	3 24	S						
6	MAR 27	3 24	F	2.14	56	1 25	110	3206	Bevel Sides
5	MAR 27	1 10	S						
4	MAR 27	12 10	F	3.05	56	1 72	249	1816	Groove
3	MAR 27	9 05	S						
2	MAR 27	9 05	F	1.05	56	.60	69	986	Face Ends
1	MAR 27	8 00	S						

TOTAL HOURS 8 RATE 56 MATERIALS 5.04 LABOR 4.40 TOTAL CHARGE 9.52

Showing a sample daily cost card.

Increasing the Efficiency of Electric Motors

Use of Ball Bearings Proves Effective—Sliding Friction Reduced to the Minimum—Comparison of Different Types of Bearings—Permanency of Lubrication—Less Space Required

By R. H. CHADWICK

INDUSTRIAL operations are carried on for profit, and profit depends upon the difference between selling price and cost. This difference due to the events of the past few years, has been steadily decreasing—especially in the manufacture of electric machinery. For on one hand the cost of all raw material has been advancing as has also the cost of labor and the expense of marketing the product; on the other hand the manufacturers of electric machinery, because of keen competition in this line, have not deemed it expedient to advance their selling prices in proportion to the increased costs.

The service rendered by electric machinery produced by the various manufacturers is so nearly identical that no one company has considered it wise to take the initiative in marked advance of selling price. Such conditions might soon prove disastrous, and so each manufacturer has been endeavoring to incorporate in his machine a unique feature which will mark material improvement, thus inducing the prospective customer to pay an increased first cost and receive ultimate economy.

Many of the leading manufacturers, both on this continent and in Europe, have answered this question by incorporating ball bearings in the design of their standard equipment. No other single improvement has been made for many years, which has increased the ruggedness and economy of motors as much as ball bearings. The improvement has proven to be a marked selling advantage, and ball bearing equipment, because of its strong sales appeal, put motor selling on a more profitable plane.

For a number of years the desirability of using ball bearings on electric machinery, has been the subject of discussion by engineering societies, both in this country and in Europe, but this no longer proves to be a discussion, but has developed into a real commercial proposition.

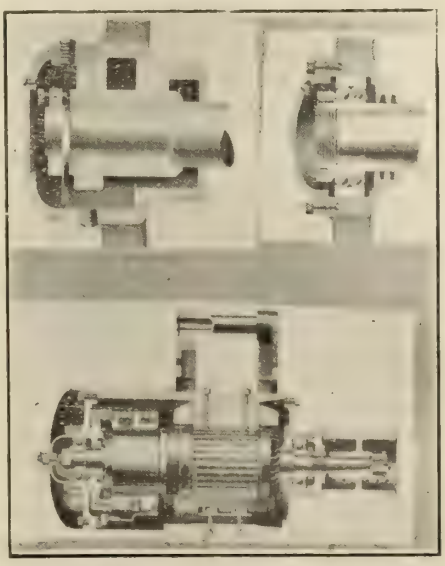
Not only has the incorporation of ball bearings in motors and generators lessened the selling expense for the manufacturer, and allowed him to charge a higher price, but it also offered such economies to the users of these machines that the higher initial cost has been much over-balanced and additional profits made possible. In fact, progressive mill owners, mine superintendents, and shop managers all over the country, who are facing the same problems of advanced costs of material and labor, and are now forced to reduce to meet the present depression, are introducing better machinery, and to grasp every opportunity for completing a manufacturing operation in less time and at a decreased expense, and so they are specifying ball bearing equipment.

In order to obtain an idea of the advantages of the application of ball bearings to electric machinery, a series of questions were recently submitted to motor manufacturing engineers and users of ball bearings throughout the continent. A careful analysis from the data received, giving the tests, and experience of motor designers and users shows the following advantages in favor of ball bearings.

Maintained Air Gap

Among the principal advantages of ball bearings on motors, are their precision and freedom from wear, this being due to the fine limits maintained and the Swedish chrome alloy steel, thoroughly hardened, which is used in the manufacture of same. The bearing adjustment remaining constant keeps the rotor in the center of the magnetic field. This permits the motor manufacturer to employ air gaps with clearances so slight that they could not be considered on motors having any other type of bearing. On induction motors a close air gap is of vital importance in the improvement of the machine efficiency and power factor.

Chief among the difficulties with plain bearings is the fact that after a period of service the bearings wear down to an amount varying with the load and service conditions. If this wear continues, it will finally permit the armature to touch the pole pieces with resulting trouble—perhaps a stripped armature. In a ball bearing, hardened steel balls, roll on hardened steel raceways, thus sliding friction is practically eliminated and accuracy maintained.



Upper left—Bearing using ring or chain oiling system.
Upper right—Ball bearing chamber open at side.
Below—Axle lighting generator. Armature shaft mounted on H. B. ball bearings.

On axle driven generators used for railway car lighting, the bearings must maintain the air gap or a stripped armature results. Ball bearings have replaced plain bearings for this service, almost entirely because of the dependability attained. Records of 200,000 car miles, where ball bearings are used, have become common, in spite of the frequently excessive tension of the belt. The shock and distorting action of the shaft due to crossovers, switch frogs, and uneven tracks, the snap of the generator belt when flying ballast is picked up and passes between the belt and the pulley, all deflect the armature shaft. It is found the self-aligning ball bearings accept these shaft deflections without binding or wear.

Improved Commutation

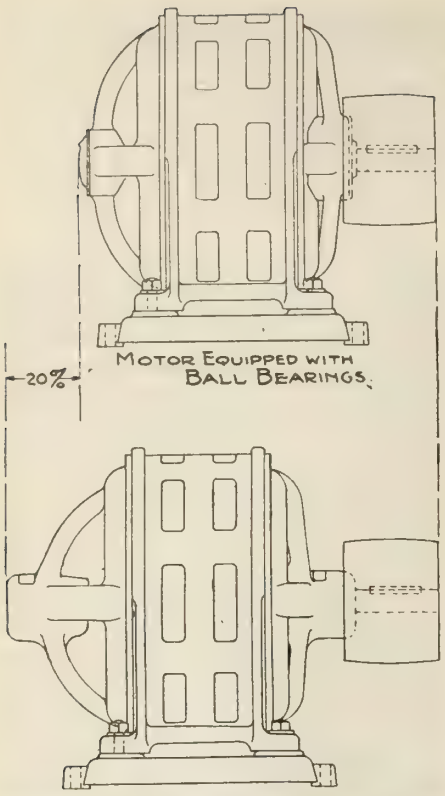
The fact that ball bearing housings are fitted with felt rings, and are sealed so as to prevent the possible escape of lubricant and also prevent the intrusion of dirt or grit into the bearings, keeps the commutator clean. Commutators are thus protected against a conducting mixture of dust and oil and good commutation is maintained. Precision and durability of bearing setting also insure better commutation.

Freedom from sparks from the commutator in flour mills, coal mines, textile mills, woodworking plants or wherever there is combustible dust, reduces the possible danger of ignition or explosion, thereby materially decreasing the fire and accident hazard.

Comparative Efficiency

On motors in which the shaft is subject principally to rotating action (torquet), bearing friction is a very small percentage of the motor losses. This is the case in direct coupled units, centrifugal pumps, motor generator sets, etc. The bearings carry little if anything, in excess of the weight of the rotor, therefore, pressure between shaft and bearing lining is inconsiderable and bearing friction is a minimum.

Where the motor shaft is subject to bending action, however, bearing friction becomes an important consideration. This is the case with belt and



Showing gain of floor space by use of ball bearings.

gear drive motors. The bearings are subject to severe, bending, pounding or shock strains, especially at the driving end. Ball bearings in this instance show a decided saving over plain bearings. This is due to the fact that in ball bearings the friction is practically constant, over a wide range of pressures, and because rolling is substituted for the rubbing action of plain bearings.

Compactness

Compactness is required in conditions usually found in general industrial applications for induction, and direct current motors. To get this feature of compactness, motor manufacturers develop the greatest possible horsepower from a given size of motor frame. The reduced size per horse power capacity gives the greatest driving power in limited space conditions. The length of motor bearings affects the question of compactness to an important degree. Babbitt bearings are usually designed with the box length two and one half to three times the diameter of the shaft which they support.

Contrasted with this, the length of bearings along the shaft usually is not over one-third of the shaft diameter. Surrounding the bearing is the lubrication chamber, which at its outside limits is one-half or one-third shorter along the shaft than the plain bearing for the same motor, with the result that the overall length of motors can be reduced 10 p.c. to 27 p.c. by the employment of ball bearings. Where a consideration of aisle room, floor space, machine arrangement, etc., is necessary, a ball bearing motor goes a long way towards solving the problem, as shown in the following table:

PLAIN DIRECT CURRENT MOTORS

SIZE of Motor H. P.	MOTOR LENGTH OVERALL Sleeve bearing Motor in inches	Ball bearing Motor in inches	REDUCTION in length per cent.
5	26-1/8"	23"	12
6	26-7/8"	24 1/4"	9.8
7	31-11/16"	26"	18
8	35-1/2"	29 3/4"	16.2
9	38-7/8"	32 1/8"	17.4
10	41-9/16"	34 1/4"	17.6
11	45-7/8"	37-7/16"	18.4
12	49-7/8"	38 3/4"	22.4

INTERPOLE MOTORS

Motor	MOTOR LENGTH OVERALL Ring Oiling Bearing Motor Inches	Ball Bearing Motor Inches	Reduction in length Per Cent.
1/2"	18-7/8"	16-1/4"	13.9
1	20-15/16"	18"	14
2	23-7/16"	19-7/16"	17
3	25-1/8"	19-5/8"	21.8
5	28-1/8"	22-1/8"	21.2
7 1/2	33"	25-9/16"	22.6
10	37"	28-3/4"	22.3
15	43-1/8"	33-1/4"	22.9
20	45-1/2"	33-3/16"	27.1
25	45-5/8"	37-3/4"	17.3
30	51-3/8"	38-1/16"	26
40	53-3/16"	41-5/8"	22.2
50	57-1/8"	42-13/16"	25

Simplicity And Cleanliness

The use of ball bearings reduces the head construction to its simplest terms. Instead of oil rings, chains, wicks, waste packing or other devices, which are required for plain bearings motors, ball bearings require no oiling devices other than the ball bearing itself, which are, in themselves, positive self-lubricators. Instead of necessitating frequent inspection of the bearings, renewal of the lubricant, and possibly occasionally rebabbitting, ball bearing motors require no attention other than the periodic lubrication; the length of time between inspections being from one week to six months, depending entirely upon the nature of the service. Ball bearing motors are clean. The bearings are encased within heads with sealing grooves on each side of the bearing, preventing the leakage of lubricant. With this protection, dripping or leaking of oil is eliminated and there is no danger of goods becoming soiled or contaminated with oil from this source.

Gear Drive Motors

Where gear drive is used, ball bearings on electric motors are of particular advantage. In order that gears shall run smoothly and quietly, the proper distance between pinion and gear centres must be maintained. It is a fact that noisy chattering gears may be caused by wear having taken place in the bearings supporting the gears. After long service with this type of drive, ball bearings show no appreciable wear, and consequently the gears mesh properly, giving longer and better service.

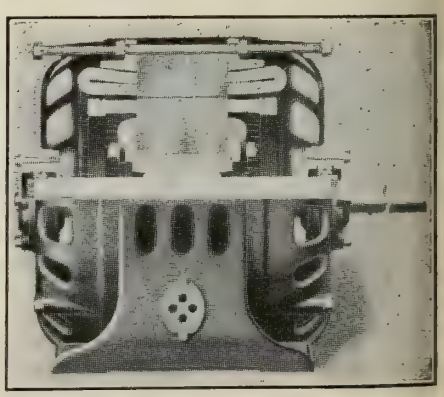
Plain bearings must be designed so that the pressures are well under the limit for the corresponding speed of the bearing. To reduce unit pressure in the bearing surfaces it is necessary to increase the rubbing area. This may be done in either of two ways. First by increasing the journal length. This, of course, offers the disadvantage of increased floor space required by the motor, and where compactness is a desirable feature this is a serious handicap. Second, by increasing the shaft diameter. Increasing the diameter, increases in direct ratio the speed of the rubbing surfaces, which should be kept as low as possible, because each increase of rubbing speed directly increases the likelihood of hot bearings. Larger shafts also mean heavier and more costly motors.

Whether, therefore, the bearing length or the shaft diameter be increased, the plain bearing is confronted with positive limitations. Ball bearings are designed for high speeds and heavy loads. The housings are short, and the motor on which they are used may be made very compact. Because of the compact construction the distance between the bearing and pinion is reduced, hence the overhung load on the bearing is proportionately reduced.

Ball Bearings on Axle Generators

Ball bearings are now used almost exclusively on axle driven generators as used on railways. A few years ago these machines were equipped with plain bearings. The service is so severe, however, and the attention that can be given is so small, that ball bearings have proved to be the only equipment that will "stand up." The generators are exposed to snow and ice, heat, dirt, and water, the jolts and shocks of passing crossovers and switches, and the continual jar of heavy track suspension. These conditions all play havoc with the plain bearing generators. The testimony of a superintendent of inspection of one of the largest railroads is eloquent with the advantages of ball bearings on these generators. He says "The cost of generator maintenance has been reduced on coaches 66 p.c., on diners 46 p.c; we have never had a hot bearing; have not lost any fields or armatures, the inside of the generator is dry, and we have no trouble due to grounds or short circuits." This is typical service where self-aligning ball bearings are used.

(Continued on Page 26)



Showing armature shaft fitted with ball bearings.

A New Form of Toothed Gearing

Radical Departure From General Practice—Great Flexibility Provided by Small Rollers—Adaptability to Modern Requirements—Tooth Forms Compared—This Type Practically Noiseless

By W. RUS. DARLING

THE PROBLEMS of power transmission have occupied the minds of many succeeding generations of engineers since Archimedes discovered the properties of the lever, gave unlimited extent to the notation of numbers, and founded the method of indivisibles or exhaustions which led up to the finest discoveries in geometry, and some of the greatest modern inventions. Following Archimedes, Appolonius of Perga, who was the first to derive the conic sections from a single cone, Pappus, Diocles and Nicomedes, who invented some of the higher curves, even Diophantus, who gave us the characters used in algebra, all helped towards the determination of that little curved line which encloses the form of a modern gear wheel tooth.

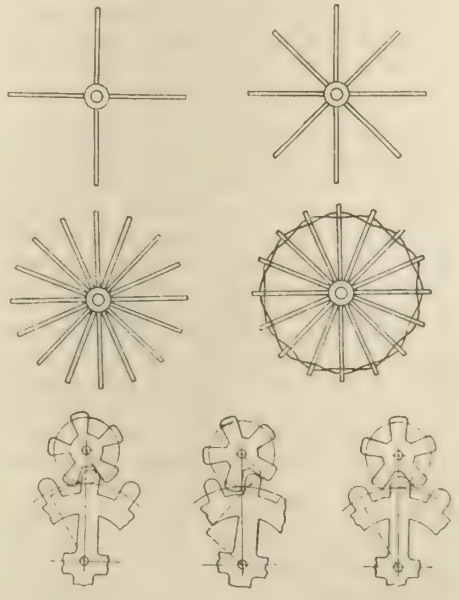
The higher geometrical science was originally applied to astronomical research, and enabled Aristarcus to expand immensely the conception of the solar system. By it Hipparchus sought to explain the apparent inequalities in the motion of the celestial bodies by the hypothesis of eccentrics and epicyles. Then mechanicians naturally followed the discoveries of the great men of the Alexandrian school, and devised eccentric, elliptical, and planetary gears. From the same geometrical sources there came later square and triangular gears, and other less familiar variable speed devices.

It is commonly supposed that the greatest mechanical discoveries are the result of chance that the most celebrated mechanicians had no theoretical knowledge and that even famous mathematicians have failed when they attempted to put their ideas into practice. It is no doubt true that chance sometimes unfolds important inventions, and that useful results do not always follow the laborious investigations of the theorist; but it is necessary for this that the productive causes be of the very simplest kind. The chance mixture of some substances gave birth to important chemical combinations; two convex lenses, placed parallel to each other at a certain distance and directed to a distant point, indicated the principle of the telescope.

The First Gear

History tells us that the first gear wheel was composed of flat pieces of wood, arranged in the form of a cross, Fig. 1, which were made slightly longer in one wheel of a pair. This was not for the purpose of modifying speed or power, but to ensure engagement. Subsequent developments of this idea extending over centuries are illustrated in Figs. 2, 3, and 4. In the latter the extremities of the arms are stiffened by binding, and indicate the first approach to the modern toothed wheel. Previous to 1674 teeth were of no particular scientific form, but were merely more or less regular excrescences on the rims of the wheel and pinion. About that time Roemer, a Danish mechanician, first applied the epicycloidal curve with the object of securing uniformity of pressure and velocity.

Within the last 50 years makers of clocks, watches, chronometers and mathematical instruments shaped their wheel teeth to please the eye drawing them to an enlarged scale for better discernment then reducing them to the required size. Lancashire makers of watch wheels used the bay leaf as a pattern. It was not until the works of Camus were translated from the French that wheel teeth began to take a definite shape, and engineers and others realized that tooth designing was a science rather than an art and that only by following certain basic principles could they get uniform velocity, durability, and efficiency in their machines. Camus pointed out some of the limitations in toothed gears, for example, that pinions of a certain number of teeth were unsuitable for working with particular spur wheels, on account of the line of pressure being either outside or inside the pitch circle, Figs. 5, 6, and 7. In this connection it has long been considered unwise to have less than 14 teeth in any pinion, and in present-day work, whenever high ratios are required, involving pinions of small diameter, the teeth are made to a fine pitch with a corresponding widening of the face.



Figs. 1 to 7.

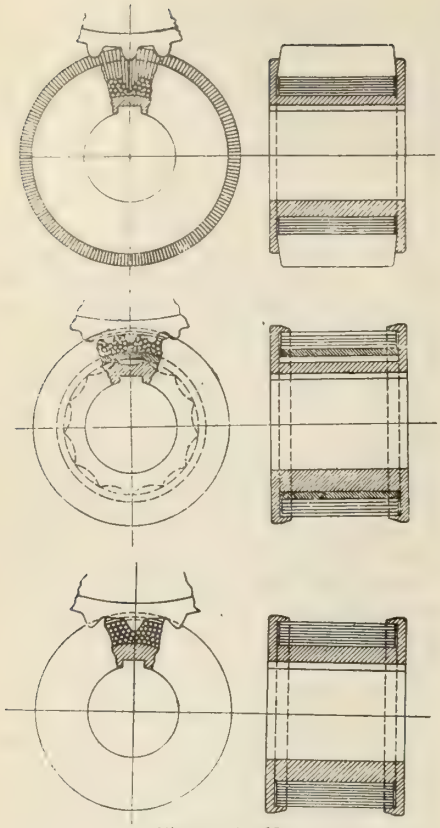
Tooth Pressure

This brings us down to modern times and the question of tooth pressures, which still awaits the final answer. It should be easy to determine, even in the laboratory, what pressures can be economically withstood by the various metals available for wheel teeth; but the great difficulty of maintaining, under certain conditions, the contact of wheel and pinion teeth along the whole face must be recognized, and also the possibility of intermittent point contact provided for in the design and material.

In the case of reduction gears fo marine turbines, several devices have been tried, or proposed, for imparting flexibility and compensating inaccuracies of alignment and contact, but these have shown, naturally, better results in the testing department than in actual service. In so elastic a structure as a ship, no land trials can adequately indicate the behaviour of her machinery in heavy weather at sea. Even the most careful loading and trimming of cargo will leave the machinery in a different condition from that which prevails when running light. In a heavy sea there is a constant change of conditions, of torque, of alignment, of gear contacts, and of tooth pressures and it is not to be wondered at if heavily loaded gears wear more rapidly in heavy weather.

It is not proposed to make detailed mention of the best-known devices for fighting these evils but some of the less familiar propositions may be of interest. From Holland comes the proposal to subject the pinion blank to the torsion at which it is expected to work when in service, and to retain it in that condition while the teeth are being cut. A special machine has been devised for this purpose, and while the idea seems practicable, it appears, at the best, to provide only for mean conditions. In the United States of America it was discovered that pinions which had lain in the store for some months before being fitted into place had become so much distorted that they had to be removed, and the teeth recut, after a brief and noisy trial run. This led to the suggestion that certain parts of machinery should be laid aside in a rough state for some time before machining, so as to get rid of internal stresses. A very sensible practice adopted in machine-tool works in Germany reminds one that more thought should be given to the prevention of gear troubles rather than

Paper read before the Institute of Engineers and Shipbuilders in Scotland.



Figs. 8 to 13.

to their cure. This practice is to balance all rotating parts, and, according to report, it materially reduces the noise and vibration usually ascribed to other causes.

If inaccuracies, either in the form of teeth, alignment, or balancing of parts, were the sole cause of power transmission troubles, there would be no excuse for their continued existence, but there are, and always will be, certain varying conditions on land and sea which must be conquered. To overcome these varying conditions, it may be necessary to revise some of the basic theories, a to steer clear entirely of makeshifts and half-measures. A theory is nothing else but a regular union, or methodical and connected arrangement, of all the facts relative to a certain natural or artificial effect; facts which are obtained by true experience. If a theory is perfect, and the product perfect, the resultant effect should be perfect. The tangible elements, being subject to the five senses, may be easily dealt with and eliminated, and with imperfect results before us the theory must bear the blame.

I have endeavored to outline the combination of sciences from which were evolved the modern wheel and pinion, but the new gear which I now propose to introduce comprises an element which, to the best of my knowledge, has never before been applied to practical mechanics. Before embarking upon any radical change in a time-honored theory or practice, it is well to investigate their origin and development, and determine whether the justification is to be found in an inherent or an incidental deficiency.

Figs. 8 to 19 show how the new Autopitch Gear developed in the mind of the inventor, the first form consisting of a wheel body with loose pieces of thin plate fitted close together round the rim, forming, as it were, a regularly laminated ring in the position usually occupied by teeth and their corresponding spaces. It may be interesting to note how this idea originated. Having arrived at the conclusion that the old theories were unlikely ever to produce a gear which would in its own composition, cope with the varying conditions of wear, torque, alignment, expansion, etc., and that some of these conditions were natural and therefore permanent, the following list was made out to indicate requirements of a perfect gear:—

Strength, sufficient to ensure safety.

Durability, unlimited.

Adaptability, to all possible variation of conditions.

Elasticity, sufficient to absorb unavoidable vibrations of other parts.

Noiselessness, approaching to silence.

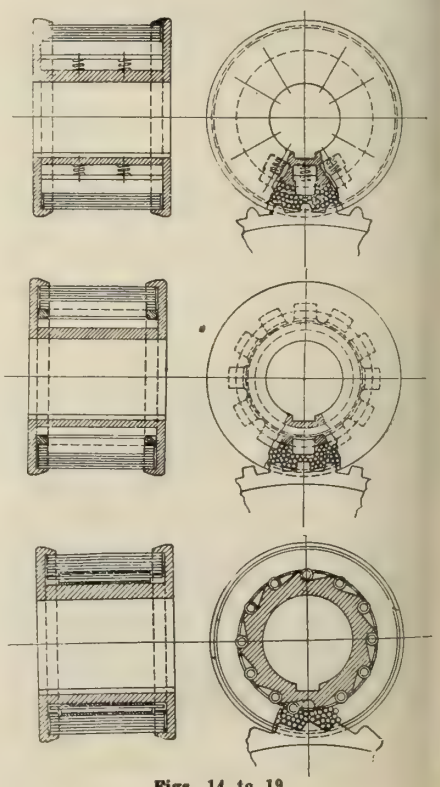
Economy, both in cost of production and in power.

The first requirement, strength, seemed to be a matter of design plus material, the second, durability, of material plus design; the third, adaptability, seemed to lend itself less to ordinary methods of solution, and was set aside for a deeper analysis; the fourth, elasticity, seemed to depend on material plus design plus mounting; the fifth, noiselessness, would appear to be covered by the fourth plus workmanship; and the sixth, economy, may be accepted as secured by the realization of the other five.

On looking over this list it was apparent that the third requirement would be most difficult to fulfil, all the others being within the scope of modern knowledge and practice. With the time-honoured principle of the wheel and pinion still guiding the mind, a careful review of the reasons why this principle had failed to produce the desired adaptability, led to a concentration of thought on the pinion. Any trouble with the larger wheel of a pair was traced to the pinions which drive them, and it was then concluded that the solution of the problem might be found in a pinion which would have no pitch or form of teeth except that imparted to it by the engaging wheel. In other words, every driven wheel should be its own odontagraph. Simple minds mould their ideas from simple patterns, and, in this instance, having come to the conclusion above stated, the next step was to find some simple basic element or principle in nature, which, when viewed in the light of centuries of thought, experience and application, might point some untrodden way to the desired end.

The old mill wheel, with its continuous stream of water "gearing" into it, suggested possibilities. The mill stream adapts itself to almost any conceivable variation of a nature corresponding with those to be met with in mechanical gears. If the mill stream could be rolled up in a circle of suitable diameter, and provided with a shaft and bearings, it would form a pinion of the required adaptability. The absurdity is, of course, apparent, but in search for a new theory, apparent absurdities must be fully considered. And this same apparent absurdity is one of the most familiar features of nature; the feature which makes it necessary to build ships instead of railways. By the same method of reasoning the earth is revealed as a pinion, in constant motion, which, given the outside connection, might drive the universe. In the earth as a whole there is the embodiment of the idea of a mill stream revolving continuously round an axis. But in building up a theory the "methodical arrangement of facts" must be complete. Imagine a paddle-steamer in a fixed position relative to the motion of the earth, and the wheels driven by the water revolving with the earth, and you have the idea of the mill stream mounted on an axis. Being in possession of a theory which appears to be sound, it remains to be seen whether it can be applied within the limitations of known or achievable practice.

It is probable that machine-cut teeth are not always correctly shaped, although the machines ensure the equality of their pitch. The bearing between opposing teeth may be only at a point, or points, instead of on a line the full width of the wheel. Even this line contact, when acquired, is not a mechanical ideal. Teeth slide as well as roll, and concentrated pressure and friction are, therefore, of great importance, and it is only the high quality of the material available that enables thousands of horse-power to be transmitted through



Figs. 14 to 19.

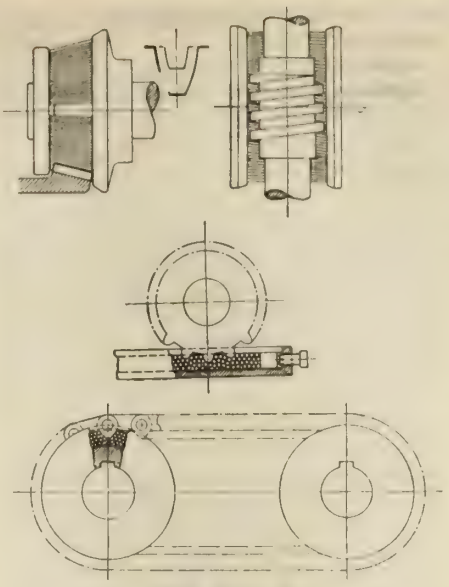
one, two, or three lines of contact of one, two, or three feet lengths.

The value of the oil film and its existence between the engaging teeth are apparently accepted by authorities on gearing, and I sincerely hope that the acceptance is justifiable. If this film of oil is actually constant, it must be concluded that the pressure, the wear, and the transmission, are all effected through the medium of that oil film. It is estimated that in modern high-speed gears, the period of contact is about one-thousandth of a second, and from that fact is deduced the retention of the oil film.

From the foregoing it may be reasoned that the thicker the film the better, and, to carry this reasoning to its logical end, if the teeth of one wheel were eliminated and only the oil left, the theory of the endless mill-stream and the earth-driven paddle-wheel would be realized in practice. Absurd again, of course, but the question resolves itself into one of degree. How near can one get to a continuous oil film? The fluidity of oil makes it impossible to retain it in the form of a pinion rim of sufficient thickness to engage the teeth of the spur, so something else must be considered. If the oil is solidified the effect is no better, because, even if the radial forces suspended action, one revolution of the pinion would give it the impression of the spur teeth and destroy the continuity aimed at.

Reverting to the rational forms and materials of gear teeth, the finer the pitch the closer together, and therefore more nearly continuous, become the successive films of oil. If, however, the teeth are made too fine to carry the load, all the advantage would be lost, and it must be concluded, for the present at least, that the continuous film is impossible in practice; but there is an element which has not yet been considered. It is neither a fluid nor a solid, and yet possesses something of the nature of both. It is sometimes called a semi-fluid, and perhaps the only familiar form of it is to be found in balls. If a number of balls are poured into a vessel they will find a common level; if run out on a table they will behave much like water.

A less familiar form, perhaps, found in rollers, and here is an element which can only flow in two opposite directions. It is this fact, this limitation, which enables it to be harnessed in the form of an endless mill-stream within the compass of an ordinary pinion, Figs. 8 to 19. These figures show how this semi-fluid can be controlled and kept in its appointed place. The density of the element may be varied by having more or less rollers in a given space, and each roller being supported by all the others; their individual diameter does not materially affect their strength as a combination, which, in fact, forms one solid "fluid" tooth, equal in thickness to almost the circumference of the pinion.



Figs. 20 to 24.

Reverting to the "absurd" proposition of a continuous oil film it may be seen how nearly approach has been made to its realization. It is at once apparent that each roller provides a line of contact with the engaging wheel tooth, so that, instead of one line of contact per tooth, there is a number varying with the depth of gear mesh. Further, each roller has a film of oil over its entire length and circumference, therefore, there is actually that continuous oil film which was previously thought absurd. Not only that, the metal-roller element upon which the film is built is almost as fluid as the oil itself.

Having now completed a brief and rugged analysis of the theory and construction of a pinion designed to fulfil certain requirements, more particularly that of adaptability to varying conditions, there remains to be set forth, in a few words, its application to power transmission and the extent to which it meets those requirements. It may be easily seen that a pinion of this construction is able to accommodate itself to any straight tooth in a wheel, and will continue to do so until the tooth is entirely worn away. It is, therefore, independent of the contour and thickness of the tooth. Also, the tooth may engage with it at any point of its circumference, and it is thus independent of pitch. These facts indicate the elimination of geometrically designed teeth as a necessity, and also, that irregularity of pitch and missing teeth will not interfere with smooth and continuous running. Further, there are no tooth clearances, and therefore no backlash. Other irregularities are provided for in the fact that the rollers are free to incline in either direction across the face. The alignment may be faulty, parts may expand or contract, the foundations may warp and twist, but the little rollers will cling to the teeth of the wheel till it is ready for the scrap heap.

It is, perhaps, at sea with double-reduction gears and turbines that "varying conditions" are most pronounced and in this connection I will at this point in roduce some notes of an expert.

Some Notes on Behavior

"In vessels fitted with single-reduction gearing, the teeth should not suffer from the 'shock' forces which break or tend to break propeller blades, as the teeth are sufficiently strong to safely transmit the forces to the turbine; by so doing the speed of the turbine rotors is reduced, or may even cause them to stop or reverse when the forces tending to break the propeller are great. By this action the single-geared turbine acts as a cushion to the teeth, and it is for this reason that there are many successful steamers sailing today with this type of gear. But in the case of the double-reduction geared turbine this would not be the case, as the secondary pinion spindle carries the heavy primary gear wheels, which are virtually fly-wheels humming at between 500 and 600 revolutions per minute—the effect of which is to lock and damage the teeth when the propeller blades are breaking or tending to break.

"As the section at the root of a tooth on the main gear wheel of, say 4 feet 6 inches radius is very small when compared to the section of a propeller blade at 4 feet 6 inches of a 400-feet cargo steamer, and although there is about a three-tooth section in contact, it is only natural to assume that when destructive forces are tending to break the propeller blades the teeth will give way instead. The second-reduction pinion with helical teeth requires a slight fore and aft play, which becomes a fore and aft shooting of pinions and spindle, upon its well-oiled bearings, when the vessel is pitching, rolling, and butting into the waves."

It will be readily understood that the fore and aft shooting of the pinions referred to in these notes might have a very serious effect on the gear, and in the case noted it was so severe that every alternate five teeth in the main wheels were damaged by the impact. This effect was found to have its cause in the use of helical teeth, the pinions being shot to and fro by the action of the inclined planes in motion. This end-play had increased to ⅝ inch in the case cited.

Helical gears were first suggested by Dr. Hook, of Cambridge, with the object of obtaining continuity of engagement and smoothness of action; but, in cases like that cited, these virtues are not necessarily present. From what has been said of the new gear it will be gathered that these objects are expected to be gained with simple straight teeth; it has been claimed that the Autopitch pinion will mesh accurately with any straight tooth of whatever shape or thickness, but there are, no doubt, certain forms which will give better results than others. This presents a problem more difficult to solve than that of the pinion itself. In most of the trials carried out existing wheel patterns have been used, but it is intended to make experiments with teeth of various forms, and to compare results

Owing to the adaptable nature of the pinion tooth, clearances are unnecessary, and the periphery of the pinion may be fitted right down to the root of the wheel tooth, thus taking advantage of all the available surface contact.

In cases where existing tooth forms are used, it is neither necessary nor advisable to fit the periphery of the pinion beyond the normal pitch circle. Wheel teeth designed to gear with this pinion should not be more than half the radial length of standard teeth, and may be less. This is a point of some importance, as, assuming the thickness to be the same, the tooth will be correspondingly stronger. It also opens up the question of pitch, but the details are too obvious for inclusion here.

Some Forms of Teeth

Figs. 8 to 20 indicate some possible forms of teeth which may be used with this pinion, but further investigation and experiment will be necessary before the best form is determined. In Fig. 20 the light lines indicate the existing standard tooth and the heavy lines the proposed tooth. The measure of adaptability secured by this new form of gear wheel permits of its being used with bevels, worms, racks, and toothed chains, and several wheels with differing tooth pitches may be driven by one pinion. Figs. 21 to 24 will render a verbal explanation unnecessary in connection with these applications.

In conclusion, a brief review of the requirements for a perfect gear and the extent to which they have been met may now be given.

The first requirement was strength, and in the new pinion there is one almost continuous tooth, composed of hard-steel wires of, say, 14 W. G., the power being transmitted by as many of these as circumstances require. The tooth of the engaging wheel is, say, half the radial length and the same thickness, and is, therefore, four times the strength of a standard tooth. It is to be noted, further, that the load is distributed over the entire surface of the tooth in full gear. So much for strength.

Unlimited durability is, perhaps, too much to ask, but in theory at least it is nearly approached. The only part of the pinion subjected to frictional motion, and therefore to wear, is the rollers. These may not only be of a very lasting material, but their combined superficial area is very considerable, and the wear is distributed over the whole of that area. Further, the rollers may wear a great deal before the mass loses the density necessary to prevent slip. Even then, the slip would appear gradually and could be corrected at the first stoppage of the machine. Without removing the pinion a few new rollers can be dropped into place as easily as dropping oil, and the pinion is thus gradually renewed. The teeth of the engaging wheel will only cease to work when they cease to exist.

The question of adaptability has already been dealt with at some length, and I will only add that experiments have been carried out on wheels with broken and missing teeth, unequally worn teeth, bent shafts, wheels eccentrically and obliquely mounted, and imperfect alignment of parts without disclosing any undesirable effects.

With reference to elasticity, this is covered, for the most part, by the previous requirement, but it may be added that a mass of thin rollers with their continuous film of oil is expected to provide all the elasticity necessary. When the pinion is stationary the rollers settle down into a dead mass, but in motion the radial forces give them life, so to speak, and increase their elasticity as a whole.

Noiselessness is a very desirable quality in gears, and it may be gathered from the nature of the new pinion that any sound caused by it must be different from that of other types. All noise has its origin in vibration, and when one is absent so also is the other. Any of the new pinions which have been fitted make a sound like a stream flowing over a pebbly bed, and it decreases with increase of power.

There remains but the question of efficiency or economy of power, and, at the moment, I am unable to give any figures. The pinions in use so far have been fitted for the purpose of surmounting difficulties which had previously seemed insuperable, and have proved entirely successful. In some cases it was required to engage and disengage the gears frequently while the machine was running, and this could not be done by sliding the teeth into mesh. Pinions of the new type may be moved into gear instantaneously or gradually while revolving at any speed. This is done regularly at present at a speed of 2,000 revolutions per minute without shock or danger of any kind. This fact appears to indicate adaptability elasticity, and efficiency.

In bringing this new form of gear to your notice I have attempted to indicate a departure from the beaten track in the realm of power transmission.

EXECUTIVES SHOULD CONSIDER GRINDING OF PARTS

(Continued from page 18)

and coolant composed of kerosene mixed with a slight amount of light machinery oil.

Fig. 6 shows three special work holding fixtures used in connection with a double spindle grinder where the work is chucked in a central head, the spindle heads being located at either end of the bed. This machine grinds simultaneously two holes in the opposite ends or sides of such parts as hollow shafts, bearing cages, wrist-pin holes in pistons, etc. Both wheels work in unison and are advanced and withdrawn and likewise swung clear of the work at one motion of the pilot wheel. Grinding coinciding holes in this way, at the one setting of the work, insures accurate alignment of the ground surfaces, and in the case of pistons, brings the axis of the holes square with the outer surface.

INCREASING EFFICIENCY OF ELECTRIC MOTORS

(Continued from page 22)

The Lubrication Problem

Ball bearings offer the motor user one solution of his lubrication problem. The bearings are contained within simply constructed bearing head brackets, with liberal lubricating chambers, which are sealed on both sides and by end caps. These end caps are fitted close to the motor shaft, and are provided with felt retaining washers, which make it practically proof against leakage of lubricant as well as the intrusion of moisture, dust, lint, grit, or other foreign substances from without.

Ball bearings are positive self-lubricators. The ball spacer or retainer is of such construction that the bearings are open at the sides, thereby giving free circulation of the lubricant in the ball paths. Oil rings, chains, or similar rotating oiling devices are done away with entirely, and positive thorough and uniform lubrication is assured. It will be readily appreciated from the use of ball bearings on motors that: 1. They eliminate the frequent troublesome inspection of plain bearings—the user need not concern himself heretofore about the possibility of oil rings sticking. 2. Motors equipped with ball bearings are free from the nuisance and dirty conditions caused by creeping oil and dust around the bearing heads. Frozen bearings due to oil or lint, or draining of the oil reservoirs are practically eliminated.

Security against such conditions in many instances is worth the cost of the motor, and is particularly valuable in textile mills, flour mills, woodworking plants, or other places where dripping oil, adds to the fire hazard, or is ruinous to stock in process.

Briefly summarizing, the economies offered by ball bearings, are:—

(A) Smaller gaps permissible, because they will not wear down as plain bearings do. This gives an improved power factor for induction motors.

(B) Danger of armature touching the pole pieces is eliminated.

(C) Leakage of oil is prevented. Thus oil cannot drip onto the commutator, or oily dirt collect, causing flashovers.

(D) Overall length decreased from 10 to 20 p.c., resulting in a more compact motor.

(E) Longer period between motor inspection and lubrication required—once in six months against once in two weeks, with plain bearings.

(F) Fewer repairs and decreased maintenance cost.

(G) Improved motor commutation.

(H) Improved efficiency, because of reduction in bearing losses.

Don't strike a piece of hardened steel with a hammer.

Don't use the bed of the planer for a tool chest.

News From the Welding Field

Commercial Welding on High Pressure Boilers

Eliminate Guess Work—Weekly Test of Operator's Skill and Progress—Choice of Gas or Electric Process for Certain Classes of Work—Best Method of Applying Patches

By EDWARD H. HEIDEL

BOILER welding requires fusion of metals and the absolute control of the flame or electrode, as the case may be. Experiments or guess work must be eliminated and welds made only according to latest approved methods. Only experienced welders should be allowed to make welds in fire boxes or any pressure work.

The time necessary for an operator to qualify as a boiler welder depends entirely upon the individual himself. Commencing, a test weld should be made at least once a week for breaking or bending test, inspection of break will show development made as well as the defects yet to be overcome. When the test pieces show operator has become proficient a test piece of standard dimensions should be submitted to the engineer of tests for final analysis and approval. If this sample test piece meets all the necessary requirements, the operator may be permitted to weld on fire box or other pressure repair work.

Welding rod material for boiler work must at all times conform to specifications for gas and electric welding rods, and none other should be used. Welding wire specifications of the American Welding Society for mild steel have been proved to give the best results.

No piece of work that is to be welded is properly prepared unless it is thoroughly cleaned and free from all scale, oil, rust, or other foreign substance. The weld must be made on clean, bright metal at all times and that condition must be maintained throughout the welding operation. Places not chipped clean in beveling or coated with oil should be cleaned with a roughing tool or sand blasted; also the metal should be cleared at least ¼" on each side of the bevel.

Carefully fit all patches, cracks or sheets allowing no more than 3/16" or less than ⅛" space at the bottom of the "V" opening. When the opening is greater than 3/16" necessarily more metal will have to be added thereby slowing up the work and allowing for greater expansion and contraction. When the opening between the plates closes to less than ⅛", welding must be stopped as the gas welding rod or electrode cannot properly penetrate to the bottom of the "V." When enlarging this opening use a hammer and chisel but when a cutting torch is used a slag or layer of oxide is left on the parts cut and unless removed, will become part of the weld, which will sooner or later show up as a defective weld.

All edges to be welded must be beveled to 45°, total 90°, except on very heavy material, one inch or over. All welders and those preparing seams for welding must be provided with a gauge for testing the bevel and opening between the plates.

Reinforce all welds about 20% thickness of sheet which is in fire box work approximately ⅛". Where possible build up slightly from the opposite sides. Butt welding on longitudinal or cross seams, "lap" welding on flanges, sheets to be lapped ½", ⅝" maximum, ⅜" minimum.

All sheets and patches must be put on a standard or uniform line avoiding stay bolt holes where possible. Better results will be obtained where line of weld is located in center between stay bolt rows.

When cutting out sheet or patch which has previously been welded, all of the old weld must be thoroughly chipped out. It is good practice to extend patch or sheet one row of stay bolts larger or higher.

Where allowance cannot be made for expansion or contraction due to the design or shape of part to be welded, the "back step" method of welding is preferred.

In bolting up patches or sheets preparatory to welding, it is good practice to put in a ⅝" bolt through every fifth stay bolt hole and then from the opposite side screw in staybolt between each ⅝" bolt. This will hold the sheets in line, but should the sheet warp or buckle it would only be necessary to tighten up bolt on stay bolt to again line up the sheet.

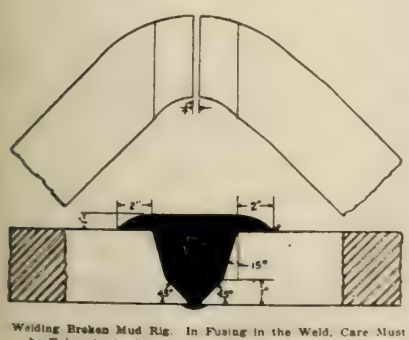
Where sheets are to be welded in fire box by the gas process it is necessary to remove the adjacent row of stay bolts as the holes will be pulled out of round and bolts cannot be tightened by hammering; however, this is not necessary when making weld using the electric process.

Certain restrictions have been placed on locomotive boiler welding known as the A. R. A. restrictions, which are as follows:

Locomotives—Autogenous Welding

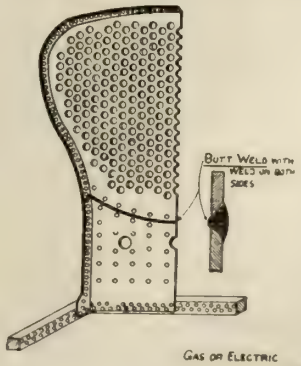
Rule No. 1. Autogenous welding will not be permitted on any part of a locomotive boiler that is wholly in tension

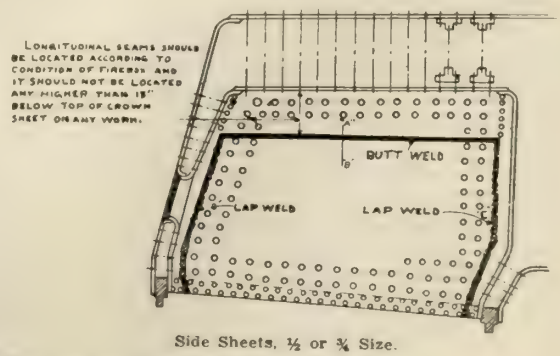
Paper read before the February meeting of the American Welding Society, Chicago Section.



Welding Broken Mud Rig. In Fusing in the Weld, Care Must be Taken to Avoid Fusing the Metal to the Outer Plate

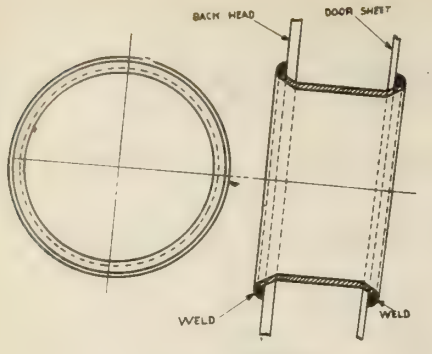
Section of weld in mud ring.





Side Sheets, ½ or ¾ Size.

Welding flue and side sheets.



Welding stoker tubes.

under working conditions; this to include arch or water bar tubes. Rule No. 2. Staybolt or crown stay heads must not be built up or welded to sheet. Rule No. 3. Holes larger than 1½″ in diameter when entirely closed by autogenous welding must have the welding properly stayed. Rule No. 4. In new construction, welded seams in crown sheets will not be used where full size sheets are obtainable. This is not intended to prevent welding crown sheets to other firebox sheets. Side sheet seams shall not be less than 15″ below highest point of crown. Rule No. 5. Only operators known to be competent will be assigned to firebox welding. Rule No. 6. Where autogenous welding is done, the parts to be welded must be thoroughly cleaned and kept clean during the progress of work. Rule No. 7. When repairing fire boxes a number of small adjacent patches will not be applied, but the defective part of sheet will be cut out and repaired with one patch. Rule No. 8. The autogenous welding of defective main air reservoirs is not permitted. Rule No. 9. Welding rods must conform to the specifications issued by the Inspection and Test Section, for the various kinds of work for which they are prescribed.

Standard practice in railroad work for firebox welding includes the following: Welding of fire boxes complete; welding one-half and full side sheets; three-fourth door sheets; door collar; front and back flue sheet patches; stoker tubes; application of crown sheet; reinforcing mud-ring corners and seams; welding flue sheets; welding flexible sleeves; welding broken mud-ring; cut off and cut out stay bolts.

Welding Firebox Complete

The firebox should be set up, preferably in mud-ring, with all staybolt and mud-ring holes put in, except mud-ring corner holes, which should be drilled after sheet is laid up and welded. Welding edge should be chipped to a 45° angle (total 90°) and chipped on a straight line so as to insure a uniform opening between welding edges of ⅛″. Lower portion of sheet from point 14″ from bottom of flue and door sheet should not be chipped until box is in place and mud-ring corner laid up to ring.

Bolt sheets securely in place, being sure that there is a uniform opening of ⅛″ all along welding edge. All fitting up to be done before welding is started. Hold sheets in place with strongbacks or clamps bolted through staybolt holes placed about 12″ apart. Tack sheets between clamps with a tack at least 3″ long, when clamp can be removed and welding completed.

Lap welding of flanges on door sheet, throat sheet and flue sheet (sheets lapped ½″) is recommended when sheets are fitted up in firebox, but when firebox is fitted up on the floor and can be welded from both sides, butt welding is preferred, except on crown sheet.

Welded crown sheet seam must be lower than 15″ from the highest part of crown in all cases. Where crown sheet is welded to flue sheet and door sheet, sheets must be lapped ½″ and welded on both fire and water side down at least 15″. In complete firebox installation all mud-ring rivets should be removed. Use "back step" method starting at bottom of each intermediate space, welding upwards, finishing at top of seam.

Full and Half Side Sheets

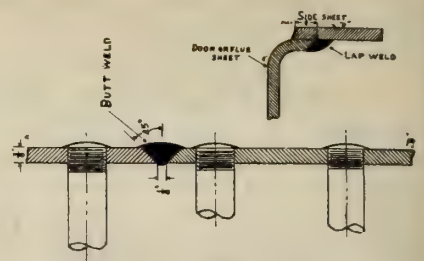
In applying side sheets, the sheet may be cut above mud-ring between mud-ring rivets and first row of staybolts, if rivets and sheet are in good condition, otherwise the sheet should extend to the bottom of the ring. The condition of the sheet will determine the location of the top weld, but this top weld must be at least 15″ below top of crown sheet.

In fitting new sheet in place standard bevel gauge with the ⅛″ opening must be used, sheet to be bolted in place to mud-ring. Staybolts may all be applied except the rows adjacent to seam which is to be welded.

Tack sheet a 3″ tack every 12″, then weld, using the back step method, alternating from center to either end. Welding on flanges must be done from the bottom up. Butt welding on cross seam and lap welding on flanges.

Three-Quarter Door Sheet

When three-quarter door sheets are applied, cut is made one, two or three staybolt rows above the door hole; condition of sheet determining location of cut. Bevel made from fire side, clamped and tacked every twelve inches, using the back step method alternating from the center of either end. Butt weld only.



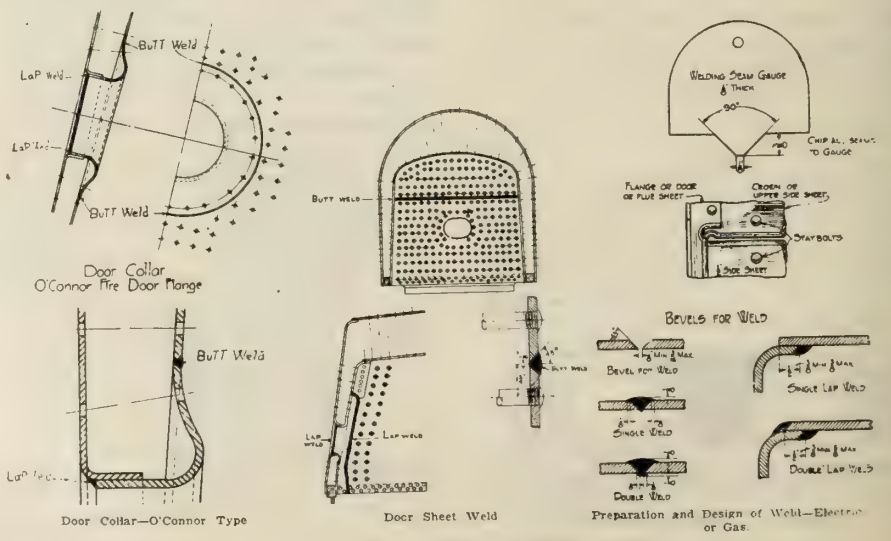
Side sheet welding details.

Door Collars

Where door collars are applied, line of cut will depend on the condition of the sheet, but in all cases door collars must have at least one full row of staybolts. Avoid locating line of weld through staybolt hole. After fitting up the sheet with gauge, tack every 12″ and weld, alternating from side to side to divide the strain. Butt weld in firebox and lap weld in door hole. Lap in door hole must be laid up tight to back bead for at least 3″. Sheet in door hole not laid up properly is the cause of leaky door holes whether welded or riveted.

Flue Sheet Patches and Bridges

Patches on flue sheet may be welded, line of weld depending on condition of sheets. In patches through flue holes cut should he made square with bridge instead of straight across, also the cut through flange to be on a 45-degree angle instead of straight through. Patches are fitted up with all flue holes in with standard bevel and opening, clamped every 12″. Then weld center bridge first, then bridge on each side, and continue changing until welding has been completed, welding flanges. Welding to be done on fire side and in all cases reinforced on water side. Knuckle cracks in flue sheets not to be welded, when these occur apply new sheet.



Showing various methods of welding sheets.

Testing Accuracy of Gear Tooth Profiles

Generating Involute Curve—Finding Radius of Base Circle—Checking the Contour of Tooth Face—Smooth Running Features—Construction and Application of Odontometer

By H. ALTON

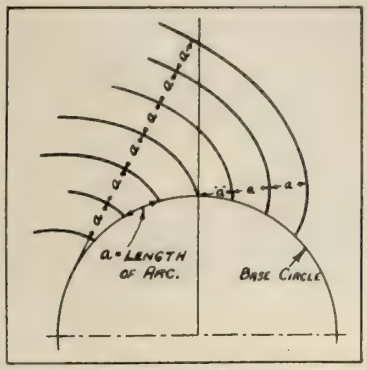
TESTING gear tooth profiles and the spacing of teeth with the same degree of accuracy obtained in many precision gauging operations is a very difficult matter. There are, of course, the well known methods of using the gear tooth calipers, and the gear testing devices which hold the gears at certain fixed centres. This latter apparatus tests the thickness of the teeth or the amount of backlash. In short, the gears are only tested as to whether or not, they will run together without interference. The precision factor really does not enter into the operation. An experienced gear inspector can detect errors in form and in spacing when using a gear testing machine, but he can tell little about their exact nature and amount.

In considering gear testing gauges and apparatus, one must not overlook the various forms of involute testing devices. These instruments are very valuable for their ability to detect and measure errors with precision Such gauges are seldom used for general shop inspection purposes. In fact they are instruments for use in laboratories largely.

The Involute Curve

Probably it would be in order to explain clearly just what an involute form of gear tooth is, as this form is the one generally used in present day practice. It lends itself to profile gauging owing to its basis characteristics. Every mechanic is familiar with the pitch circle of gears. There is, however, another circle, which must must be considered if the involute form of tooth is understood. This circle is called the base circle, and is, essentially, a circle of reference. The profile of the tooth outside the base circle is a true involute curve. The method of finding the approximate radius of the base circle graphically with an angle of pressure of 14½ degrees is shown in Fig. 1. We draw the complete pitch circle as usual. The vertical line A B passing through the centre of the pitch circle is next drawn. On the radius C D describe a semi-circle having centre of semi-circle at E. Bisect C E at F. With centre C and radius C F draw an arc which cuts the semi-circle on C D at G. Now with centre D and radius D G draw a circle. This circle is the base circle. Again referring to the involute testing devices, it is to be remembered that special discs representing either the base circle, or the pitch circle, or ratios, must be used in conjunction with them. Furthermore, the actual pressure angle employed may vary appreciably from the theoretical pressure angle specified. This is, of course, not important if the actual pressure angle is the same on all gears that mesh together. Uniformity rather than absolute accuracy as regards this factor is the more important and essential consideration. Therefore, if the base circle discs are employed, such gears may show an error in profile when tested, although they might run together properly. Thus base circle sizes would have to be determined and confirmed before the point could be definitely determined. There enters into the problem conditions that do not lend themselves to shop or production gauging. These instruments have, however, their proper places and uses.

Compiled from information obtained through courtesy of Pratt & Whitney Co.



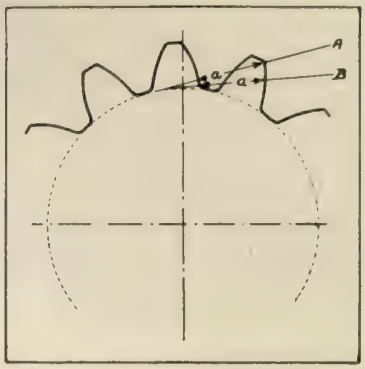


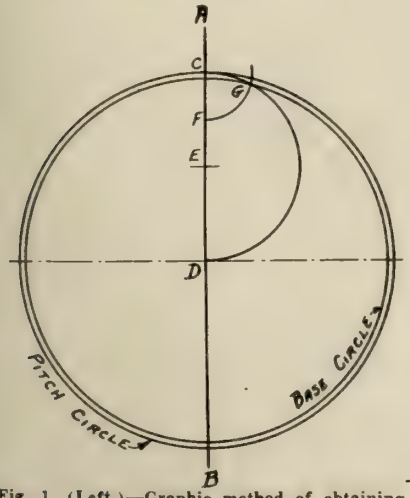
Fig. 2. (Left).—Series of true involute curves; all dimensions (a) are equal. Fig. 4. (Right).—That part of gear tooth profile between the lines A. & B. is tested by the odontometer.

Now turn to Fig. 2. Here are shown a series of true involute curves. The involute curve shown is applied to the generation of gear tooth profiles. The involute curves shown are equally spaced, or pitched, on a given base circle. The distance (a) between these involutes along a line tangent to the base circle is always the same, no matter where the tangent is drawn. This distance (a) is equal to the length of the arc of the base circle intercepted by two successive involutes.

Graphical Method

A graphical method of obtaining an involute curve is shown in Fig. 3. Take a circular piece of wood the same diameter as the base circle. Wrap around this wooden disc a thread fastened to the disc at one end and with a loop in the other end. Wind the thread completely on the disc, and then place a pencil in the loop. Unwind the thread slowly keeping it taut and the point of the pencil will describe an involute curve.

Referring again to Fig. 2, it is the distance (a) that is measured and checked by the instrument known as the odontometer. Fig. 4 shows the practical application of the distance (a). In testing any pair of profiles, if this distance does not remain constant, it indicates an error in the involute profile. In testing successive pairs of profiles, if the distance (a) does not remain uniform, it indicates an error in the spac-



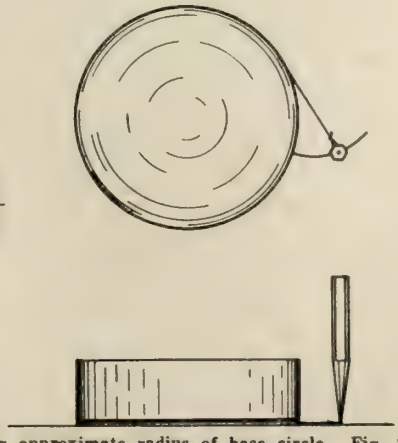


Fig. 1. (Left.)—Graphic method of obtaining approximate radius of base circle. Fig. 2. (Right) Graphic method of drawing an involute curve.

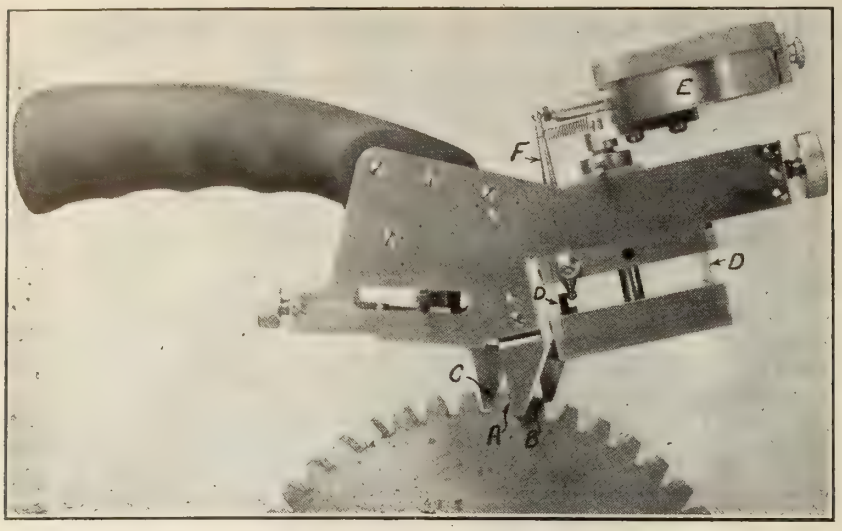


Fig. 5.—The odontometer applied to a spur gear for testing the profiles and spacing of the teeth.

ing. By referring to Fig. 4, where a few gear teeth are shown, the portion of the involute that the odontometer really tests is indicated. It will be immediately noted that this portion does not cover the entire involute flank of the tooth. These portions are known as the "overlapping" portions and are the most essential for quiet and smooth running.

Testing Tooth Profile

The odontometer is shown in Fig. 5 testing a spur gear. It is composed of a section of a straight-sided rack with two parallel effective faces, one being fixed and the other movable. A third face, set at an angle to the working faces, is used to hold the fixed working face in contact with the flank of the gear teeth. The fixed registering surface is at A, and the movable indicating surface is at B. The third surface C holds surface A in contact with the involute surface of the gear teeth. The surfaces B and C are adjustable so that the gears ranging from 3 to 10 diametrical pitch can be tested with the same instrument. No. 3 diametrical pitch means a circular pitch that is of such size that there are three teeth for every inch of pitch diameter. A gear with 10 inch pitch diameter, 3 diametrical pitch, would have 30 teeth and a circular pitch of 1.0472 inches. A 3 diametrical pitch gear, with a 7 inch pitch diameter would have 21 teeth, the circular pitch always being the same. Similarly a 10 diametrical pitch gear having a 4 inch pitch diameter would have forty teeth and the circular pitch would be .31416 inches. The indicating surface B is mounted on two thin flat springs D, which act as pivots free from back lash. The dial indicator E is actuated by the lever F which has a ratio of 5 to 1, so that each division on the dial represents a movement of 0.0002 inch of the indicating surface B.

In general the instrument is used as a comparator, to test the uniformity of interchangeable and mating gears. If actual measurements are required, the distance between the two parallel working faces of the instrument can be measured. Then, if a record is kept of the variation on each tooth, the value of this measurement between the parallel faces, multiplied by the number of teeth in the gear, corrected in accordance with the variations on the successive teeth, will give the circumference of the actual base circle of the involutes.

The instrument is made so that the dial indicator is in full view of the operator as he rocks it into the teeth. The weight of the instrument is so disposed that it rocks of its own weight into the second tooth. The handle is used only to steady the instrument and not to exert any pressure on it. The face of the fixed parallel rack tooth is made of liberal width to square up the instrument. Adjustments from one pitch to another can be quickly made. The instrument can also be used on the helical gears, the operation being identical to that on a spur gear. It is also useful in gauging and testing the uniformity of the teeth of herring bone reduction gears which are to operate at high pitch-line velocities.

The reason for the development of the instrument was the apparent need of a simple and self-contained instrument or gauge to test the accuracy or uniformity of gear tooth prifles and spacings of the teeth in production work. As stated above, it is equally adaptable to spur or helical gears, is fully self-contained, has a range of from 3 to 10 diametrical pitch, may be used to check any pressure angle, and can be applied to a gear while it is in place in the machine. A larger size of the instrument will be on the market very soon, this size being capable of testing gears up from ¾ to 4 diametrical pitch or expressed in circular pitch terms, from 4.188 inches of circular pitch to .7854 circular pitch. It is quite a simple matter to establish a definite inspection tolerance for any class of gears, as experience will soon show how much variation can safely be allowed on either the profile or the spacing before noticeably noisy gears result.

INSTRUCTION LARGELY OF INDIVIDUAL KIND

By H. A. G. WILLOUGHBY
Principal Collingwood Collegiate Institute.

COLLINGWOOD, a town of over 7,000, takes a deep interest in technical education, and the industrial and commercial committees of the Board of Education have organized various classes in accord with popular demand. For the ladies, there are very interesting classes in dressmaking, millinery and cooking, held at least two evenings a week. Commercial classes are also held two evenings a week, to give a business training, including stenography and typewriting, to those holding clerical positions, and desirous of improving their standing. During the present term, a large class enrolled for basketry and wood-work, and this class has proved very popular as a night course.

Up to the present it has been found advantageous to carry on a class in mechanical drawing. The object of such a class should be mainly to give the students a knowledge of working drawings, to enable them to read blueprints correctly and also the ability to make simple drawings, and freehand sketches. It is not the intention to produce finished draughtsmen, but a small amount of geometrical construction has been found helpful to those who are apprentices in a machine or wood-working shop.

A general outline of the course followed in the Collingwood evening classes is given below:—Mechanical Drawing—purpose, how it differs from other drawings.

Views shown in a mechanical drawing, relation of these views.

Drawings showing two views of simple objects, dimensioning and lettering, drawing to scale, conventional lines used in mechanical drawing, drawings to illustrate the application of all of these in the making of a working drawing.

Sectional drawings, assembly and detail drawings, inking in of drawings, freehand sketches of objects with all necessary explanatory measurements, these sketches to be used by the student in producing a working drawing without further reference to the object itself, and isometric and cabinet drawings.

On Dec. 1, 1919, the industrial committee opened day classes in navigation and marine engineering. The purpose of the nautical class is to provide the academic training necessary for the various grades of officers for the Canadian Merchant Marine. The subjects taught are as follows:—Preliminary—elementary arithmetic, including logarithms, decimals, square and cube root.

Navigation—problems to determine the shortest distance between any two given points of the earth's surface. How to find the position of a vessel after measuring the angular height of a

(Continued on page 44)

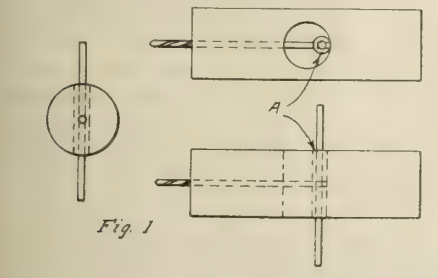
Practical Ideas for Shop Executives

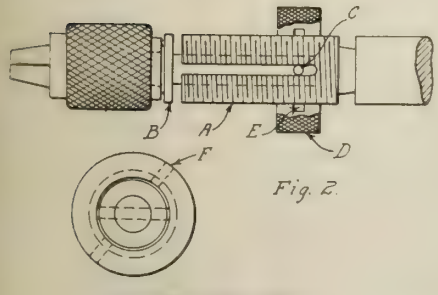
SENSITIVE DRILL HOLDERS

By Harry Moore

The use of small diameter drills on machines designed for such purposes may be quite safe and productive of good work, but attempts to use these delicate tools on heavy machines quite out of proportion to the size of hole required, usually results in a heavy mortality of drills. It is sometimes necessary, however, to do this, and when the amount of work justifies it, some kind of sensitive holder will amply repay the time taken to make it.

Turret lathes with their provision for powerful leverage are examples of suitable machines for this kind of work and in Fig. 1 is shown a simple type of holder that was used for drilling a short hole in brass bars on this kind of machine. The holder is just a piece of cold rolled drilled by the drill to be held in it, and a suitable size hole drilled at right angles through it. A piece of rod A is tapped right through and drilled in the center and this together with two short pieces of wire threaded into it forms the means of holding the drill from rotating, and also leverage to feed the drill into the work. The whole thing is held in a suitable holder in the turret which is set so that the drill point touches the work when the machine stop is reached. The work, travelling at high speed is easily and safely drilled





Sensitive Drill Holders.

then, by hand pressure on the two handles.

An engine lathe tailstock is another device that admits of leverage easily applied, but yet which gives the operator very little "feel" on delicate work. Fig. 2 shows a more elaborate holder, but one many times more useful as it holds a small drill chuck. The shank of this holder fits the tailstock spindle, and is threaded for the full distance of the straight outside diameter A. A hole drilled in the center takes the piece B which in turn takes the drill chuck. In the shank of B a pin C is driven that works on the slot in A. Knurled nut D threaded to fit A has a recess E cut in the center to clear the pin C, and also a hole F clear through to enable the pin C to be inserted in place when the holder is assembled. This is a very sensitive holder with which the operator can at all times "feel" the proper amount of pressure required, and which allows for rapidly backing the drill out of the hole by a twirl of the nut D.

GAUGING CYLINDRICAL HOLES

A very useful hint with regard to the above subject is as follows: To estimate the size of a cylindrical hole by the "play" or "travel" of a gauge, take the length of the travel of the point gauge in 1/16". Square this and divide by twice the size of the gauge in inches. the result gives the number of thousandths of an inch the hole is above gauge size. Suppose a 3" point gauge has 3/8" play; the play will be six sixteenths; $6^2=36$, hence $36\div6=6$, and the hole is 3.006" in diameter.

KEEP FLAME CLEAN

A smokeless flame is very essential if an article is to be successfully brazed. A brazing lamp using petroleum, a gas blow-pipe, or a blacksmith's hearth may be used for the purpose of heating the article to be brazed. The article should be laid on a heap of broken coke, which should be heaped around the work in the immediate vicinity of the prepared joint. Before commencing the work the spelter is mixed with crushed borax and water and carefully placed in position; the heat is then applied gradually until the water is evaporated; it is then directed onto the spelter until it fuses. Great care should be taken to see that the article is perfectly clean before commencing to work on it.

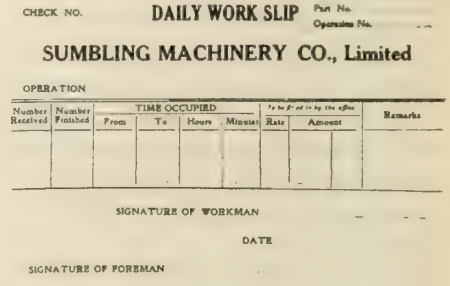
LUBRICATION OF MACHINE TOOLS

The lubrication of machine tools is largely done by hand. Experience has shown that bearings lubricated in this way are often neglected. It is essential that careful attention be given to a regular routine of oiling the tools, in order to prolong their life and minimise the frictional losses, which, in the case of light and medium high-speed machine tools, may amount to as much as 50 per cent. of the full shop load. Care should be taken to see that all oil holes are protected from entrance of dust by covers. It is the practice in some cases to place felt pads in the oil passages leading into the bearings, in order to receive the oil during each oiling, and afterwards gradually allow the oil to pass into the bearing surfaces, so that the lubrication becomes more regular, and therefore more efficient, than would be the case if the oil was fed direct to the bearing by hand oiling without the felt pads.

A SIMPLE TIME CARD

By J. H. M.

Several types of daily work reports are used in machine shops and manufacturing plants, but the one shown in connection with this article has proved very satisfactory to the firm adopting the same. Several colors are used for different work, white being for staple work, yellow for tools and equipment, blue for jobbing, and pink for expense. By expense is meant time spent for which there is no return, such as interviewing visitors to the plant, etc. This simple form keeps a close tab on the different jobs passing through the factory.


CHECK NO. **DAILY WORK SLIP** Part No. Operation No.

SUMBLING MACHINERY CO., Limited

OPERATION

Number Received	Number Finished	TIME OCCUPIED From	To	Hours	Minutes	Rate	Amount	Remarks

SIGNATURE OF WORKMAN

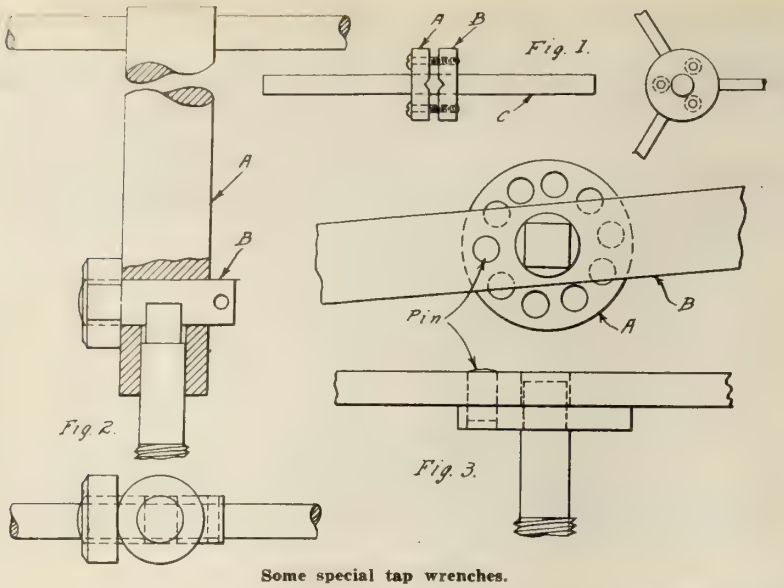
DATE

SIGNATURE OF FOREMAN

SOME SPECIAL TAP WRENCHES

By Harry Moore

The regular adjustable tap wrenches which form part of the equipment of all shops leaves very little to be desired in the ordinary run of work, but there are occasions, as every mechanic knows, when they do not quite fill the bill. Sometimes it may be that production would be speeded up by a wrench designed specially for the job, while at other times the nature of the work compels such a design. In the former case the number of pieces to be tapped would be a determining factor, and in the latter there would be no alternative. There are any number of other instances where conditions call for something different to the standard wrenches.



Some special tap wrenches.

Some of these conditions and the wrenches devised to meet them will perhaps be of interest to those who have or may be at some time or other, faced by similar conditions. The wrench shown in Fig. 1 is a time saver when used for bottoming threads where all three taps, taper, second and plug, are used in the operation. The actual holder is made from two pieces of round stock A and B having 3 Vees cut in their faces equi-distant apart, while between the vees are three tapped holes for tightening screws. One piece B is driven tight on the center of handle C, the other is a sliding fit. The method of holding the taps is clearly shown, the advantage being of course that no time is lost changing from one tap to the other. As one is used, the wrench is simply turned round to bring the next in position, both idle taps being well out of the way all the time.

The extension wrench shown in Fig. 2 has a rather unusual feature inasmuch as it holds the tap in the wrench. This was found necessary in tapping a number of holes in such a position that it was quite an operation to recover a tap if it was dropped. As some kind of wrench was needed to reach into the work and hold the tap as well, the one shown answered the purpose very well, all things considered. The shank of this wrench A is drilled at the end to take the shank of the tap and through the side a hole of similar size is drilled to take the tightening piece B which is a stud sawn off and case hardened when finished. A slot is cut in the center of B to a depth of about half the diameter and a width equal to the width of tap square and near the plain end a small hole is drilled so that a piece of wire can be inserted to prevent the piece turning when the nut is tightened. When in use the tap is pushed up the hole in the end of A and the nut tightened, thus binding the slot securely against the square of the tap. The usual piece of rod is used on the upper end of wrench as a handle. It is interesting to note in connection with this wrench how an apparently fairly complicated tool can be cheaply made. A little study will show that although this wrench looks more elaborate than a socket wrench, the latter requires a broached hole; an expensive item where only one is required; whereas the former is just a straight drilling job, apart from the slot which can be filed in a few minutes.

Another difficulty frequently encountered is the tapping of holes in positions where space is restricted, and therefore the wrench has not a free movement, but must be given very short turns, or mere "twitches" at a time. The wrench shown at Fig. 3 was devised to meet conditions similar to this. Had there been enough clearance in this instance, to allow a wrench to be lifted off the tap square and replaced in a convenient position there would perhaps have been little gained in the making of it, but such not being the case it was well worth while, as it answered the purpose as good as a ratchet wrench which was not at hand at the time. A steel disk A was drilled with a circle of holes, drilled in the center and filed out square, then driven tight on the tap square. The wrench B which was just a piece of rectangular stock had a hole drilled in the center large enough to clear the corners of the tap square, and a pin driven in tight to engage the holes in A. After tapping a few holes, the action of lifting the wrench up a little after each turn, to clear the pin, became almost automatic and entailed little delay.

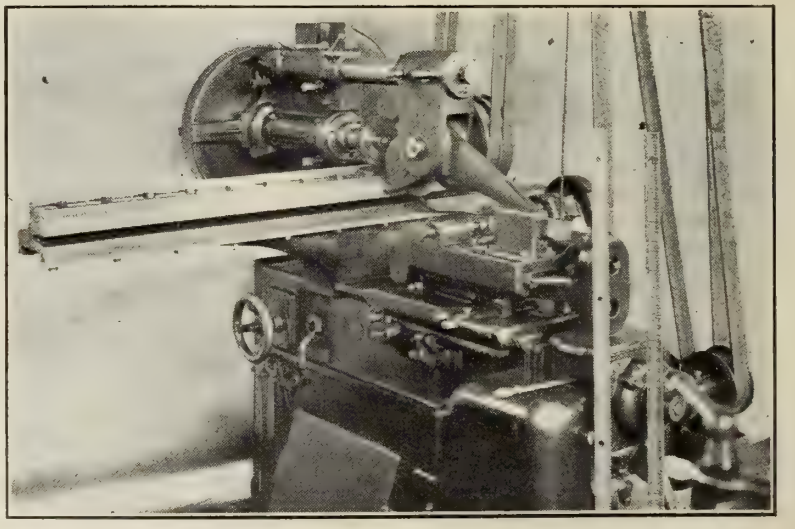
KEEP CUTTING EDGE KEEN

One frequent cause of poor milling results is allowing the edges to become dull, rather than go to the trouble of re-grinding. If they are allowed to become so dull that their bluntness can be seen with the naked eye, the cutter will fail to work at its proper speed owing to overheating, caused by some edges becoming more worn than others.

RACK CUTTING ATTACHMENT

By R. Harrison

The accompanying illustration shows a simple and highly efficient rack cutting attachment, designed to fit a B & S. gear cutting machine. The work being operated on is the mild steel trip rack used on the reversing mechanism of a grinding machine. The attachment has been in use a number of years, during which time it has given consistently good service, the only renewals being the replacement of worn milling cutters. It will be noted that full advantage is taken of the automatic movements of the machine to obtain accurate indexing and the positive intermittent action of the cutter head. Three teeth are cut at each cycle and production is at a rapid rate, the cut being taken at each reversal of what is normally the cutter slide. It will be seen that this slide carries a simple form of cam which depresses the lever operating the auxiliary cutter head as it advances. Continuous motion is imparted to the cutters through the double belting and large diameter pulley shown on the right of the fixture.



Rack Cutting Attachment on B. & S. Gear Cutter

New Things in Shop Equipment

CUTTER AND GRINDER ATTACHMENT

A new tool for the grinding of Curvex Milling cutters has been placed on the market. When it is desired to grind a Curvex cutter, the piece is mounted on an arbor between the centres of the attachment. The table is set at the zero point. From a chart of leads and angles, the taper guide bar of the attachment is set at the required angle. The table is fed horizontally, thus the cutter spindle is automatically revolved in the proper relation to the lead and spiral angle. The cutter is indexed by a plunger and index plate. The wheel spindle is mounted on an angular raising block to bring the wheel spindle to an angle of 15 degrees from the horizontal.

A special grinding wheel is used, the front face of which is dressed vertically to insure a single line of contact between the wheel and the work. This enables the work to be fed vertically to the wheel. The knee is swivelled to an angle corresponding to the helix angle of the cutter, and the table is moved past the wheel by a rack and pinion. The grinding plane is always on a true radial line from the centre of the cutter and the wheel always clears itself from the work. The wheel is dressed on the face by clamping a diamond on the table and using a vertical feed. The R. K. Le Blond Machine Tool Co., Cincinnati, Ohio are the makers of these tools.

VERTICAL DIE SLOTTING MACHINE

A rather unique vertical die slotting machine, having several interesting features has recently made its appearance. It is especially adapted for machining round, square, and irregular-shaped punches and dies. The ram is driven by a connecting rod and disc crank mechanism. The disc crank is connected to the main shaft of the machine, which shaft is located at the top of the tool. The crank pin is adjustable so that any length of stroke up to four inches may be obtained. The member on which the ram slides, and to which it is gibbed, is hinged at the top in such a manner that it can be set at a slight angle relative to the face of the column, in order to produce a clearance in die openings. The crank arm, or connecting rod, at the lower end is connected to a pin which is located in a slot in the ram.. This allows an adjustment of the ram relative to the crank arm. The lower end of the member on which the ram slides, may be connected to a toggle mechanism operated by an eccentric on the main shaft. When connected, the mechanism moves the ram over a curved path on its down stroke, thus permitting of certain curved cuts to be taken in dies. The mechanism also causes the tools to clear the work on the upward return stroke. Cross, longitudinal, and circular hand feeds of the work are each obtained through separate screws. Power feeds can be furnished if required. A variable speed gear box mounted inside the column furnishes three changes of speed. The machine is belt driven and is furnished with fast and loose pulleys. The machine is manufactured by the Peters-Bossert Co. of Cincinnati, Ohio.

SENSITIVE DRILLING MACHINE

A 12-inch sensitive drilling machine driven by a built-in electric motor with friction drive, has recently been developed. The motor is located on the top of the column and is mounted on a horizontal shaft, on the end of which is located a small friction disc. A larger friction disc is located on the vertical spindle of the machine. The motor and friction disc are mounted on ball bearings. The frictional pressure of the drive is governed by the weight of the spindle disc, thus being constant and requiring no adjustment. The friction drive is completely enclosed and is so constructed that the friction surfaces are kept free from oil. A spring counterbalances the spindle. The range of spindle speed can be easily adjusted from 450 to 1,200 r.p.m. A weight in the column counterbalances the table. Motors can be furnished to suit all standard circuits. The starting switch is also built into the machine. The tool is made in both bench and floor designs. V-blocks, cup and point centres are also provided. Some of the principle dimensions are as follows:

Greatest distance from table to nose of spindle 39 inches. Vertical adjustment of table 32 inches. Vertical adjustment of spindle arm 8 inches. Maximum height with spindle raised (Floor Machine) 76 inches. Diameter of spindle in sleeve 13/16 inches. Diameter of table 11½ inches. The spindle socket has a No. 3 Morse Taper. The motor is ½ horse power and has a speed of 1,725 r.p.m. The machine is manufactured by the Louisville Electric Mfg. Co., Louisville, Ky.

FACING AND BORING MACHINE

A machine that faces both sides of an automobile wheel to the proper thickness and bores the hole at one setting has been recently marketed. This insures that both sides will be parallel, and at the same time is a time saver. The wheel is chucked in the horizontal plane and one cutter head is above the work, while the other is below it, in the base of the machine. After chucking, the operator actuates a lever that brings up the lower head, which faces the underside of the wheel. As the spindle of this head moves upward it brings a gauge with it, which the operator locks on the completion of the operation. The upper spindle is then brought down. This spindle bores the hole and faces the top of the hub simultaneously. As the upper spindle comes down, a rod controlled by it strikes the gauge referred to above, when the hub has been faced down to the right thickness and prevents further downward movement of the spindle. The spindles are then returned to their original positions, the gauge released, the wheel removed, and another wheel put in place and the operation repeated. The lubrication system provides forced oiling to the pulley drive bearings and also to both spindle quills. The pump, which is an integral part of the machine, can be arranged to deliver varying quantities of oil. Ball bearings are provided throughout. The drive is through a countershaft located on the back of the machine near the floor. The power is transmitted from the countershaft to the spindle quills by 3 inch single ply belts. The Blomquist-Eck Machine Co., of Cleveland, Ohio, are the manufacturers.

NEW GAP SHEAR

A very rigid and especially useful type of gap shear has recently been developed. The new shear has a gap in the housings which facilitates the splitting of long plates. The machine is built in several sizes. The six foot machine can handle annealled steel up to ⅜-in. thickness. The cutter-bar or cross-head is of double and cross ribbed box construction, and is provided with long bearings, fitted into the slides of the housings by means of adjustable hand scraped taper gibs. This construction prevents springing and deflecting under strains. The long bearings prevent the cross-head from tilting and consequently it cuts clean. The cutter-bar is connected by the eccentrics by means of adjustable links. With this construction the shear knives may be set, by raising or lowering the cutter-bar, either to split long stock or to do plain shearing to the full length of the knives.

The eccentrics are double keyed and shrunk on the eccentric shaft. The eccentric shaft bearings are split and adjustable, and can be easily renewed or replaced. All shafts are of large diameter, and the gears are machine cut. The large gears are semi-steel castings and the pinions are steel forgings. The clutch is made of forged steel and is fit-

ted with a tool steel clutch pin and finger. The hold-down, or clamp, is automatically operated and is equipped with compensating springs to take care of unevenness or variation in the thickness of the metal to be sheared. The bed of the machine can be adjusted to suit the requirements of the work.

A full set of front, side, and back gauges are furnished. The back gauge is operated through a crank handle, shafts and mitre gears. Parallel graduations in sixteenths of an inch are marked from the edge of the shear blades to the ends of the front gauge supports, to enable the operator to set the gauges quickly and accurately. This shear can also be arranged with a motor drive and equipped with a long squaring arm. Some of the specifications of the six foot size are as follows:— Length of shear blades 74-inches; size of flywheel pulley 42-inches by 7-inches; Speed of flywheel pulley 280 r.p.m.; strokes of cutter bar, 18 per minute; and the ratio of the gearing is 16 to 1. The machine is manufactured by the Streine Tool & Mfg., Co. of New Bremen, Ohio.

AUTOMATIC ROTARY SURFACE GRINDER

A new automatic rotary surface grinder was recently exhibited at the New York Automobile Show. It was designed especially for the grinding of piston rings and also the sides of ball and roller bearing races, collars, washers, gears and other similar work. The machine is designed for large production. All the units are well guarded. The machine complete weighs two tons. The wheel slide operates on "V" ways and is controlled through a hydraulic arrangement, operated by oil which enables the operator to instantly get any speed from zero to maximum. This drive also makes it possible to reverse the table instantly at any desired point without shock or noise. The chrome vanadium steel spindle is mounted in a straight plain adjustable bearing at the wheel end, 2⅞ inches diameter by 6¾ inches long. The rear of the spindle is carried in a self aligning ball bearing. The main drive shaft is mounted on roller bearings. It has a two step cone, giving two wheel speeds, which enable the wheel to be operated at an efficient speed throughout its life. The chuck spindle is mounted on ball bearings and is driven by spiral gears.

When the machine is used for general work without the automatic feeding device, the chuck bracket can be adjusted to allow for grinding concave and convex surfaces. An automatic feeding arrangement is furnished with the machine when it is to be used for handling rings, ball races, collars, washers, etc. With this arrangement it is only necessary to load the magazine and take away the finished product, all operation being entirely automatic. A diamond for dressing the wheel and governing the finished dimensions of the work is an integral part of the machine. The chucks employed are of the magnetic type and provision is made for demagnetising the work at each indexing point. The mechanism cuts off the current and for an instant reverses it. This procedure not only demagnetises the work but allows the automatic feed to operate more easily.

A cutting lubricant pump is not supplied as standard equipment, but can be easily applied. An automatic vertical feed can also be furnished as an extra on all style machines. when used for general work. It is not adaptable to a machine furnished with a ring feeding device. The machine can be furnished with either the 8, 12, or 16 inch Heald Magnetic Chuck, according to the size required. The automatic feeding device can only be furnished on the 8 inch style. A 10 to 15 h.p. motor is recommended to drive the machine according to the nature of the work. The machine is manufactured by the Heald Machine Co., of Worcester, Mass.

PIPE THREADING MACHINE

A large pipe threading and cutting machine, capable of handling pipe from 4 in. to 12 in. in diameter has been recently developed. The range of the machine may be further extended down to pipe of 2½ in. diameter by the addition of some special features. Two die-heads of the stationary type are employed, one to thread pipes up to six inches and the other to thread the pipes over six inches and up to the capacity of the machine. The entire range of each of these die heads is covered by one set of chasers. The pipe chucks have three jaws, which are geared and have universal adjustment. They are also self-centering. The rear chuck has grips to provide for fitting up flanges. The carriage carries the die-heads, the cutting-off tool, and the reaming tool. The carriage may be moved by power or by hand, and has a single control lever. Automatic stops prevent the carriage from coming in contact with the chuck at one end and from running off the guides at the other end. The setting of the reaming tool is accomplished quickly, and the tool is advanced to the work by the operation of a hand wheel.

The machine has a single pulley drive, but eight speeds are obtained through the medium of a change gear box. The power is transmitted to the machine from the constant speed pulley shaft through a friction clutch, which is operated by either of two levers, conveniently placed at either end of the working side of the machine. This enables the operator to control the machine when fitting up flanges at one end. Motor drive is accomplished by bolting a motor to the back of the frame of the machine and using a silent chain drive, substituting a sprocket for the constant speed drive pulley. The machine weighs 13,000 pounds and is manufactured by the Landis Machine Co., of Waynesboro, Pa.

CENTRE DRIVE LATHE

A rather unique design of lathe has recently been placed on the market. The head stock of the lathe is in the centre of the bed. The lathe is electrically driven by a motor bolted to the back of the bed. Power is transmitted to the live spindle in the head stock by means of silent chains and sprocket wheels. The live spindle is made of cast iron and has a large central hole through it. The head stock is equipped with two chucks one at each end of the spindle which are generally of the floating type. These chucks position themselves relative to the outside diameter of the work when the jaws are tightened, at which time the chucks are securely clamped against shoulders on the spindle. By means of this construction the work is held rigidly, is positively driven, and maintains its natural position without deflection. In cases where the work is very short one chuck is omitted to permit the carriages to come closer to the head stock.

The spindle rotates in cast iron journals. The motor is at least 7½ horse power. The driving mechanism is controlled by a foot treadle at the front of the machine. This pedal functions through a clutch, starting and stopping the machine with the motor running continuously. The left hand tail stock has an extra large spindle with two holes running through its entire length, one of these holes being for the purpose of carrying a standard centre while the other is a clearance hole through which the work is telescoped when loading and unloading the machine. By withdrawing the index plunger at the front of this tailstock its spindle may be revolved and either of the two holes indexed in alignment with the spindle of the machine. There is no endwise adjustment of the spindle in the left tailstock. The right hand tailstock spindle has longitudinal motion similar to that of a standard lathe tail stock. Either tail stock may be clamped and moved along the bed to suit long or short work. The carriages have automatic and individual feed trips, and when tools are being automatically returned to their starting positions, they are withdrawn slightly from the work so as not to score it. Both carriages, when the tools are cutting, travel towards the head stock. A back-arm attachment to both carriages has been supplied on several of these machines, so that squaring of shoulders, as well as the grooving of shaft ends can be performed simultaneously with the turning operations.

The original idea was developed some four years ago when a machine of similar design was built to machine Ford automobile driving shafts. The new machine incorporates several new features. On a machine designed for turning shafts up to 2⅞ inches in diameter and having a 9-foot bed, the maximum distance between centres is 72 inches. The machine is manufactured by the Reed-Prentice Co. of Worcester, Mass.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Is New Regulation Being Broken?

ON FEB. 1st an amendment to the customs law was put into effect, which did away with the requirement for goods to be invoiced at "a fair market value for home consumption," or words to that effect. It was found that in many instances, goods in foreign countries in general, and in the United States in particular, were being sold at prices that were without doubt below the cost of production. This was done for various reasons, to increase the volume of work in factories in order to reduce the cost of production per unit, to dispose of a side line, to raise cash quickly, etc.

A large volume of these goods are said to have found their way into Canada, and, of course were invoiced at the prevailing prices in the home market. The new regulation has been framed to circumvent this condition and it requires all goods imported into Canada to be invoiced at a figure that represents "cost of production plus a fair margin of profit to the manufacturer or producer." It is understood that a number of shipments have been imported into Canada by the Canadian Metal Working Industries, and that these shipments have been purchased and invoiced at a price that would not qualify under the new regulations. In many instances the goods have been sold, "delivered," the consigners paying the duty. Many of these cases are being investigated at present, and there is every probability that corrected invoices will be demanded and the goods re-entered. The cases where the goods were purchased "delivered," is interesting, as the vendors will no doubt be forced to bear any additional expense in this connection.

It is not a patriotic spirit that prompts a firm to take advantage of such unusual conditions. It is bound to react on the whole country as this form of unfair competition is present in practically all lines of semi-manufactured and complete manufactured goods. It is, in the end, bound to increase unemployment and is detrimental to the country in a multitude of ways. It is a form of "dumping." The good it does to a favored few is largely imaginary. All manufacturers and importers should take this matter up at once and insist that Canadian workmen in Canadian factories are permitted to supply Canadian requirements. At this particular time when business is so depressed, and unemployment so general, it is most important that such practices be checked.

What Will Be Its Future?

OCCASIONALLY some engineer comes along and disturbs the peace of mind of the engineering profession by discovering something entirely out of the conventional rut. This is a good thing as it prevents stagnation of ideas and dry rot. The average designer, if asked to describe a gear tooth would proceed to discuss the forms in general use, and if well versed in the science, might go back so far as Appolonius of Perga, who is claimed to have been the first one to derive the conic sections from a single cone. From there he might proceed to tell how the first gear was composed of flat pieces of wood arranged in the form of a cross, and would perhaps enlarge on the various types of teeth now in vogue, discussing tooth pressures, clearances, etc., but it is very doubtful if he would touch upon the form of gearing shown on another page of this issue, for here we have something entirely new to the engineering profession, and known as the autopitch gear.

In this new design the inventor has attacked the pinion as the offending member, and in place of the regular accepted theory, has made the pinion almost one continuous tooth composed of hardened rollers. Adaptability is covered in the inventors' claims, also elasticity and noiselessness. So far as efficiency and economy of power are concerned he is not able to give any definite figures, but claims that recent running tests have proved entirely successful.

Several questions arise in our mind regarding the feasibility of this new departure. Will the rollers offer sufficient resistence to drive the gear? Will they soon become worn to such an extent that slip will occur, or will the rollers become distorted in use on heavy drives? These are only a few of many thoughts which arise when contemplating this new type of gearing, and it is very unlikely that the new departure will revolutionize existing methods. However, it starts a new thought, which, with further development and research work, may be of decided value to the engineering profession.

Why Should This Condition Exist?

WHEN THREE firms from one city decide inside of a few months of each other to close shop and move to another city, it is high time to ascertain the cause. Upon investigation we find that the root of the trouble lies with labor and its demands. Although these firms only employ about twenty hands each, the principle is the same, viz., that they have found a locality where they can secure contented help at a reasonable figure. Like many other concerns, these three establishments found their operating costs too high for the new levels of selling and after an attempt to show their employees the need of wage reductions they were forced to move as their workers refused to accept any cut.

What happens to the men who refused a lower scale of wages? Have they secured positions at an equal rate? We have had no opportunity of following this up, but it is a safe conclusion that a large percentage are still looking for a job. Thus, the stubborn attitude acted as a boomerang. Labor, as well as manufacturers, must consider existing conditions when asked to accept temporary reductions, otherwsie a return to a true level of business will be delayed.

A seaplane can fly from Halifax to Vancouver and descend on a lake or a river within easy reach of supplies, at intervals not exceeding 150 miles.

Keen Competition Exists In Tools and Supplies

Pig Iron, Non-Ferrous Metals and Scrap are All Dull—Steel Orders Increasing Slightly and Prices Stiffen—Wood Working Tools in Better Demand

ALL MARKETS MERELY HOLDING THEIR OWN

A REDUCTION of approximately 10 per cent., in one line of Canadian-made machine tools has taken place during the week. New lists are in the hands of the dealers, and it is expected that this move will stimulate business, otherwise Canadian markets remain the same.

Pig iron is dull, and until foundries secure more orders this condition cannot improve. Scrap metals continue weak at the decline recently recorded, and little business is being closed. As this market is largely dependent upon foundries for its business, no improvement is looked for in the near future.

Sheets, plates, small shapes and boiler tubes are moving best of all in the iron and steel trade. Prices are firm, but have not yet advanced in proportion to the increase in the States. Should the advanced prices on the other side hold for any length of time, quotations would probably rise here in like proportion.

Machine tools are fairly active but no improvement over last week can be reported. Several prospects look encouraging, but this supposition does not show up to advantage on the books.

Small tools and supplies are merely holding their own. It is doubtful if March will show any improvement over February. This month started off with a rush but has tapered down, probably owing to the keen competition existing. Prices remain the same on the lists, but it is a known fact that these are quite often shaded in order to land a good sized order. As high as 20 per cent. reduction is spoken of in some quarters, so keen are dealers for business. Most of these reductions occur on drills, other lines being more stable.

Wood working tools are slightly improved, although the spring demand has not come up to expectations. Oils and greases, waste, and steel pipe, all show a slight increase in demand, but several reductions in the price of oil have taken place during the week.

In the United States the rate of steel production remains the same, 55 p. c. A higher rate is not expected, the belief existing that the present rate is rather high for existing conditions. The production of steel for domestic consumption is at the same rate as in 1912 and 1913, the two best years before the war.

Interest centers around the possible coal strike on April 1st, and from present outlook, the miners will drop their tools on that date. The new rates offered to the men involve a reduction of 30 per cent. Coal is quite soft, selling as low as $1.80 for steam mine run, when $2.10 has been the minimum for many months. This softening is caused through consumers having already stocked up. The steel mills are not worrying over the possible strike as they have good stocks on hand.

There is a possible chance that orders for steel may drop off a little, as many are said to have been ordering material before the miners went out. Thus, stocks are heavier than they were. Prices in steel products are stiffening a little, 1.40c for bars, shapes and plates being the lowest figure now quoted. Others call for 1.50c. Sheets remain firm the prices being 3..00c for black, and 4.00c for galvanized.

Basic pig iron has advanced 25 cents, being once more $18, valley. This is the third time during the last nine months that it has reached this mark.

Toronto

March 22.

THERE IS practically no change on the local market so far as volume of business is concerned. Any improvement which may have occurred was looked for, because as season advances, certain lines pick up. One machine tool manufacturer announced a reduction of approximtely 10 per cent. on his line of tools this week, hoping to secure additional trade by this move.

Pig Iron.—The demand for pig iron is almost non-existent. Foundries remain very dull, and until they get orders from the manufacturer, there is little likelihood of the pig iron industry picking up. The existing quotation is $27.15.

Iron and Steel.—A fair volume of orders is reported in this market, sheets, plates, small shapes and boiler tubes being best of all. So far no step up in prices has been made to line up with the advance in the States, but existing quotations are stronger than formerly. Should the recent stiffening hold on the other side of the line, it is quite possible prices locally will go up in like proportion. Orders for iron and steel are coming in from a scattered territory, the variety of customers being increased every week. This is a healthy condition. Following are present quotations:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Non-Ferrous Metals. — This market shows little change. Prices remain the same, and the demand is light. Copper producers are contemplating resumption of operations, this being suggested as a cause of the hesitancy of consumers from coming into the market. Production will likely be around 40 per cent., and some believe that lower prices will result. Predictions made by those in authority say that this theory will soon be exploded, when belated buyers will enter the market at perhaps higher prices than now exist. Following are present quotations:

Lake Copper	17 00
Electric Copper	16 75
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	27 00

Machine Tools.—As stated in opening paragraph, one maker has announced lower prices. Business in this line remains much the same. It is largely a question of how the morning mail shapes up. For example, one large establishment we visited had received a wonderful mail, and were highly optimistic, while another had received nothing but dead wood, and felt the bottom had dropped out of the market. None of these opinions are correct, but viewing present conditions with the start of the year, things are somewhat improved. However, if placed alongside of last week, there is no change.

Wood working tools are fairly active, but spring expectations have not been lived up to. Further improvement is expected in the near future.

Scrap Metals.—If anything, the scrap market has stiffened, but the movement is so slight as to be hardly worth considering. Red and yellow scrap is a little more active, but buying has not been on a large enough scale to advance prices. White metals are steady in price, but very slow in movement. Cast iron continues the same as last week, but steel grades are very dull. Following are quotations:

Copper, light per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	18 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	3 00

Small Tools and Supplies.—When March is considered alongside of February, it is doubtful if any improvement will show in these lines. The month started off well but gradually tapered down, possibly owing to the keen competition existing, this in turn holding the buyer out of the market until he saw which way the cat was going to jump. It is a well known fact that standard quotations are being shaded considerably where the order is particularly desirable, and some claim that as high as 20 per cent. has been lopped off to secure a good sized order. This shows how keen competition really is, but when such chopping of figures occurs, it is usually drills that are being quoted as other lines are more stable.

Miscellaneous.—Oils, greases, waste, and steel pipe are all holding their own. A few reductions in the price of oil have taken place, and following are existing prices on these lines:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bls.	1 00

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	18	Dark colored	13
Mixed colored	14		

Montreal

March 22.

IN MANY lines business continues to improve as the season advances. The scenes along the harbor front are more or less representative of what is occurring in many lines of the iron and steel business. Over five hundred men were taken on by the Harbor Commissioners during the past week. The new cold storage plant is rapidly nearing completion, and is expected to be ready at the opening of navigation. This plant is stated to be the third largest in America, as there is a large amount of high class machinery in the building, it will prove the means of employment for a large number of men as soon as it is in operation.

Iron and Steel.—Reports from the local iron and steel markets show that business is still improving. Increased activity in the building trades is evident everywhere. A general firming up in prices of steel was evident during the past week, several mills having made slight increases in their quotations, which have reacted locally, through forcing into the market many consumers who were awaiting the bottom level in prices to be reached.

This together with the seasonable increases has made an increase in the volume of business passing. Merchant bars are still very quiet, but there is a distinctly better tone to structural steel. Inquiries are coming in more freely, and a larger share are being converted into orders. Even those inquiries that have not so far been turned into orders have a genuine ring to them, and in many cases there is every indication that they can later be closed. Sheets and plates are more active, but no orders for rails have been received as yet, although it is expected that these will be placed this month. In some quarters considerable influence over market conditions is credited to the railways. It is commonly stated that when the railways do not come into the market, it is sufficient to warrant the smaller buyers staying out, as quotations cannot have reached their low level. Thus, although the business of the railways only amounts to about ten per cent. of the business of the country, it has an influence over purchasing to a much greater extent.

Quotations locally in all lines remain the same, and the possibility of a coal strike is making itself felt. Stocks are low, thus there is every indication that lower prices will not be quoted locally for some time at least. In the States, considerable price cutting has been taking place. During the past week, producers, jobbers, and the mills met and agreed on a standard price minimum. In some quarters there is a desire for a higher minimum, but following are local quotations:

Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00

Pig Iron.—The producers of pig iron had a meeting this week when it was expected that a revision of prices would be made, but this did not occur, the same quotations being in force. Business in the foundries has not improved, but there is a better feeling throughout the trade, and it is expected that the demand for pig iron will increase as the season advances. Just how long the existing level of prices will be maintained is hard to foretell, for producers claim there is no money in the sale of iron at present prices.

Machine Tools and Supplies.—No change in the machine tool market has taken place. The demand is light and it is only in a few instances that sales have been reported. No further changes in any quotations have been received. Business is almost completely confined to the supply end, a fair amount of business being closed. From week to week improvements are noted, but they are only nominal.

Non-Ferrous Metals.—Everything in non-ferrous metals appears to be quiet this week. No price changes have occurred and the demand is about only holding its own. For some time past there has been little or no activity in this market, but in some quarters a movement is looked for in the near future. Local quotations are as follows:

Lake copper	16 75
Electric copper	16 50
Castings, copper	16 25
Tin	34 00
Spelter	7 00
Lead	6 50
Antimony	6 50
Aluminum	23 00

Scrap Metals. — No change has been noted in the scrap metal market, prices being very weak, and the demand negligible. For several months this market has been quiet. Local quotations are as follows:

Copper, light per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 machine composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate per gross ton	9 00
Heavy melting steel	3 00
Axles (wrought iron)	20 00
Rails (scrap)	12 00
Malleable scrap	12 00
No. 1 machine cast iron	19 00
Pipe, wrought	6 00
Car wheel	18 00
Steel axles	18 00
Mach. shop turnings	6 00
Stove plate	16 00
Cast boring	6 00
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00

Pittsburg

March 22.

LITTLE CHANGE has occurred in the iron and steel situation in the past week. The rate of steel production, measured in steel ingots, is about 29,000,000 tons a year as it has been for the last three or four weeks. As almost all buying of steel for many months past has been for prompt shipment, the rate of production may be taken as an index to the rate of buying, which has not changed materially for several weeks. All things considered, the rate of production is rather high for existing conditions, hence there is no ground for expecting any increase in the volume of business in the near future, or until there are decided changes for the better in underlying conditions. The advent of spring might be expected to bring heavier demand, but the high rate of production recently suggests that this influence has been discontinued. Spring affects consumption rather than production and it takes time to finish steel and put it in shape for actual consumption, so that it may be assumed the recent heavy demand has been discounting the advent of spring.

Production of Steel.—Making allowance for slight decrease in exports, the production of steel for domestic consumption has lately been running at the same rate as in 1912 and 1913, the two best years before the war, while the rate is several million tons a year above the production in the best year prior to 1912. While the demand for steel looks large by comparison with pre-war records, it looks small by comparison with the capacity, or with pro-

duction in the late years of the war and in 1920. Capacity is about 52,500,000 tons, and on this basis, the production at 29,000,000 tons, is 55 per cent. of capacity. While steel producing capacity has greatly increased since the war started, it does not follow that capacity of manufacturing consumers has increased in the same ratio. In other words, it is quite possible that consumers of steel may be quite busy without the steel mills being correspondingly busy.

The Coal Strike.—No developments have occurred reducing the prospect of there being a general suspension at the union bituminous coal mines April 1, when the present two-year scale with the United Mine Workers expires. The labor organization demands a national scale settlement as in the past, while the operators in some districts, including the Pittsburg district, have refused to meet in the former manner. The old practice was for the operators in the four states, Illinois, Indiana, Ohio and Pennsylvania, to meet and arrange a scale, scales for other districts in the country being then arranged in conformity, making certain allowances. The four states were called "the central competitive field," but this combination has now been broken up. The operators are willing to meet their employees, district by district, but the men have not consented to that.

Last week the Pittsburg Coal Producers' Association sent a formal invitation to District No. 5, the local organization of the United Mine Workers, proposing a wage agreement conference March 20, but the president of the district refused the invitation. Several weeks ago the operators published the scale they are wiling to pay beginning April 1, involving reductions of about 30 per cent. from the present high scale, and with elimination of the check-off. As matters now stand the prospect is plain that there will be a suspension, which may decrease in extent from week to week by men breaking away from the union strike order, beginning perhaps at mines on the fringes of union districts, where there are non-union districts nearby.

The coal market in general began softening about a fortnight ago and last week it turned quite soft, as to both union and non-union coal. Pittsburg district coal sold down to $1.80 for steam mine-run, when about $2.10 had been the minimum for many months, until very recently. Sellers at much under $2.00, while originally union, are supposed to have special arrangements with their men, as $2.10 is regarded as approximately representing cost with the union scale.

The trade attributes the softening in the coal market to consumers having practically completed their stocking, well in advance of the date for the suspension, the presumption being that consumers feared a last minute rush for coal, with higher prices, and wished to get through early. The steel mills exhibit no concern in connection with the prospective suspension. They are understood to have comfortable stocks, while unless there are many sympathetic strikes in non-union fields, where not a few union miners have been working lately, the non-union mines can be counted on for a great deal of coal.

It is possible that buyers of steel have been influenced in their buying policy lately by the impending mining suspension, receiving extra encouragement thereby to replenish their stocks which were at a particularly low ebb at the inventory date, thus there is a possibility of orders becoming less plentiful, rather than steel becoming less plentiful, at the beginning of April.

Steel Prices.—Regarded as a whole the steel market seems to be stiffening in price rather than declining farther, although there are some cross currents In bars, shapes and plates prices below 1.40c seems to have practically disappeared, while several mills have announced 1.50c as their price objective, a price that is very low relative to cost of production, for bars, shapes and plates had declined closer to pre-war minimum prices than other steel products.

Sheets continue remarkably firm, at 3.00c for black and 4.00c for galvanized. The latest talk among mills is that there may be an advance from the present level, the attitude being that when mills have been able to maintain these prices for more than three months, and have been getting more business lately, there is no occasion to think of any decline.

Concessions from the $2.40 price on nails, possibly down to $2.25, are being made to large buyers, but $2.40 is still regarded as "the general market." In pipe there seems to be a little less shading than a fortnight ago.

Pig Iron.—Basic pig iron has advanced 25 cents, to $18, valley, this being the third time in the past nine months it has been at that particular figure. The $18 price was established by two sales, 600 tons by the Republic Iron and Steel Company and 1,000 tons by W. P. Snyder and Company, the leading merchant furnace interest in the valleys. Foundry iron is steadier, as there do not seem to have been any concessions from $19, valley, in the past week. Bessemer remains quotable at $20.50 in odd lots. Connellsville coke has softened in general tone, following the weakening in coal, but is still quotable at old prices, $3.25 to $3.50 for furnace and $4.25 to $4.75 for foundry.

BUSINESS CONDITIONS AS GALT MEN SEE THEM

"Business is spotty, but slightly improved," is how C. K. Jansen of the Galt Machine Screw Co., sums up the situation. Speaking to Canadian Machinery regarding the sources from which orders are coming, Mr. Jansen mentioned that the automobile and wood-working fields were best of all at present, also special orders for new tools, etc. The metal working trade is not sending in many enquiries, but hopes were expressed that the wood working field would soon be ordering more freely. The latter-mentioned industry is picking up a little in some quarters, but so far the screw making trade have not felt the effect of this improvement. The majority of orders being received are of the hand to mouth variety, usually for immediate delivery. This shows that stocks are low in manufacturing plants, and that once manufacturers secure business the screw making trade will likewise benefit.

A. J. Oliver, of the R. A. McDougall Co., Galt, says that while their machine tool business is very quiet, they expect their pump trade to pick up in the spring, although small orders in place of the usual large quantities are looked for. This firm is changing over from steam to electric power, and in the near future will use steam for heating purposes only. They feel that a considerable saving will be effected by this move.

Mr. Whitehall, of the Elliott & Whitehall Co., Galt, told Canadian Machinery that they are at present working nights to close orders on time. They are working with 16 of a staff, and are securing better sales and producing more work now, than they did formerly with double the staff. Mr. Whitehall is a firm believer of going after work rather than hoping for it to come to him, and says that this is the reason his plant is busy at the present time. This firm is doing a variety of work including dies for use in automobile plants, stove factories, and other articles used in the shoe industry, etc. In addition to the above they are making their regular line of cutters and reamers, and have developed a bridge taper reamer which is said to be meeting with the approval of the trade.

S. L. Clarke, of the Perfect Machine Co., says that while they are quiet at present, he firmly believes that another two months will see things considerably improved so far as their firm is concerner. Referring to Galt itself, Mr. Clarke, is convinced that 1922 will be a good year for that city. Prospects are bright for a fairly active building season, and several residences are now in course of erection. Three firms are considering locating in Galt, in fact one of the three has decided to locate, and has bought four acres of land in the north end of the city. This firm, the International Tank and Silo Co., have an office at present in Toronto, and they plan to build a one storey factory 280 ft. x 300 ft., of "L" shape. The other two concerns are almost sure, according to Mr. Clarke, to come to Galt in the near future.

CHANGE IN TARIFF

A dispatch from Kingston, Jamaica, states that the Legislative Council has passed a tariff measure giving a preference of 25 per cent. on goods imported from Canada and Great Britain and of 50 per cent. on empire manufactured cotton piece goods.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 4[illegible]
Tank plates, Pittsburgh mill price	1 40
Structural shapes, Pittsburgh mill prices	1 40
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 25
Castings, copper	16 25	17 00
Tin	34 50	34 50
Spelter	7 25	7 25
Lead	6 75	6 75
Antimony	8 00	8 00
Aluminum	27 00	27 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.83	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under, 50 per cent.
4½-in. and larger, 40 per cent.
4-in. and under, running thread, 30%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, net.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 00	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 50	3 50
Medium brass	4 50	4 50
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00
	Per Ton	Gross
Boiler plate	$9 00	$9 00
Heavy melting steel	9 00	12 00
Axles (wrought iron)	17 00	20 00
Rails (scrap)	10 00	12 00
Malleable scrap	10 00	12 00
No. 1 machine cast iron	18 00	19 00
Pipe, wrought	7 00	6 00
Car wheel	18 00	18 00
Steel axles	16 00	18 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	16 00
Cast boring	3 00	6 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 24½
Solder, guaranteed	0 26
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 25	...
Galvanized sheets, No. 28		5 55
Queen's Head, 28 B.W.G.	7 00	....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 35
Linseed oil, raw, single bbls.	1 00

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored.13

Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

The city council of Ottawa, Ont., contemplate the erection of an abattoir at the cost of $300,000.

It is reported that a representative of a Canadian firm was down in St. Johns', Newfoundland recently, with a proposition to establish a flour mill, which would employ 500 men.

An automobile factory costing $50,000 is being erected in Hull county in the vicinity of Hull, Que., by a Canadian Automobile Corporation, 197 Sparks St., Ottawa, Ont.

The total amount of construction done in Canada for the month of February 1922 totals $10,718,300. Nearly seven million dollars of this was spent on industrial work.

The daily output of the Durant Car Co., of Leaside, Ont., has increased to nearly 25 per day since the first of March; 4,000 cars are expected to be finished by the first of July 1922.

The Canadian Car & Foundry Co., of Montreal, has secured an order from the C.P.R. for 50 compartment and 3 refrigerator cars.

It is estimated that the C. N. R. has between 5,000 and 6,000 cars that need repairs, overhauling, etc.

The Boiler Engineering & Equipment Co., dealers in boiler compounds and used boilers, of 222 Craig Street, West, Montreal, have moved to new quarters, 68 Prince Street, Montreal.

Actual gain in cash position of Canadian foreign trade is stronger by $150,000,000 than 12 months ago.

The Fulled Brush Co., has installed new machinery and equipment in their plant at Hamilton, Ont., for the manufacture of their product.

The Canadian Pacific Railway Co., is reported to be negotiating with the Port Arthur Shipbuilding Co., for construction of a large lake passenger ship.

The Enterprise Foundry Co., Sackville, N. B., is reported as stating "Our main plant is running full time with about 80 per cent. crew. This applies to our foundry department as well as all others."

Kerr and Goodwin Machinery Co., Brantford, have recently shipped three carloads of the "Brantford" oil engines to England. Other shipments have been made recently to South America and the British West Indies.

The J. S. Rose Co., state that the item which appeared in our January 26th issue to the effect that they had discontinued their Toronto office was incorrect as they still hold stocks at their office in the Page Bldg., Toronto, and are still meeting the requirements of the Canadian trade.

A report from Washington states that there is a possibility that industries in the states may open negotiations with Canadian coal companies for their requirements, if the strike in American coal fields takes place.

An encouraging factor of present conditions is the steadily growing activity reported in the building industries in Toronto. It is expected that some large construction jobs will commence in the near future.

Orders for iron ore, approximating three of four hundred thousand tons, have been received by the Dominion Iron and Steel Co., to be shipped from Wabana to steel companies in Europe.

The Lymburner Brass Works, Inc., 1025 Boyer Street, Montreal, Que., want complete equipment for a brass foundry.

The Central Machine and Welding Co., 38 Bromston Lane, Montreal, Que., is in the market for a welding machine and small lathe.

The F. T. Hill & Co., Markdale, Ont., is in the market for modern flour mill equipment to replace that which was destroyed by fire. Estimated loss $35,000.

The plant of the Blystone Manufacturing Co., manufacturers of sand sifters and other foundry equipment, at Cambridge Springs, Pa., was recently destroyed by fire. A new factory will be erected immediately.

Construction of a four storey addition to the building of the Great West Life Assurance Co., Winnipeg, Manitoba will be begun immediately. The addition will cost $300,000. The work will be completed by October 1st, 1922.

The demand for Canadian paper by United States users shows a steady return to normal according to a report issued by the Canadian Pulp and Paper Association. Most of the Canadian mills are now working in about 90 per cent. of their maximum capacity.

A large addition to cost about $150,000 will be added to the University of Ottawa building this year. Completed plans for its erection are now in the hands of contractors and work will likely commence in a month.

The waterworks commission of Brantford, Ont., is having plans prepared for an addition to the pumping station to cost $250,000, including the installation of three gauge centrifugal pumps with electric motors.

The Empire Cotton Mills, Welland Ont., have decided to erect dye mills adjoining their present plant at a cost of $200,000. A by-law will be submitted to the ratepapers granting the company certain concessions.

At a meeting of vessel owners at Kingston, Ont., it was decided to reduce freight rates 35 per cent., for the Cleveland navigation, which opens with the break up of the ice. This announcement was made by J. S. Sowards, one of the prominent marine men of the city.

Announcement has been made of the appointment of C. R. MacKenzie to the position of assistant to the vice-president of the financial and accounting department of the C. P. R. at Toronto. Mr. MacKenzie has been assistant to the general manager at Montreal, since 1918.

The city of Toronto proposes to spend about $7,000,000 in municipal undertakings during 1922. Included in the estimate just compiled by the Works Commission is an item for additional pumps and extension of reservoirs to cost $1,060,000.

If the course of exchange be true augury of 1922 eventualities the Canadian outlook is 100 per cent. better than a year ago. The new year opened with Montreal dollars at 5 per cent. discount. The old year began business with Montreal dollars worth 85c a piece in New York.

The Perfect Machine Co., of Galt, Ont., reported "Business is fairly good, at least 100 per cent. better than the winter of 1920 and 1921. Our foundry has been busy all this winter and orders are on hand which will be sufficient for possibly another month."

Some good orders have recently been received by the Horton Steel Works, Bridgeburg, Ont. In connection with the sprinkler system in the Canadian Libby-Owens Sheet Glass Co., new plant at Hamilton, they have completed the installation of an elevated tank of 50,000 gallon capacity and 75 feet high.

Largely through the instrumentality of the British Columbia division a large order for wood conduit piping being placed reeently by the B. C. Telephone Co., was retained in Canada. It has been intimated that the company had intended to place the order in the United States. The order is for over 15 miles of conduit, which will require more than 250,000 ft. of lumber.

At a meeting of the Board of Directors of the Ford Motor Co., of Canada, Mrs. Gordon M. McGregor, wife of the late first vice-president, was appointed a director to fill the unexpired term of her husband. Wallace R. Campbell, who for some years has been secretary and assistant treasurer, will succeed to the position of first vice-president. and treasurer. Mr. Campbell's old position will be filled by P. W. Grandjean, assistant secretary.

The Boston Blacking Co., have just finished installing new machinery in their plant at 152 McGill St., Montreal, by which they have nearly doubled capacity. They are now engaged in enlarging their cement plant at Cote St. Paul by putting in new boilers and other machinery and improvements.

Machinery is wanted for Guatemala industry. It is reported that a company has been formed in the republic of Guatemala with the object of establishing plans for the manufacture of jute fabrics, and allied products. Those interested should address the Central and South American Export Company of Guatemala, Guatemala, Central America.

Speaking recently on unemployment in Canada, Hon. James Murdock, Minister of labor, stated:—"I see it is easing up, and I am glad to say that the gentlemen who are directing big business in the country are showing every disposition to assist all they can in creating employment. I look for the breaking of spring and the finer weather conditions to help considerably."

An interesting story comes from Iroquois Falls the home of the Abitibi Power Co., Montreal, which illustrates the real improvement and the demand for newsprint from the United States. A special train of 50 cars loaded with paper was dispatched on March 10th from the Falls to Chicago for the printing of the Monday issue (March 13) of the Chicago "Tribune."

Trade in the small tool and supply business continues to improve in Canada and is bound to improve as the season advances. The increase in building is helping the tool trade. Should general building operations develop as promised it will stimulate activity in many lines of manufacture which supply materials.

Fire breaking out in Picton, Ont., on March 12th, from an unknown cause totally destroyed the planing mill, stables, flouring and grist mill of Messrs. Hyatt & Hart. The loss is placed at $20,000 partly covered by insurance. The greatest loss is on the machinery. Only last fall this concern installed a new flouring mill.

H. J. Logan, member for Cumberland, has notice of a resolution on the order paper that all goods to receive the benefit of the British preferential tariff rate must be imported through a British port. This proposal has already been discussed before and advocated by the Maritime Provinces Board of Trade. It will affect a very large proportion of Canadian imports.

The Durabla Manufacturing Co., of New York, manufacturers of Durabla gaskets announce that the first shipment of Canadian made Durabla goods are going out this week, following the expenditure of $30,000 in a Canadian plant to meet the demand for Canadian made goods. Durabla gaskets will be sold in Canada at the American price under guarantee to perform the work it is sold for or money refunded.

It is believed that the Montreal Public Service Corporation contemplate developing power on the Chippawa River, Pontiac County, where 90,000 H. P. can be generated. This corporation is seeking power to construct transmission lines in 23 counties in the province of Quebec.

S. Webb, Canadian Trade Commissioner at Buenos Aires, reports prospects for Canadian trade in the Argentine are brighter than at any time during the past year, owing to the falling exchange rate, improved position of export trade and increasing number of inquiries from Argentine importers.

It has been stated, that the Durant Motors of Canada are to erect an addition to their present plant at Leaside, Ont., which will make that town the location of one of the largest automobile plants in the Dominion. The new building is to be completed by early fall. With the addition the whole plant will cover an area of 28 acres and will employ a force of nearly 3,000 men, as compared with the 600 at present engaged. 50 cars per day will be the output.

The Canadian Rampo Iron Works, Niagara Falls, Ontario, manufacturers of railway switches, crossings and switch stands, are making extensive additions to their plant. Considerable new machinery has been installed and a new building is planned, representing, it is understood, a total outlay of about $100,000. Exceptional activity in railway construction is anticipated.

The Hayes Wheel Co., Chatham, Ont., is making an effort to secure business with British automobile firms who are in the market for 20,000 chasses during the present year. The manager of the Chatham company has left for Britain to negotiate business. The British motor car manufacturers intend to press their export business more strongly especially to other parts of the British Empire.

A new industry is to be established in St. John, N. B. as a result of the decision of the town and council of that city, to award a large contract for cast iron pipe to a local company which promised, if they secured the contract to establish a foundry, and make the pipes in the city as the beginning of a new industry. It is promised that the work will be extended to a point where employment will be given to from 160 to 200 men.

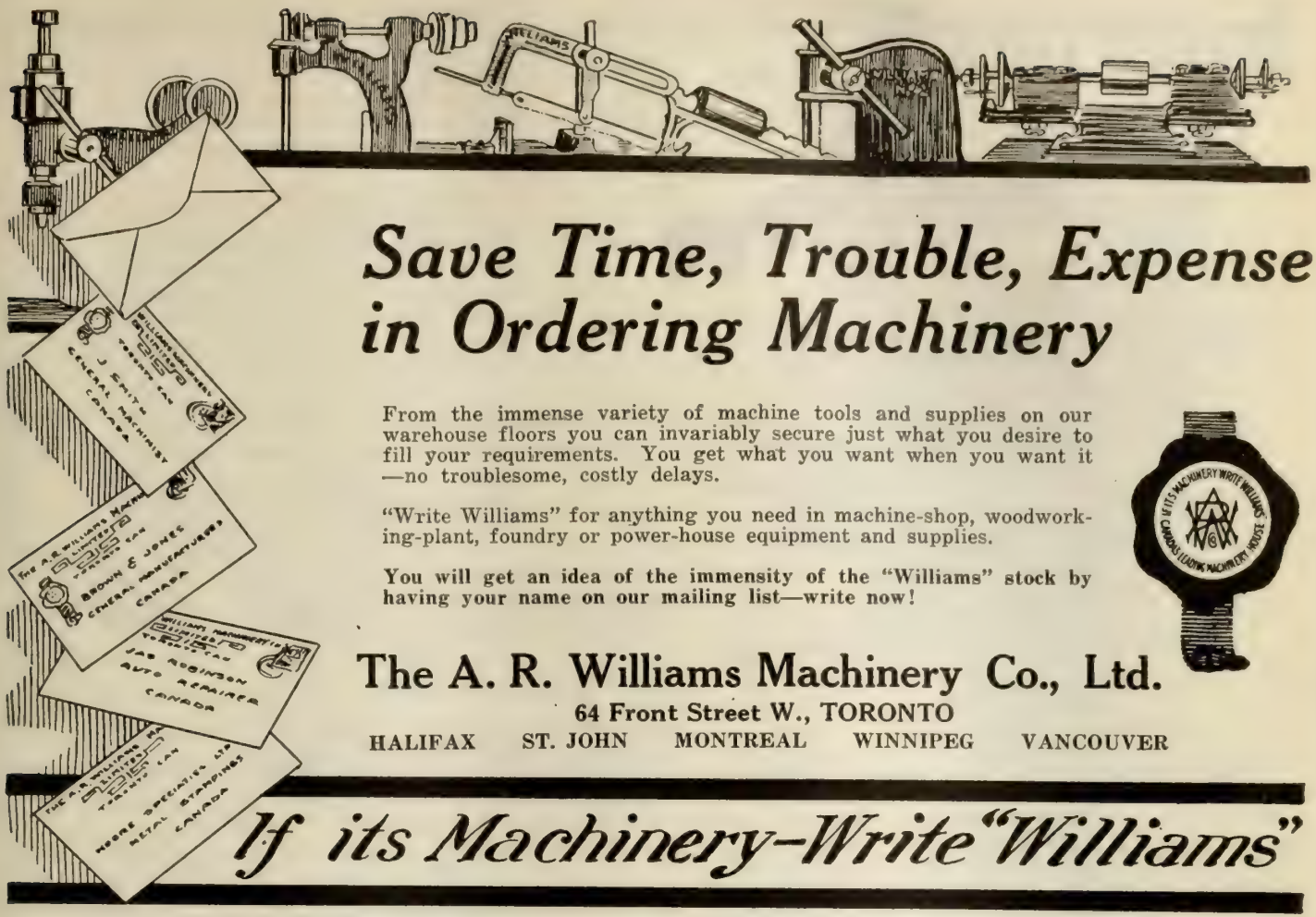
H. Graham, general manager of the Bond Engineering Works, Toronto, has been in England for the past six months, and brings back with him some first hand information regarding conditions in Great Britain. In conversation with Canadian Machinery he said that the textile trade seemed to be picking up slightly, but that the engineering branches, especially the shipbuilding and machine tool business was very dull indeed. Mr. Graham touched upon the present labor trouble and mentioned that it was particularly unfortunate at the present time when Britain was trying so hard to get properly on its feet. Woolen goods were picking up, but this improvement was confined to the finer grades. Mr. Graham feels however that it is only a question of time before Great Britain manages to master these labor difficulties, when they will once more take their proper place in the commercial world. Speaking about his firm's activities in Toronto, he said that they are doing all in their power to improve their lines, wherever possible, and were taking this opportunity of preparing for the increased business which will come when general conditions improve.

Two industries of considerable importance are negotiating for location in Welland. One would manufacture seamless steel tubing such as is used for boilers, and would take over the building and plant of Welland Machine and Foundries which would be considerably extended, and the other would acquire the building and plant of Electric Steel and Metals, which has been lying idle for some time, and would use it for foundry and rolling mill purposes. No details are as yet ready for publication.

Contract for the construction of four steel cargo ships has been awarded to Fraser, Brace & Co., Montreal, for the work to be done at Three Rivers, Quebec. The ships are to be coastwise coal freighters, for the George Hall Coal Co., of Montreal. The vessels will be 250 feet in length between perpendiculars, with 43 ft. molded beams. They will be built partly on Isherwood plan. Each ship will be equipped with electric lighting plant and refrigeration system of a type not yet decided upon, and will start in June.

Speaking about history please note the following: The first Canadian cheese factory was established in Ontario in 1864 and the first Canadian Creamery for butter making in Quebec in 1873. The first centrifugal cream separator was imported from Denmark in 1882 and the Government organization of cold storage services dates from 1895. According to official record the number of dairy factories operating in Canada in 1920 was 3,161, comprising 1,045 creameries, 1,683 cheese factories, 405 combined butter and cheese factories and 28 condenseries.

The directors of the Steel Company of Canada at a meeting held in Montreal on Friday, March 17th, declared the regular quarterly dividends of 1-3/4 per cent., upon both the preferred and the common shares of the company. President Robert Hobson, who was present from Hamilton for the meeting, briefly commented on the business outlook to the effect that conditions are gradually improving. He gave no intimation that anything of a boom is expected, contenting himself with the above statement. The annual meeting of the company will not be held until the middle of April, at which time the figures of the company for the current year will be announced.



Save Time, Trouble, Expense in Ordering Machinery

From the immense variety of machine tools and supplies on our warehouse floors you can invariably secure just what you desire to fill your requirements. You get what you want when you want it —no troublesome, costly delays.

"Write Williams" for anything you need in machine-shop, woodworking-plant, foundry or power-house equipment and supplies.

You will get an idea of the immensity of the "Williams" stock by having your name on our mailing list—write now!

The A. R. Williams Machinery Co., Ltd.
64 Front Street W., TORONTO
HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

The Lion and The Mouse

DO YOU remember reading in the school books about the great big lion who was caught and trapped in a gigantic net by hunters? Then along came the little teeney mouse who nibbled away at the netting and was successful in setting the lion at liberty again. The net was too strong for the lion to break but the constant nibbling of the mouse, breaking mesh after mesh, was able to perform the seemingly impossible.

A person who is not subscribing to CANADIAN MACHINERY is in exactly the same circumstances as the lion imprisoned in a corner—not being able to enjoy the freedom of expanding his capacity for knowledge.

CANADIAN MACHINERY acts as the mouse. Week by week it will give information —which, on account of the lack of it, has tied you up in an industrial way—will nibble away the meshes, one at a time, that are keeping you from getting the results you want.

Ask us to send you a sample copy. It will not obligate you and it will be a pleasure to us.

CANADIAN MACHINERY,
143 University Ave.,
Toronto, Canada.

Please send me a sample copy of your paper and oblige.

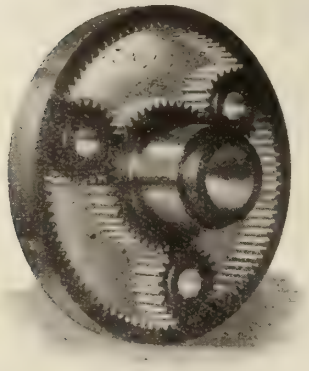
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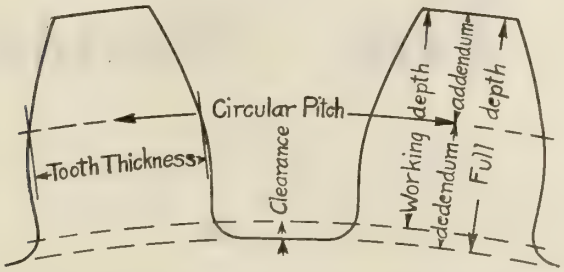
Internal Gears





A Planetary Gear Drive

GEAR DATA FOR YOUR NOTE BOOK
Cut this out,—more coming later



Circular pitch is the centre to centre distance of the teeth measured along the pitch circle. Diametral pitch is the number of teeth per inch of pitch diameter.

Write For Quotations

Hamilton Gear & Machine Co.

76 Van Horne St. - TORONTO

A report from Sarnia, Ont., states that the Pere Marquette Railway Co., plan the erection of a $350,000 bridge of the jack-knife type, over the Black River to replace the present draw bridge in that city. It is proposed to commence actual construction work on this structure this year.

Road construction is brisk at present not only around Toronto and this part of the province, but it is the same in practically every province of the country. The Province of Ontario is working on a large program of something like 1,800 miles of new or re-constructed road to be spread over a period of five years. An index of this possibility lies in the fact that in about 10 years the number of motor vehicles licensed in the province of Ontario has increased from about 25,000 to 250,000 and there is today about one vehicle to every eighteen inhabitants of the Dominion, or about one to every three families. This means a great impetus and demands not only for road building but also the manufacture of motor vehicles for passengers and freight, and in these respects engineering activities are very marked at the present time.

INSTRUCTION LARGELY OF INDIVIDUAL KIND

(Continued from page 30)

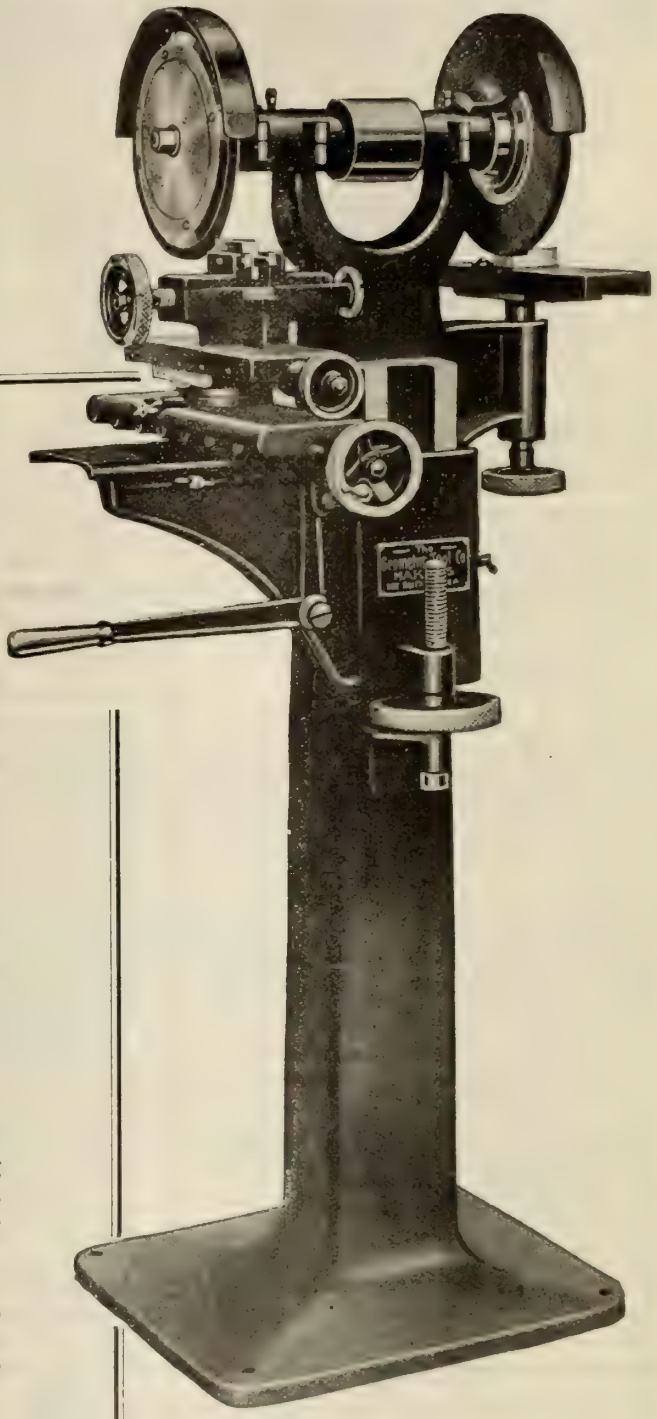
heavenly body above the observer's horizon, with a sextant.

Magnetism—laws relating to both permanent and induced magnets and the disturbing influence they may have on the compass needle when placed on board ship, and how that disturbing influence can be counteracted by placing permanent and induced magnets around the compass.

Seamanship—including the manoeuvring of vessels under all conceivable conditions; stowage of cargo; and ship construction. Signalling, by flag and Morse.

The instruction is for the most part individual, a few of the subjects being handled by the lecture method. Up to the present fifteen have been successful in passing their examination as chief officer for inland water vessels, five for master inland water vessels, four for master coasting trade. In addition to this several pupils are attending the class to educate themselves for the higher grades of their profession, so that they may be prepared to take a step higher when they can produce the service necessary for that advancement.

The marine engineering classes are designed to give the academic side of the training necessary for the examinations for the various classes of marine engineers. The requirements for these examinations are given in regulations, relating to the examination of engineers, issued by the department of marine, Ottawa. In these classes, instruction is individual.



Sharp Chasers Cut Clean Threads

Accurate, uniform threads result only from dies which are maintained in the highest state of cutting efficiency. This means that chasers must be kept sharp, and ground uniformly.

Even if just touched up from time to time, the chasers respond splendidly, with clean threads. And with this machine—the Geometric Chaser Grinder—the matter of keeping threading tools up to scratch is a comparatively simple matter.

Any make of chaser can be ground on this adaptable machine. The two wheels permit the easy grinding of both milled and tapped chasers. In addition, the plain wheel lends itself readily to various kinds of tool grinding.

Uniform grinding of a set of chasers is purely a mechanical matter through the use of adjustments which can be accurately set to govern the grinding of an entire set of chasers.

The Catalog describing this machine is a mine of information on chaser Grinding. Write for it.

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:
Williams & Wilson, Ltd., Montreal.
The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg, St. John, N. B.

Classified Opportunities

Two cents a word, including "Canadian Machinery' box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

The old established firm. Patents everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.
FETHERSTONHAUGH & CO.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (etfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

AGENCIES WANTED

I WANT TO GET IN TOUCH WITH AN ENergetic young man who is very familiar with the metal-working trade in one of the larger cities in Canada. The work I want him for can be done in spare time—it is not altogether easy, such as "taking candy from a baby,' but with little effort he can double his income each week. Apply early to Box 803L, Canadian Machinery.

IF YOU ARE LOOKING FOR A HIGH-GRADE firm to handle through the hardware jobbers and consuming trade throughout the Dominion, write us. It will be worth your while to investigate the special features of our marketing proposition. We know what co-operation means. Write to Box 860T., Canadian Machinery.

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

REGO WELDING and CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co. of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern Work. Our advice and estimates will save you money. Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

FOR SALE

FOR SALE:—ARCWELL ELECTRIC WELDing outfit, Heald Internal Grinder, 10 Pyrometers, Portable Crane, 5 Elevating Trucks, 1 four spindle drill, Sandblast outfit, several tool grinders, Warner Swazey screw machine 300 feet Matthews' Gravity Conveyor, 3 Tool Furnaces. This equipment almost new will sell cheap. Box 802L.

SITUATIONS WANTED

SALESMAN, 6 YEARS' MACHINE TOOL EXperience, 10 years general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery, (c23m)

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium and heavy work, green and dry sand. Bench, floor and machine molding, melt by analysis, and thoroughly competent on cupola practice. Good reference. Box 804. Canadian Machinery. (C11M.)

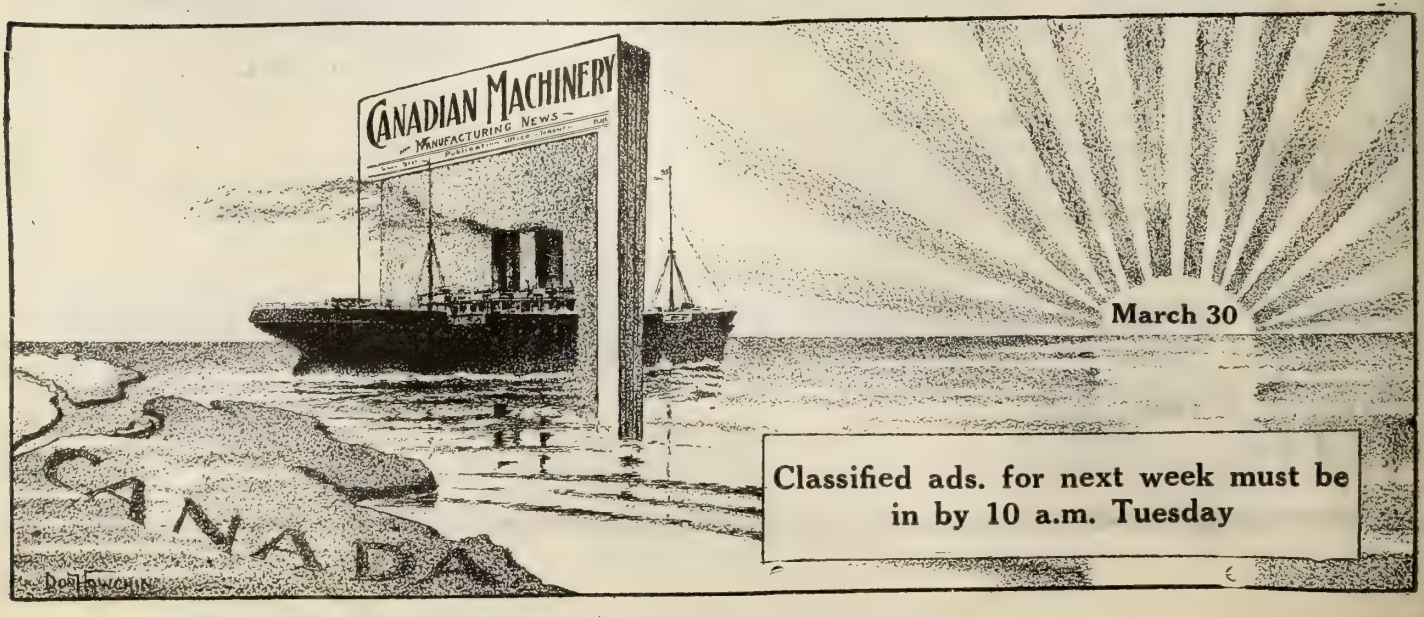
MACHINE WORK WANTED

MACHINE WORK WANTED FOR LATHES, shapers, milling machine and planer, etc. Hourly or contract basis. Prompt delivery. W.H. Sumbling Machinery Co., Toronto. (etfm)

WANTED TO BUY—A SECOND HAND LOcomotive crane in first-class condition 7½ or 10 ton capacity. Address Standard Steel Construction Co., Welland, Ontario. (C.9.M.)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.



HINTS TO BUYERS

For Hardness Testing



THE PYROSCOPE

in shop and laboratory use the

Standard Scleroscope

Universally adopted; direct reading; inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification.

BOOKLET FREE.

Heat Indication

by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem.

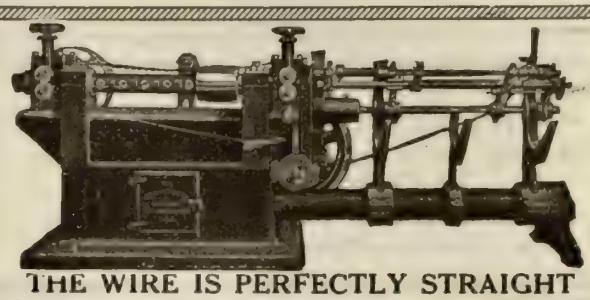


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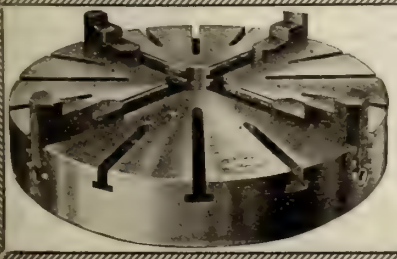


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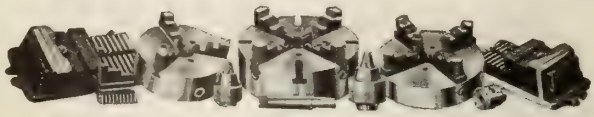
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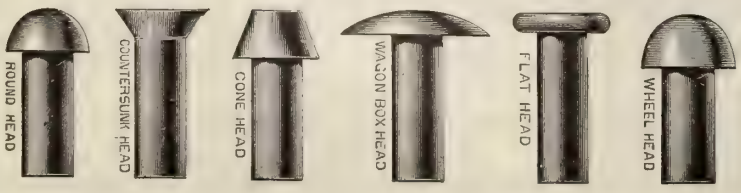
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Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Ford-Smith Machine Co., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Quartz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Aikenhead Hardware Ltd., Toronto, Ont
Can. Desmond-Stephan Co., Hamilton
Ford-Smith Machine Co., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Die Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, On
Fisher Motor Co., Ltd., Orillia, Ont
Ford-Smith Machine Co., Hamilton, On
Banfield & Sons, Ltd., W. H., Toronto

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont
Preston & Schwartz, Galt, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros Tool Co., Chicago, Ill

Drafting Boards and Tables
Darling Bros., Ltd., Montreal, Que

Drafting Materials
American Lead Pencil Co., New York City, N.Y.
Darling Bros., Ltd., Montreal, Que.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill

Drill Rods
Aikenhead Hardware Ltd., Toronto, Ont.

Drilling Machines, Bench
Burke Machine Tool Co., Conneau Ohio.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Electric and Hand
Aikenhead Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Cincinnati Electrical Tool Co., Cincinnati Ohio.
Jardine & Co., A. B., Hespeler, Ont
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneau', Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis
Steinle Turret Machine Co., Madison, Wis
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Drill Press Sleeves.

BUYERS' DIRECTORY

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Sheffield Engineering Supplies, Ltd., Montreal, Que.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont
Northern Electric Co., Montreal, Que
U.S. Electrical Tool Co., Cincinnati, O.

Electric Wiring Devices
Banfield & Sons, Ltd, W. H., Toronto, Ont.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Roelofson Elevator Co., Galt, Ont.

Equipment, Elevator Safety
Roelofson Elevator Co., Galt, Ont.
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont. Montreal, Canada.

Engines, Capstan
Goldie & McCulloch Co., Ltd., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Ford-Smith Machine Co., Hamilton, Ont.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Williams Machinery & Supply Co., A. R., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings Ltd., Oshawa, Ont.

Flexible Shafts
Aikenhead Hardware Ltd., Toronto, Ont.
Strand & Co., N. A., Chicago, Ill

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
Ford-Smith Machine Co., Hamilton, Ont
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que

Furnaces, Electric
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Greenfield Tap & Die Corp., Galt, Ont
Johansson Inc., C. E., Windsor, Ont
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Johansson Inc., C. E., Windsor, Ont
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Johansson Inc., C. E., Windsor, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Standard
Johannson Inc., C. E., Ploughkeepsie, N. Y.

Gages, Thread
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Ltd., Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont
Ford-Smith Machine Co., Hamilton, Ont
Gardner & Son, Robt., Montreal, Que
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont
Renold (Hans) of Canada, Ltd., Montreal, Que
Dominion Engineering Works, Limited Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que
Morse Chain Co., Ithaca, N.Y.
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont
Hamilton Gear & Machine Co., Toronto Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Aikenhead Hardware Ltd., Toronto, Ont.
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R. Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Cutter and Reamer
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Disc
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont
Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Face
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Ring Wheel
Ford-Smith Machine Co., Hamilton, Ont

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Ford-Smith Machine Co., Hamilton, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Machine & Tool Co., Toronto, Ont.

Grinding Wheels
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Ford-Smith Machine Co., Hamilton, Ont
Norton Co. of Can., Ltd., Hamilton, Ont.

Guards, Emery Wheel
Ford-Smith Machine Co., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis

Hack Saws, Power
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

Hammers, Drop
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Bradley & Son, Syracuse, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.

BUYERS' DIRECTORY

Hammers, Electric
Aikenhead Hardware Ltd., Toronto, Ont
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que
Cleveland Pneumatic Tool Co., Toronto Ont.
Bradley & Son, Syracuse, N.Y.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Williams Machinery & Supply Co., A. R Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y

Hardening, Case-Hardening and Tempering
Canada Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Gardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John Dundas, Ont.
Dominion Engineering Works, Limited. Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Aikenhead Hardware Ltd., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal, Q

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis I
Simonds Canada Saw Co., Montreal, Que

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Lamps, Electric
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Dalton Mfg. Corp'n, Sound Beach, Conn.
Perfect Machine Co., Ltd., Galt, Ont.
McKenzie Machinery Co., The, Ltd., Guelph, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McKenzie Machinery Co., The, Ltd., Guelph, Ont.
McDougall Co., Ltd., R., Galt, Ont
Perfect Machine Co., Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Roelefson Machine & Tool Co., Toronto
Williams Machinery & Supply Co., A. R., Montreal, Que

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J G., Everett, Mass
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis

Lathes, Polishing (See Polishing and Buffing Machines)
Ford-Smith Machine Co., Hamilton, Ont

Lathes, Relieving
Hendey Machine Co., Torrington, Conn
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J G., Everett, Mass.
Cowan Co. of Galt, Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis
Oliver Machinery Co., Grand Rapids, Mich.
Roelefson Machine & Tool Co., Toronto, Ont.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Northern Electric Co., Montreal, Que

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N Y

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R I
Can. Fairbanks-Morse Co., Ltd., Montreal
Canada Foundries & Forgings Co., Welland, Ont.
Dodge Mfg. Co. of Can., Toronto, Ont
Ker & Goodwin Machine Co., Brantford Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto Ont
Starrett Co., L. S., Athol, Mass
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Williams Machinery & Supply Co., A R Montreal, Que

Manganese Steel
Can Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont
Atkins & Co., Inc., E. C., Indianapolis, I
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Fisher Motor Co., Ltd., Orillia, Ont
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Aikenhead Hardware Ltd., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Ackworthie, Ltd., John, Birmingham, Eng
Burke Machine Tool Co., Conneaut, Ohio.
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R I
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal

Milling Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal Q
Ford-Smith Machine Co., Hamilton, Ont
Kearney & Trecker Co., Milwaukee, Wis
Roelefson Machine & Tool Co., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Burke Machine Tool Co., Conneaut, Ohio
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Ford-Smith Machine Co., Hamilton, Ont
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont
Roelefson Machine & Tool Co., Toronto Ont.
Williams Machinery & Supply Co., A R Montreal, Que.

Milling Machines, Vertical
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto Ont

Monel Metal
International Nickel Co. of Can., Ltd Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal
Northern Electric Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto Ont
Wisconsin Electric Co., Racine, Wis

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nail Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Beckford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can Consolidated Rubber Co., Ltd Montreal, Que.

Packing, Steam
Can Consolidated Rubber Co., Ltd Montreal Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co Kalamazoo Mich
Quaker City Rubber Co., Philadelphia Pa.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patents
Fetherstonhaugh & Co., Ottawa, Ont

Pans, Wet and Dry
Frost Mfg Co Chicago Ill.

Pattern Shop Equipment
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co Ltd Montreal, Q
Fittings, Ltd., Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phonograph Motors
Banfield & Sons, Ltd., W H., Toronto

Phosphor Tin
Canada Metal Co. Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
American Pipe Bending Machine Co., Boston Mass
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa.

BUYERS' DIRECTORY

Williams Machinery Co., A. R., Toronto

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Crane Ltd., Montreal, Que
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Ltd., Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Aikenhead Hardware Ltd., Toronto, Ont.
Crane Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planer Type

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cowan Co. of Galt, Ltd., Galt, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Ford-Smith Machine Co., Hamilton, Ont.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stall Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Aikenhead Hardware Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal Q.
Canadian SKF Co., Toronto, Ont
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Ford-Smith Machine Co., Hamilton, Ont.
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Aikenhead Hardware Ltd., Toronto, Ont
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Butterfield & Co., Inc., Rock Island, Que
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rheostats
Northern Electric Co., Montreal, Que.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont

Rivets, Chain
Fittings, Ltd., Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Robinson Co., F. B., New Haven, Conn

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Mills
Frost Mfg. Co. Chicago, Ill.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Aikenhead Hardware Ltd., Toronto, Ont
Atkins & Co., Inc., E. C., Indianapolis
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Cowan Co. of Galt, Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Preston Woodworking Machinery Co.,

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Aikenhead Hardware Ltd., Toronto, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Banfield & Sons, Ltd, W. H., Toronto, Ont.
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Aikenhead Hardware Ltd., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Wood and Machine

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,
Williams Machinery & Supply Co., A. R., Montreal, Que.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Roelefson Machine & Tool Co., Toronto,
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stall Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Banfield & Sons, Ltd., W.H., Toronto
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stall Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Ford-Smith Machine Co., Ltd., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
National Acme Co., Cleveland, Ohio

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Ford-Smith Machine Co., Hamilton, Ont

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto
Can. Consolidated Rubber Co., Rubber Machinery Shops, Kitchener, Ont.
Crescent Machine Co., Ltd., Montreal, Q
Ford-Smith Machine Co., Hamilton, Ont
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio

Specialties, Swaged and Headed Wire
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Spring-making Machinery
Sleeper & Hartley, Inc., Worcester, Mass

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

BUYERS' DIRECTORY

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Banfield & Sons, Ltd, W. H., Toronto, Ont.
[illegible] Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Fisher Motor Co., Ltd., Orillia, Ont.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
[illegible] Company, Wallace, Hamilton.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
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Union Drawn Steel Co., Hamilton, Ont.

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British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

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United Alloy Steel Corp., Canton, Ohio

Steels, Alloy and Carbon
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Atkins & Co., Ltd., Wm., Sheffield, Eng.
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Pilot Steel & Tool Co., Montreal, Que.
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Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
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British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
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Steel, Magnet
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Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

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Galt Machine Screw Co., Galt, Ont.

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Can Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que

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Alkenhead Hardware Ltd., Toronto, Ont.
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

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Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Preston & Schwartz, Ltd., Galt, Ont.

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Cunningham Co., R. H. Walkerville, Ont.
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Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

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Gisholt Machine Co., Madison, Wis.
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Williams & Co., J. H., Brooklyn, N.Y.

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Wright Mfg. Co., Lisbon, Ohio

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Gisholt Machine Co., Madison, Wis.
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Turrets, Tool Post
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McDougall Co., Ltd., R. Galt, Ont.

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Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

List of Directory of Dealers will be found above Advertising Index

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THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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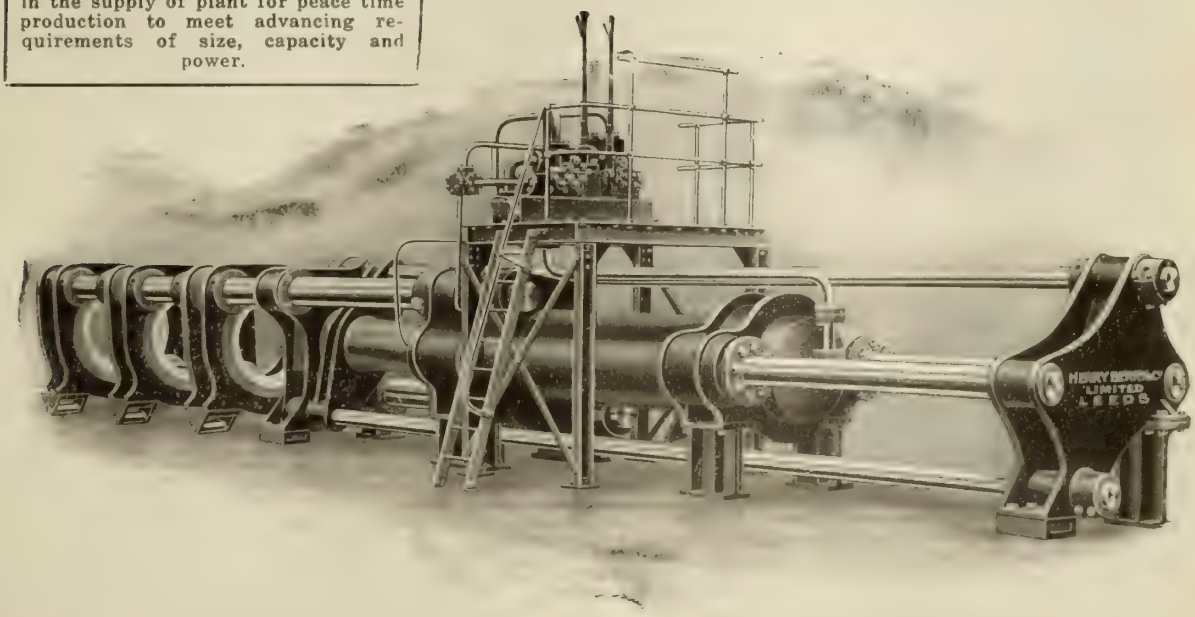
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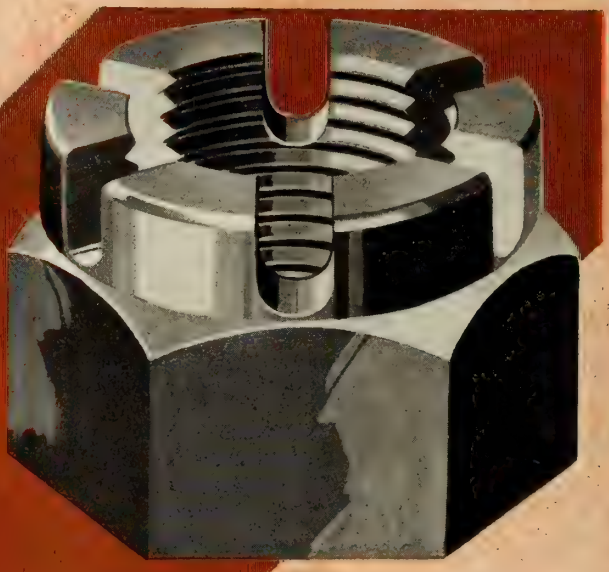
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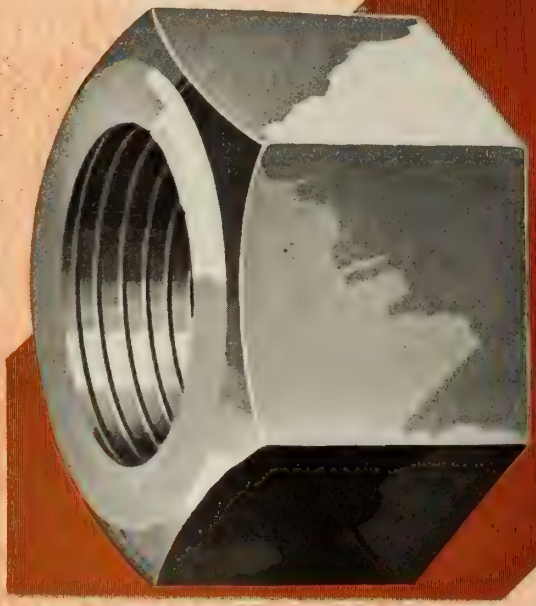
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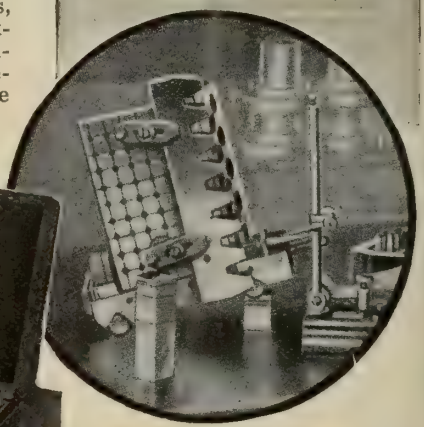
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The BERTRAM Page

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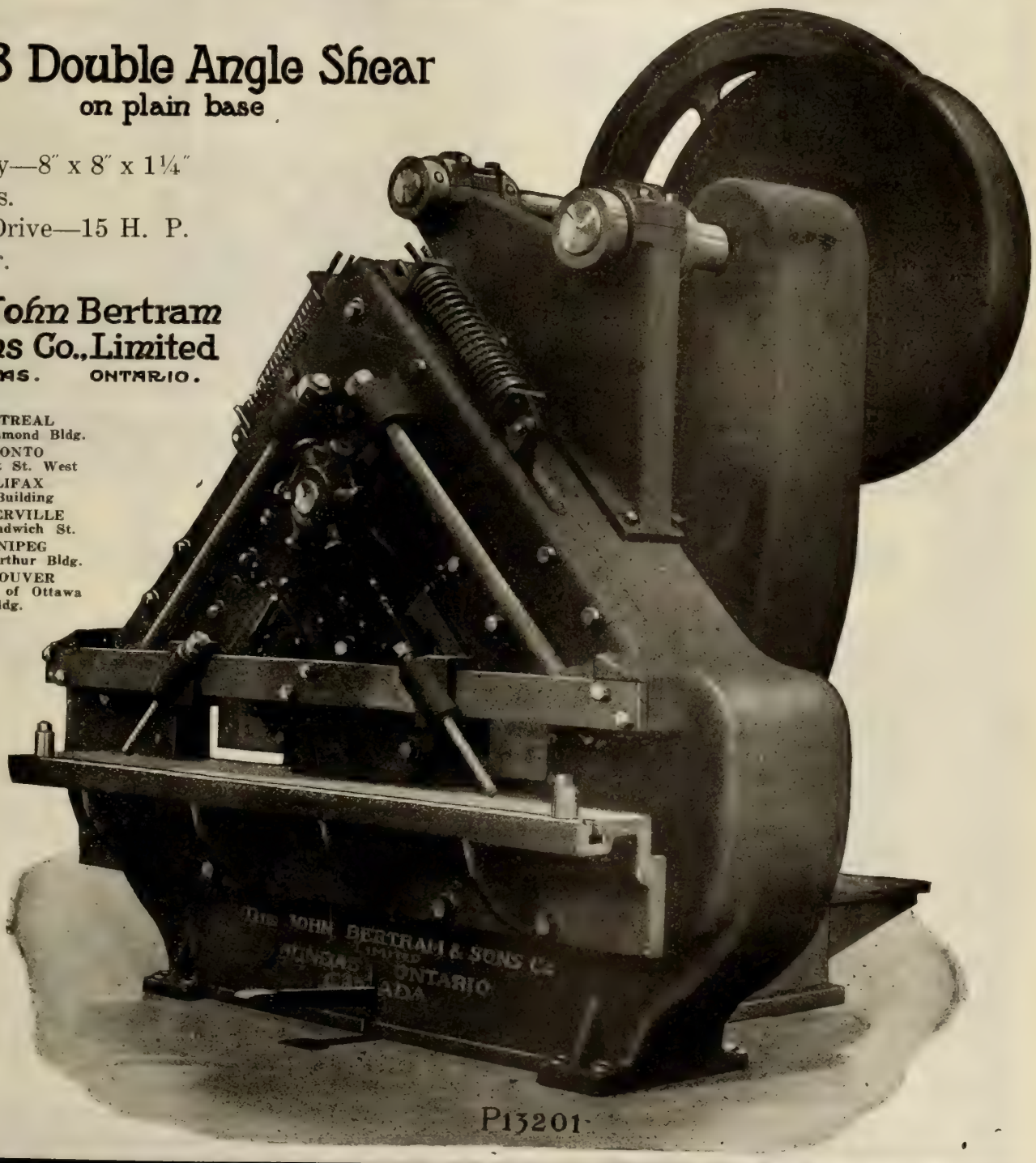
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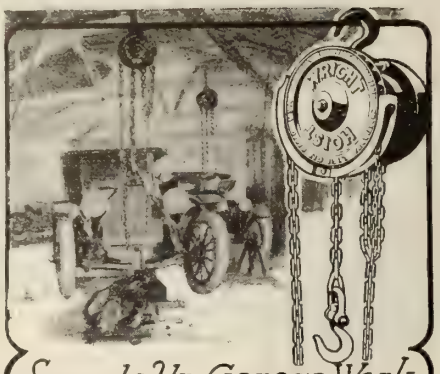
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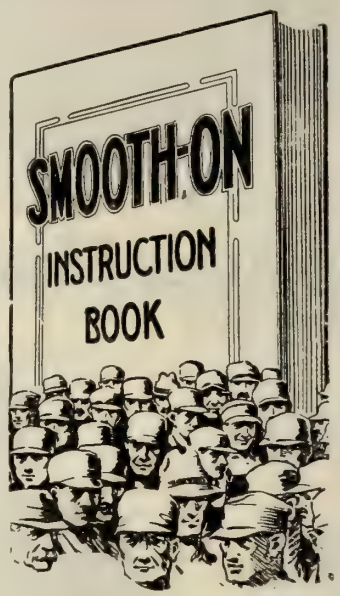
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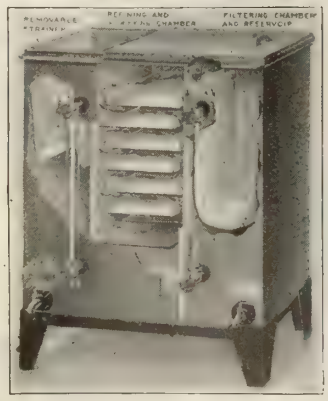
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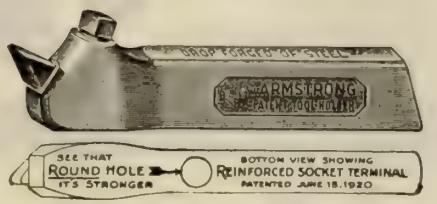
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Everlastingly Good



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"THE TOOL HOLDER PEOPLE"
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Buy Harris Heavy Pressure for all-round machinery work, and you get

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The first cost may be more, but **THE LONG RUN** makes the value, and, if combined with no trouble, the profits are accumulative. Buy your Babbitt from Life-Long Babbitt Men, and get

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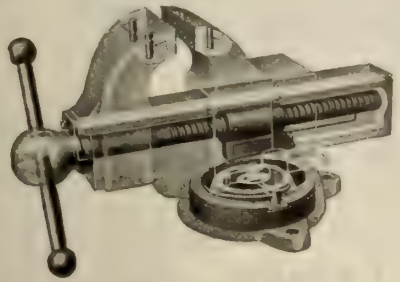
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Handle slides easily, yet stays put at any point. This has been a Parker feature for years. Also Removable Steel Jaws pinned from the top. Solid steel strengthening bar cast inside the slide. Extra strong saddle and under portion, and many other practical points.



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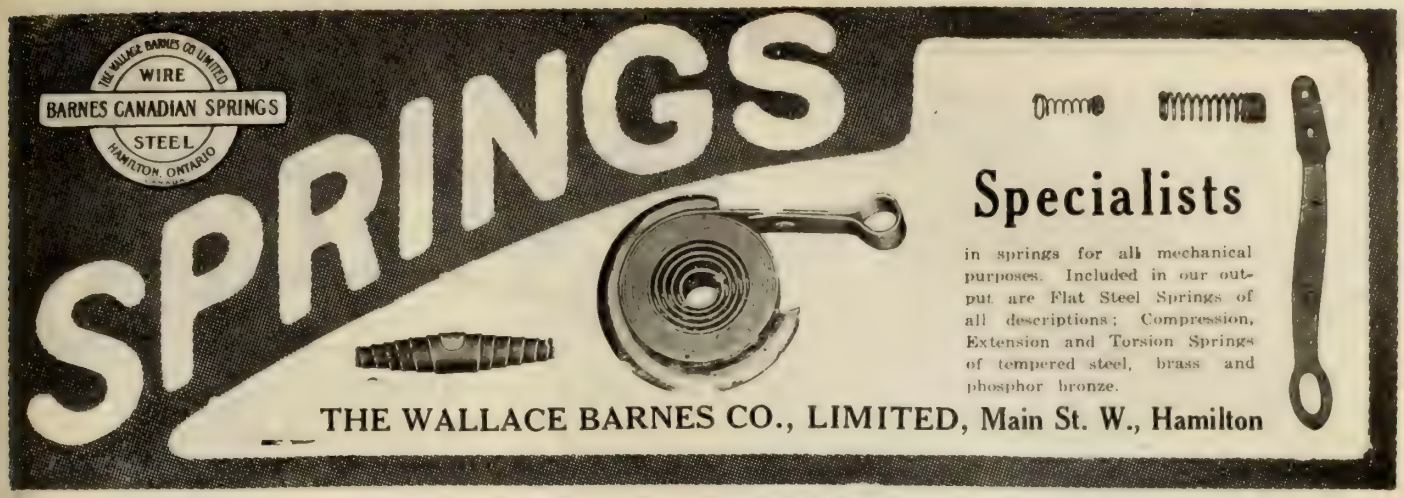


HEADS RIVETS COLD

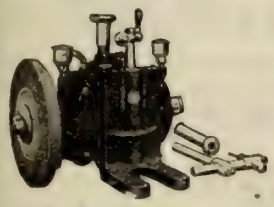
Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
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And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.
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Send us sample assembly parts with rivets or sketch of your work,
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Let us shoulder your riveting problems.
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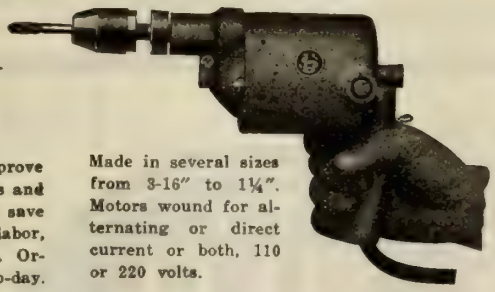
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Friction Clutches From Stock

Johnson Clutches, both single and double, can now be obtained from stock in our standard slow speed type to fit all common shaft diameters and all standard pulley bores, within the range of light and medium horse powers that we cover.

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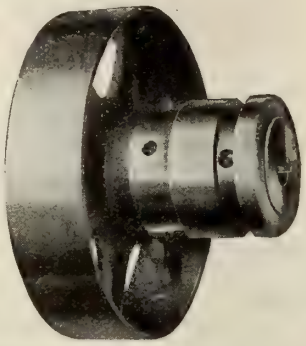
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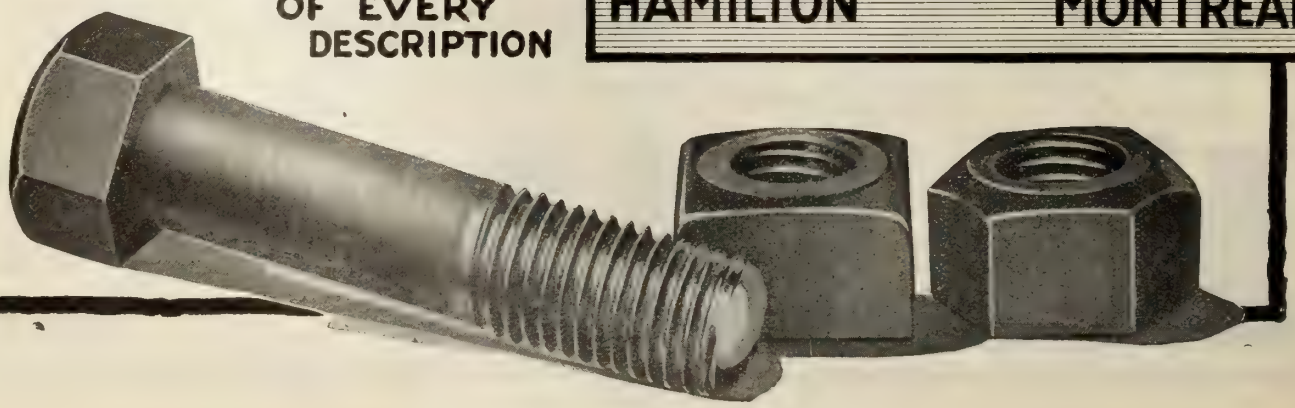
HAMILTON MONTREAL

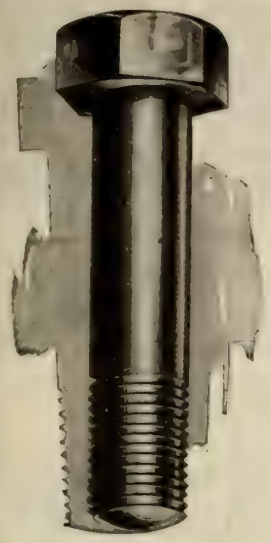
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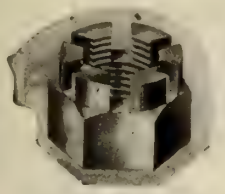




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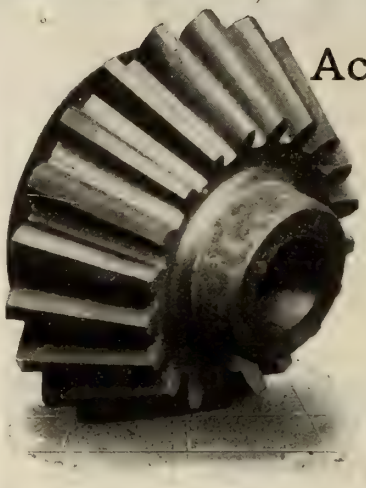
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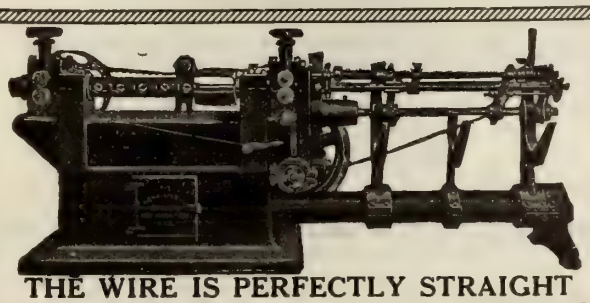


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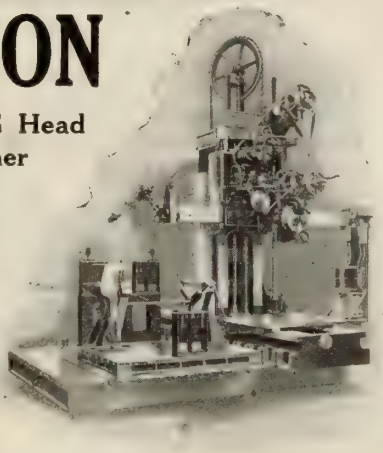
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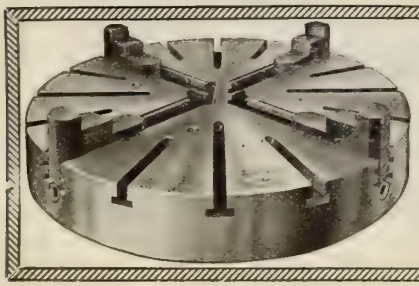
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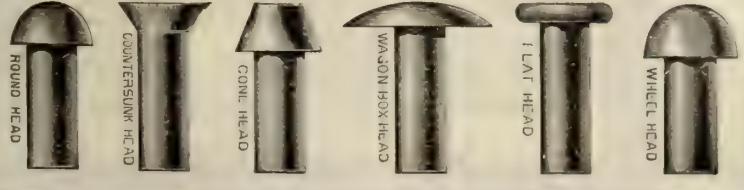
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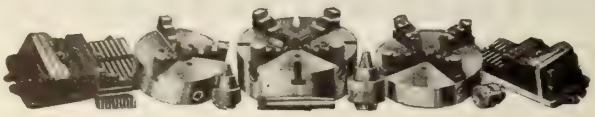
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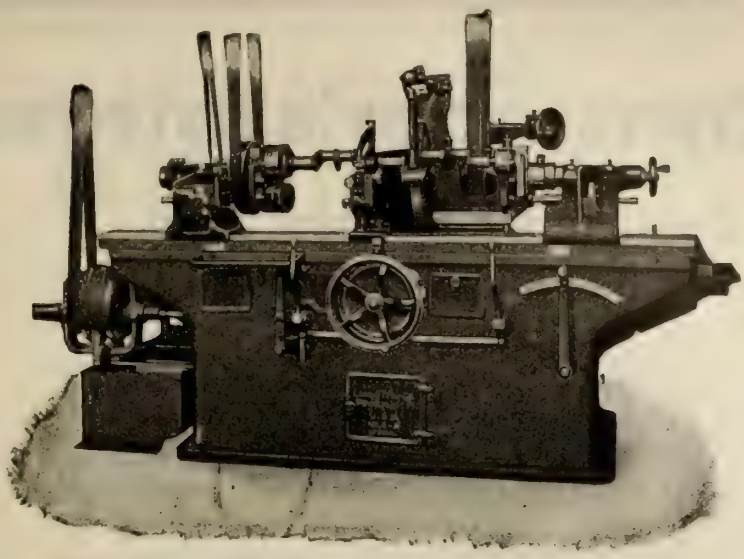
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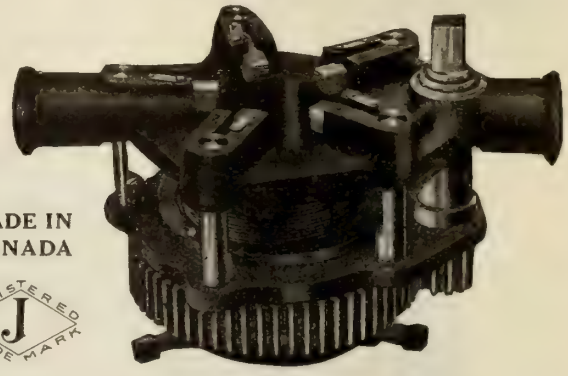
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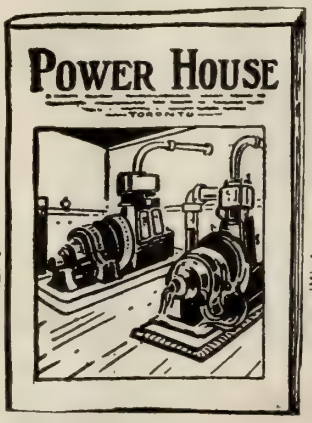
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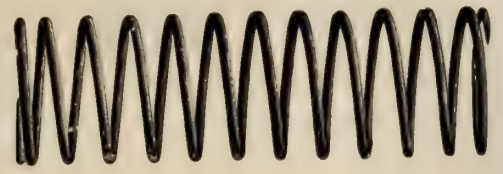
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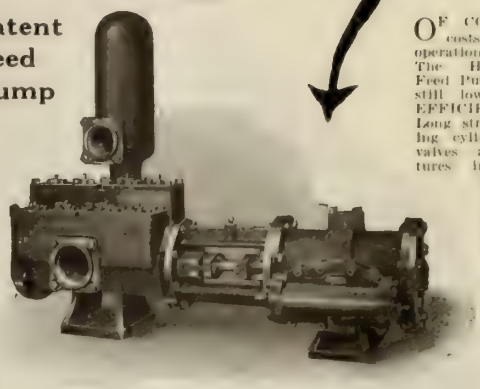
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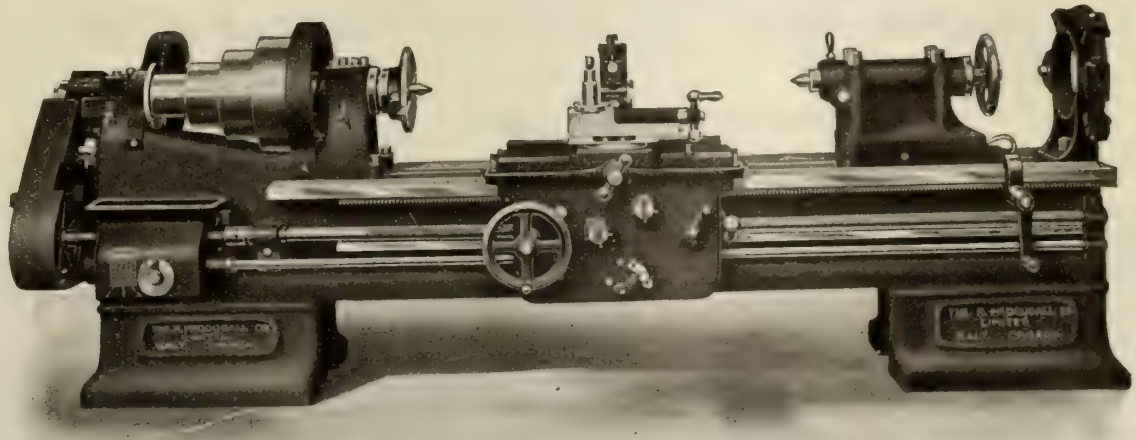
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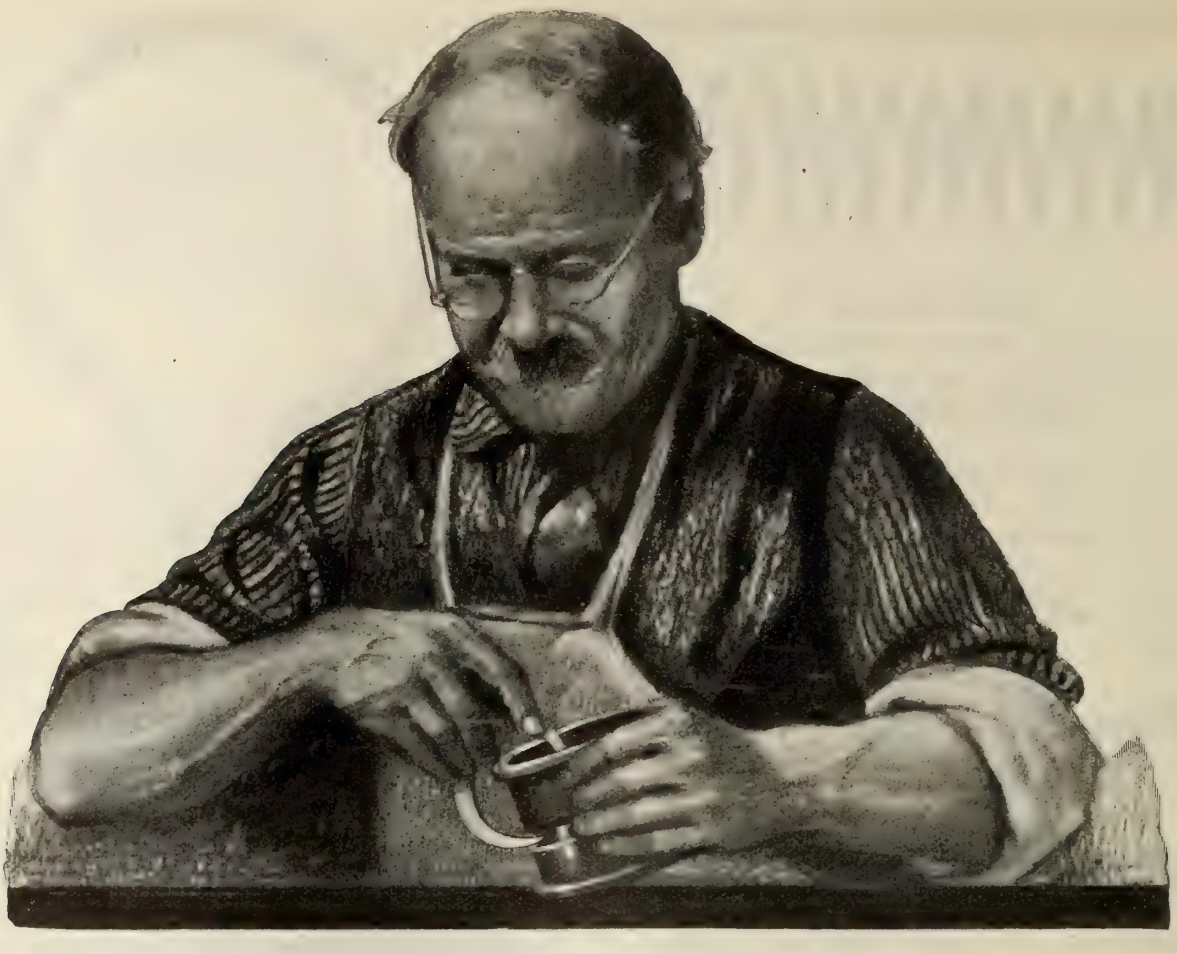
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII, No. 13 MARCH 30, 1922

Protect Your Cutting Tool Investment

Suitable Racks and Storage Facilities Should be Provided—Workmen Should Recognize Need of Careful Handling—Speed and Feed Important—Ample Chip Clearance Should be Provided

By H. ALTON

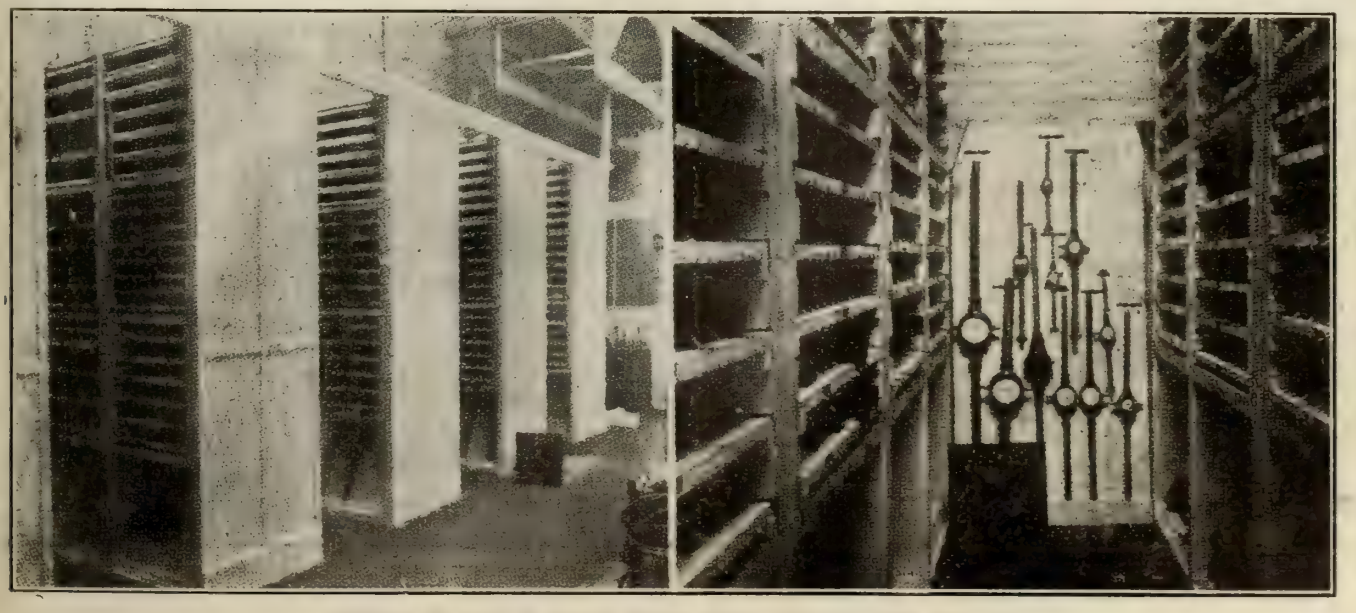
THE MANNER in which edged tools are cared for is so important that the success of a shop can almost be judged by the extent to which this factor enters into the administration of its affairs. Even the small repair shop employing a few men, has its tool problems, although in many instances it does not realize it. Then we can jump to the other extreme and consider the highly specialized modern shop manufacturing, on an interchangeable plan, thousands of similar articles. Here tools occupy the attention of a highly specialized department. In a nutshell every machine shop has a certain number of tools, and as they represent an investment, upon which returns must be made, they must be cared for not only while they are actually doing work on a machine, but also during idle periods.

Small Shop Practices

Many small shop foremen do not give the tool problem the attention it deserves. Take the shop where a general line of repair work is done. Here one usually finds in general use on the lathes, shapers and planers, a fair number of tool holders. Somewhere in the shop you will find a few bars of hardened carbon tool steel ⅜ in., ½ in. and ⅝ in. square, with an occasional odd bar of high speed steel. Probably the practice in the shop, is that when a man has completed a job on a machine he removes the tool bits from the tool holder and places them in his private tool box, considering them his own property. The reason that this practice is so common in this type of shop, is probably because each man grinds his own tool bits and believes that the clearance and rake angles that he places thereon, being largely guided by the "feel" of the tool against the wheel, and the "look" of it afterward, are especially adapted to removing metal, and he further feels these tools should be set up by himself. The interesting feature of this practice is the almost universal distrust of tools ground by the "other fellow." Thus in a general way these tool problems take care of themselves.

Use and Abuse of Twist Drills

From the lathe and the planer, let us go over to the drilling machine. There are many examples of thoroughness shown in the care meted out to drills in the small shop, but then, we too often run across gross carelessness. Some examples of the latter may be seen in the miscellaneous collection of twist drills, from ⅛ in. diameter up to 1 in. or larger on a shelf or in a box without any attempt being made to preserve the cutting edges or to arrange them as to size. In examining the drills we discover most of them to be carbon steel with an odd one or two high speed drills here and there. Every time a drill is selected, dozens of drills must be handled and finally when the correct size is found the dozen or two drills not required are carelessly tossed back. This treatment is disastrous to cutting edges. Sizes become obliterated, and then time is lost in determining proper sizes. It is also bad practice to place the point of a revolving drill against a piece of work and neglect to start the feed. If the work happens to be cast iron, from which the scale has not been removed, the effect is even worse. Loose chucks that permit the drill to drop out at unexpected moments are also a menace to cutting edges in two ways; the first, that the falling drill



Showing the value of making suitable storage racks for tools, dies, etc.

coming in contact with a hard substance has its point and cutting edges damaged. and second, a mechanic who will put to work a chuck that functions so indifferently will not usually have any scruples which would prevent him from applying a steel hammer to the nose of the drill in an effort to force it far enough into the spindle to bind. Then too, the writer could never understand the line of reasoning that prompted shop men to purchase small letter and number sizes of drills, whose diameters were expressed in thousandths of an inch, and larger drills in 1/64 of an inch dimensions and then allow any of his employees to sharpen these drills on a plain emery wheel. Angles of clearance are not maintained and often a half inch drill will make a 17/32 in. diameter hole after such grinding. All these factors have a very direct bearing on the life of the cutting edges.

Drilling Grey Cast Iron

In many cases, when drilling in grey cast iron, no lubricant is necessary for the drill. In fact drills usually perform to much better advantage when no lubricant is applied. When a drill has a proper edge, the clearance angle is correct, the speed and feed are reasonable, and one readily recognizes the characteristic chips that are produced. They remind one of the chips produced by a very sharp wood bit boring a hole in a piece of soft pine. Of course, as the drill goes deeper into the metal the chips produced are forced up through the spiral flutes of the drill and are more or less broken up. Sometimes in certain lines of work the chips clog and cause the drill to heat. This condition of affairs is usually automatically announced by the "squeaking" of the drill. The dust present in cast iron chips works in between the full diameter of the drill and the sides of the hole. When this occurs the hole is usually found to have a ragged appearance and is more or less enlarged and out of round. Lubricants will not remedy such a condition but rather tend to aggravate it. It is necessary to nip this trouble in the bud, and when drilling deep holes in cast iron, if your drill is vertical, always withdraw the drill from the hole and clean it out as soon as it is noticed that chips appear to come from the hole less freely than they did in the first inch or so of the drilling, and do this as frequently thereafter as judgment suggests. When short drills are used it is practically impossible to sink the drill below the flutes which provide chip clearance. Results are always unsatisfactory when this is done.

Drills may be driven at too great a speed. This form of abuse is sometimes present in production shops and is frequently found in contract work shops. The following is an incident that is enacted daily. A mechanic goes to the radial drill and wants to drill a couple of tapping holes for a one inch tap. He finds the back gear out and the belt on the cones in such a manner as to give next to the highest speed. (The man that preceded him was using a quarter inch drill.) Now as the holes that are to be drilled are only in grey cast iron through a flange about one inch thick, the drill is placed in the chuck and spindle and the power applied. In nine cases out of ten the drill is a carbon drill and its "temper" is drawn. In contract shops carbon drills are usually more in evidence than high speed drills. These shops, of course, have in stock a good range of high speed drills but these drills are always kept under much closer supervision in the tool stores. Hence in emergency jobs of a petty nature carbon drills are abused. From their very nature, high speed drills can take care of more rough usage without undue injury, than carbon drills. But we cannot evade the fact that hardened steel is necessarily brittle and undue rough handling does not in any way add to the life or to the usefulness and efficiency of a drill.

Twist Drills in Steel

The drilling of holes in steel does not vary fundamentally from the drilling of cast iron. In steel, however, lubricants are essential. The general practice is to use more high speed drills in steel than in cast iron. The chips produced by a properly ground drill working in steel, also have characteristics that are easily recognized. The chips appear in long curly pieces, and generally speaking, the hole in steel is cleared of chips automatically to much better advantage than in cast iron, as there is absent the large quantity of dust-like chips. Properly ground drills will maintain their edges in steel for a remarkably long period, if driven at proper speeds, given reasonable feeds, and supplied with a proper lubricant in sufficient quantities at the proper place, which is the cutting edge. Lard oil forms the base of most of these cutting lubricants. In fact a large majority of the soluble oils on the market today are substitutes for lard oil and have a certain percentage of it in their make-up.

Drilling Holes in Plates

A punch is not always available and it is sometimes necessary to drill holes in sheets or plates. It is often hard to clamp such material securely under a drill. When breaking through, if there is any lost motion in the spindle, the drill will in all probability be broken, if it is of a small diameter. Blocks of hard wood should be placed under the plate at the point where the hole is to be drilled, and then the feed should be finally made by hand. It is a good practice to keep all lost motion of drill spindles and to be careful at all times when the drill is "breaking through" whether drilling in cast iron or steel. On the old general purpose radial drill when the head is out at the end of the arm even if the lost motion of the spindle is negligible, there is enough spring to make "breaking through" disastrous to small diameter drills.

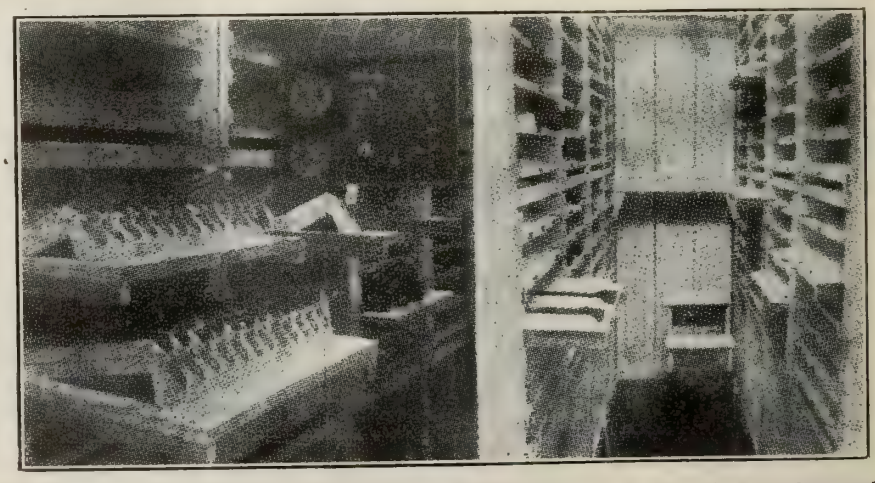
Clamping Drill Work

Better results from drilling are always obtained when work is firmly clamped. In production work jigs and fixtures are usually provided which permit the work to be securely held. It is in the case of the small odd job that clamping is neglected and trouble arises. If a piece is held in the hand and the drilling started, more often than not, the piece is torn from the hand and spins under the drill scattering odds and ends of loose pieces all over. Clamping should never be neglected as many drills are broken and many more have their cutting edges ruined through this cause.

Drilling Non-Ferrous Metals

Now and again there crops up a job that necessitates the drilling of a hole in copper, babbit metal, lead, etc. In most cases drills ground to do good work in iron and steel do not perform satisfactorily, no matter how keen their edges may be in non-ferrous metals. Brass is about the only exception. Iron and steel-working tools usually perform satisfactorily in brass and can be operated with no ill effects at very much higher speeds.

Returning to copper, it is not usually economical to grind a drill especially for this work and generally we worry along with a drill ground for operating in iron and steel. Some mechanics recommend turpentine as a cutting lubricant. Some advise other practice. The writer has found that when a drill is ground with little clearance and an attempt made to



It is often a good plan to arrange tool shelves so that they slide out as shown in both photographs.

give excessive rake that good results in copper can be obtained without any lubricant and at no mean rates of feed and speed. Babbitt metal presents many difficulties owing to its nature. It is difficult to clear chips from anything but a shallow hole if a twist drill is used. If the hole required does not need to be drilled to extremely close dimension use a flat drill.

Taps and Dies

Taps should be used much the same as drills. They should be used dry in cast iron and with lubricant in steel. Owing to the design of a tap it should have complete protection at all times as its cutting edges are easily ruined. As soon as the land of a tap is ground off it is impossible to maintain its size and its usefulness is ended. Hand dies have their cutting edges more or less protected by their design, but careless use of dies has its bad effects. Dies in a die head on a bolt cutter or pipe threading machine usually receive a fair amount of consideration.

Solid Lathe and Planer Tools

Every shop has an accumulation of solid lathe and planer tools. It is an unfortunate fact that you will often find these tools scattered under the various machines, or mixed up with plates and straps in boxes, cabinet legs or in miscellaneous cupboards. It is difficult to explain why such tools, which often represent quite an investment, are not given better treatment. Their cutting edges yield to harsh usage in the same manner as do more delicately designed tools. A little care in placing these tools out of harm's way when a job is completed would save many a little slip of the cutting edge. The time consumed in grinding a new edge on the tool before it can be used again, and also the time spent in looking up a tool carelessly put away, are luxuries too expensive to be enjoyed under present conditions.

Milling Cutters

The milling cutter is an expensive tool to make, and considering its design, it is one that stands for a great deal of hard usage. Not only are milling cutters expensive from a point of view of first cost, but also when a milling cutter becomes dull it is an expensive item to sharpen it, if all items are considered. True it is, that modern milling cutter grinding machines make the job a short one. But these grinding machines are not only expensive, but there is the difficulty of keeping these machines busy and usually the carrying charges to be borne, per sharpening, are heavy. A milling machine operator who thoroughly understands how to get the most out of his cutters between grinding is a real craftsman. When roughing jobs are to be done, in no case should a high grade finishing cutter be employed. Speeds should be studied, and feeds understood. Work should be properly clamped and all necessary parts locked in place. A good supply of cutting lubricant should be distributed over the entire surface of the cutter. In all cases of side and face mills a copious flow must be maintained or else several streams of liquid provided. Chatter should in all cases be eliminated, as it is disastrous to the finely ground milling cutter. Every support should be given the arbor, bearings should be properly maintained and work fed at proper speeds. A cutter should not be backed over work. The table should always be lowered a trifle so that the work can pass freely under the revolving cutter.

The application of the milling principle has been made to large machines for railroad and heavy manufacturing work. Slab millers and large facing machines employ huge milling cutters with inserted teeth. The centres of these cutters are not high speed tool steel but are often made of carbon tool steel, or high carbon forged steel. They are not hardened. The sharpening of the large milling cutters is an expensive process. However, the relatively large number of teeth and the comparatively slow cutting speed enable the cutters to remove a large quantity of metal between grindings. No specific instructions can be cited as applicable to this type of cutter. Care and common sense will provide the necessary measures for preserving the edges.

Hack Saw Blades

The humble little hack saw blade always comes in for an unusual amount of abuse. The hand power saws never wear out, they are always broken, when just in their prime. By the use of mere words it is difficult to convey the idea of the methods that it is necessary to practise if the life of the hand saw is to be extended. The saw blade must be guided straight and not allowed to bind. Even pressure must be maintained on the cutting strokes and the operator of the saw must keep his eye on his work. In the case of the power hack saw, the blades get a better opportunity to do useful work over a longer period. But even here it is often noticed that blades are minus an odd tooth or so which greatly cuts down the speed of cutting.

The File

The file is an edged tool. The point of each tooth on it is as beautifully sharp as the edge of a good chisel. If the tool is carelessly handled some of these teeth are broken, with the result that the next time the file is used it seems dull or makes furrows or ridges in the work. Do not throw files carelessly into a drawer with cold chisels, hammers, and other hard objects. It is bad practice to leave files lying around on the bench or lathe where they are quite apt to be swept on the floor and broken. Hardened steel is necessarily brittle and all files are as highly tempered as is practical. Files kept in a damp place will rust and rust will ruin the best tooth ever cut on a file. A good mechanic will not use a file for any other job than that for which it was intended. The expression that "it is only a file" is often made use of to justify the abuse of the tool. Many shops that appreciate the value of a file provide racks for them when they are not in use.

Conclusion

The whole problem of how tool edges become damaged can be boiled down to the statement that damage is caused by the carelessness or ignorance of the mechanic, and shop owner. A good mechanic will always give consideration to his tools and when a job is finished he will put them away carefully. A good shop owner will provide good tools, choose competent and trustworthy men to use them and provide good tool storing facilities for the tools when they are not in use. He will see that the storage bins and racks are not in a damp place and that the room is heated in winter. All tools that are put away for long periods of time will be greased. A systematic record of the tools in store would be kept and any tool required could be located without loss of time.

NEW SCHOOL TO BE OPENED IN SEPTEMBER

EVENING industrial classes were organized in Sarnia in the fall of 1919. About the same time a campaign was begun with the object of passing a by-law to provide funds for the erection of a combined collegiate and technical school. This campaign was successful and the new school is now nearing completion. It will be opened in September. We believe it will be the most complete school of its size in the Province, and the total cost of building, grounds and equipment will approximate $7,000,000. The grounds comprise about 7¾ acres in the heart of the city.

During the past three winters evening classes have been conducted in the following subjects, mechanical drawing, architectural drawing, shop mathematics, auto mechanics, stationary engineering, marine engineering, masters' and mates' course, arithmetic, English, wireless, woodwork, bookkeeping, stenography, typewriting, art, French, Spanish, cooking, home nursing, fancywork, plain sewing, dressmaking, millinery, industrial physics and chemistry. The attendance has been very satisfactory in these classes considering the inferior accommodation which we have had at our disposal. With the opening of the new school the conditions will be ideal. The attendance at its highest point was nearly seven hundred.

The new school has all modern appointments. One wing is entirely devoted to technical work. There are two gymnasia, swimming pool, showers, large auditorium, fine art, science and commercial rooms. The school has a capacity of about eleven hundred students. The attendance at the institute has been growing very rapidly and is now about 540. These students will be transferred to the new school in the Fall and, in addition, the technical branch will be opened.

Getting Orders out of Unsuspected Territory

Untrained Salesmen Put This Idea Across and Brought in Good Business—Confined Their Effort to Local Field and in Two Days Proved Value of Plan

By J. H. MOORE

ENTHUSIASM and faith are the the two basic and desirable qualifications in any successful organization. Right in Toronto we have a company which can feel justly proud of asserting they have an overflow of both qualities. The firm we refer to, the Ontario Wind Engine and Pump Co., have been good enough to show us the inner workings of their executive staff, and from the managing director down, each employee is behind the company, pushing sales to the best of their ability.

A short time ago, those in charge were forced to admit that business was tapering off. "We must do something to increase sales, and keep the men working," was the predominating thought, so A. T. Thom, managing director, in conference with various members of his staff, decided to start something entirely new in the line of an intensive selling campaign. One suggestion led to another, until eventually a plan was mapped out, which for want of any better name was called the co-operative sales campaign.

The novelty of the idea lay in the fact that specialized salesmen would not be used, and that the field of activity would be the city in which they were located. In other words, an effort would be made to secure new business in Toronto, and at the same time ascertain if they themselves could buy more advantageously in their own locality. This feature made the scheme co-operative.

It was decided to use senior male members of the office staff as salesmen, or rather representatives, for the object was not simply a selling campaign. These men were paired off, and the city was divided into sections, each two men covering a previously arranged territory. It wasn't a case of picking out the chief industries of Toronto as a possible hunting ground, but rather to take a defined area and visit everything that even looked like a factory. The question was never asked, "Can we sell anything in here?" but rather the idea was, "We will go in and see if we can sell anything. If not, they may be able to sell us something." With this objective, they laid their final plans, the managing director, sales manager, collection manager, purchasing agent, etc., all joining in the effort.

In the daily newspapers, there appeared an advertisement as shown in Fig. 1. This explained briefly the object of the scheme, and appealed to the manufacturers in a direct way. The novelty of the idea took hold, and although the heralds of co-operative effort were only out two days, they found more business in that time than they had ever dreamed existed, even in their most enthusiastic moments. As Mr. Sykes, the sales director, put it, "We uncovered undreamt of possibilities, sold goods where we never expected to, and received so many enquiries that we were all swamped with work. In fact when we got back to the office Thursday morning we doubted if we would be able to give the form of service we desired, that is, the best. We felt that the scheme was a failure if we did not render first-class service, so everyone made it a point to give the company the best he had in him.

"The result being," continued Mr. Sykes, "that we have satisfied the prospects uncovered, kept our men employed, and are at present running at about 60 per cent. normal, which is not bad considering present conditions. I always feel a pang when we have to let a man go, and it is a source of keen satisfaction that the sales idea we put across, prevented such a move."

One of the reasons that this sales scheme was such an unqualified success was the careful planning that went before the actual launching of the campaign. For example, every man knew the products thoroughly which his firm had to sell, and he also knew what they required. He went into every plant with an open mind ready to discover articles his plant needed, and in many cases found them. In fact, on one call the representative found the solution of a problem that had been bothering them for some considerable time, and in a most unlooked for place. The owner of the plant visited, received an order he might never otherwise have landed, and the Ontario Wind Engine and Pump Co., were on the other hand mighty pleased to be able to thus place the order and put an end to their former troubles.

Several incidents of this nature occurred, and while they did not actually all solve problems, they did suggest better means of purchasing goods and so on. To make sure that every representative brought back accurate and standardized information the form shown at Fig. 2 was used. This was always filled in while at the plant, so that no one trusted to their memory. The fact that the men traveled in teams gave

To Toronto Manufacturers

Gentlemen:

Although our plant has operated continuously throughout the period of depression, we believe that every manufacturer should do his utmost to relieve the unemployment situation in Toronto. To do so we have developed the following co-operative plan:

On Tuesday or Wednesday of this week a representative of our firm will call on you, regardless of the nature of your product. He will not be a salesman—simply a member of our office staff. His mission will be to ascertain whether you make or could supply any article or material which we use, or if we can supply anything you require.

This is simply a straight business proposition to improve conditions in our own city. It is quite probable that there are firms in Toronto with which we are unacquainted, that could supply us with material or articles we require. It is equally probable that the opposite holds true. By co-operation, therefore, we will both be doing our part in increasing business in the city and relieving unemployment.

As our representatives have a big task before them in covering the city, we would greatly appreciate your making arrangements to have them promptly received when they call. Should our representative, by any mischance, fail to see you, a telephone message will be welcomed and personal attention given.

We manufacture and can supply promptly Grey Iron Castings, Custom Galvanizing, Machine Shop Jobbing, Wood Tanks for all purposes.

A. T. Thom
Managing Director.

Fig. 1.—Showing the style of advertisement which appeared in daily papers.

Canvassers' Questionnaire

Ontario Wind Engine and Pump Company, Limited

City of Toronto Campaign

March 7th and 8th, 1922.

Name of Firm .....
Address .....
Name and position of party interviewed .....
Manufacturers of .....
Interested in what line .....
When next in the market .....
Business conditions and prospects .....
What of their products might interest us .....
General remarks .....
.....
.....
.....
.....
Date ..... Canvasser .....

Fig. 2.—Style of questionnaire used by the canvassers.

them more confidence, and what one man would forget to ask, the other was sure to catch.

The co-operative effort behind the movement gave them a chance to go further than the purchasing agent. They were not solicitors for trade alone, but possible customers, and the general manager in each concern was always pleased to receive them. Problems in manufacturing were discussed frankly, and the results of the campaign can be partially understood when we mention that in one case alone, a casual visit resulted in a $7,500 order. To state in actual figures the result of this sales effort would stagger the most skeptical, but of course this is a private business matter which need not be discussed. Enough to say that all concerned are firmly convinced that it is the best thing they ever started. They are at last catching up with the enquiries which resulted from the campaign, and will soon go out in search of further business. The interest in the scheme was not confined to local manufacturers, for several firms out of town called up by phone to discover further particulars. Several merchants downtown are at present studying the scheme to see whether they can adopt it to their business, and generally speaking, the new effort has started many thinking.

The big idea behind the movement has been "Service." The staff are not content to file away the questionnaires for future reference, but are closely following up every prospect. On the road they have seven men selling their goods, this being only one less than last year, and he quit of his own accord, so that we can readily see that everyone couples his enthusiasm and faith in the products made, by actual sales.

This firm have operated their plant continuously throughout the period of depression, and as Mr. Sykes says, "We're going to keep on doing it." We feel sure that if consistent effort, plus enthusiasm count for anything, they will have no trouble in this respect. The idea contained in this sales story can be carried into other fields, and anyone desiring further particulars will receive it freely from the company already mentioned, as they are fully convinced that the more manufacturers cooperate with each other, the sooner business will reach normal.

THE WORKING OF METALS

"The rolling of metals appears to be complicated by so many variables," said Dr. F. Johnson at a meeting of the Birmingham Metallurgical Society, "that it defies at present a purely theoretical analysis.

"For a given condition of the metal the velocity of flow was proportional to a difference between the actual shearing stress. Therefore a slow rate of rolling would produce lower stresses in the metal than would a fast rate. In cold rolling 90 per cent. of the resistance to rolling was accounted for by roll-neck friction. In the rolling of metal plates and bars there always occurred an amount of lateral spread. A knowledge of the amount of spread for a given material and a given reduction was necessary, because too much spread would over-fill a pass and produce fins, whilst insufficient spreading would result in under-filling of the pass and an imperfect shape.

"One of the greatest factors influencing spreading was the extent and shape of the projected contact area. In rolling rods the splaying of grooves was adopted in order to produce fins of such a shape that by turning the rod through an angle of 90 deg. at the next pass the fins might be pressed back into the rod. No roll grooves were perfectly circular. Even the finishing pass allowed for a slight amount of inevitable side-spread by having the rolls left slightly apart."

LARGEST CIRCULAR SAWS IN THE WORLD

The accompanying illustration shows two of the largest saws ever made for lumbering operations. These were manufactured by Disston & Sons for work on the Pacific Coast. These saws are 9 feet in diameter, each having 190 detachable teeth inserted in the rim, a feature that facilitates repairs. Great care was necessary in the production of the ingots and plates, as the latter had to be exactly flat and true, The rough ingots contained 1,140 lbs. of the steel and the finished disc weighed 795 lbs. The teeth attain a speed of 130 miles an hour



Micrometers Make Standardization Possible

Obtaining Measurement More Accurately—Care Should be Exercised in Making Adjustments—Fine Tools Affected by Change of Temperature—Keep Tools in Cases When Not in Use

NO OTHER instrument has done more to assist the mechanic to make precision measuring a reality than the micrometer. The young machinist or tool maker, just embarking on a shop career, always considers it a red letter day when he becomes the proud possessor of his first "mike," usually the 0 to 1 inch size in an attractive case, with a 1 inch standard disc. The fact of their possession, always lends an air of superiority to the possessor as he strives to create opportunities that necessitate their use.

Going back nearly four generations we find the prototype of to-day's micrometer caliper in a French tool called "Systeme Palmer." It was during a visit to the Paris exposition in 1867 that Messrs. J. A. Brown and Lucian Sharpe were impressed with its possibilities. Earlier in the same year a brass

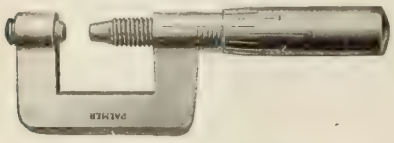


Fig. 1.—"Systeme Palmer."

manufacturing concern in America, encountered trouble when one of its shipments were returned because it was "out of gauge." Of the three U. S. standard gauges then in use, no two agreed. The unfortunate manufacturer conceiving the idea of a measuring tool, sent a sketch to Messrs. Brown and Sharpe for experimental work. The tool was not of practical commercial value as it was difficult to read. The need of a tool, capable of measuring sheet metal accurately and quickly was apparent, and in the same year was produced the "pocket sheet metal gauge" adopting the Palmer system of divisions, and also adding means of compensation for wear of both the screw and measuring surfaces.

Principle of the Micrometer Caliper

One may define the only mechanical principle of a micrometer as a screw free to move in a fixed nut. The backward movement of this screw affords an opening for the work to be measured. The size is indicated by the graduation. Fig. 3 shows a standard design of micrometer caliper. As the frame is stationary, the spindle C, which is attached to the sleeve at E, approaches or recedes from the anvil B, when the sleeve is revolved. The graduations on the hub A, are in a line parallel to the axis of the screw and conform to the pitch of the screw. The bevelled edge of the sleeve D carries graduations which enable reading in one-thousandths of an inch to be taken.

The customary pitch of the screw is 1-40 of an inch. (40 threads to the inch). Thus the distance traversed by the screw or spindle during one complete revolution is 1-40 of an inch or .025 inches. As the graduations on the hub conform to the pitch of the screw (40 to the inch) each division equals .025 inches, and every four divisions represent 0in., .100in. .200 in. etc. (10ths of an inch) each tenth of an inch is numbered 0, 1, 2, etc. The bevelled edge of the sleeve is graduated into twenty-five parts and figured every fifth division 0, 5, 10, 15, 20. When twenty-five of these graduations have passed the horizontal line on the hub, the spindle having made one revolution, has moved .025 inches. Thus when the spindle moves only far enough to cause one graduation to pass the horizontal line on the hub it will have moved 1-25 of .025 inches or .001 inches. The distance between the graduations on the sleeve is great enough to permit half and quarter thousandths to be readily estimated.

To read—first note the last figures visible on the scale of the hub, representing the tenths of an inch. Multiply the number of divisions visible beyond this figure by twenty-five and add the number of the division on the scale on the sleeve that coincides with the graduations on the hub. Then the tenths shown, added to this sum expressed in thousandths, is the reading. Example:—In Fig. 4, .200 inches (2-10 inches) are shown by the figures in the scale on the hub, and one graduation is also visible, while on the bevel on the sleeve the graduations show sixteen divisions from the zero to the line coincident with the horizontal line on the hut Then the reading is .200 in. plus .025 in. plus .016 in. which is .241 in.

Measuring to Ten-Thousandths

To obtain readings in ten-thousandths of an inch a vernier is employed on the hub of the micrometer caliper, as shown in Figs. 5 and 6. The vernier used consists of ten divisions which equal, in overall space, nine divisions on the sleeve. Thus one division on the vernier equals 1-10 of 9-1000 in. equals 9-10,000 in. Since each graduation on the sleeve is 1-100 in. or 10110,000 in. the difference in space between a division on the sleeve and a division on the hub equals 10-10,000 in. minus 9-10,000 in. equals 1-10,000 in. Since the two zero lines on the vernier coincide with lines on the sleeve when the reading is exact with respect to the number of thousandths, the difference between the lines on the sleeve and the lines on the vernier at numbers 1, 2, 3, etc. equals .0001 in., .0002 in., .0003 in., etc. Thus when the first second or third, etc. lines coincide, the sleeve has moved past the exact zero setting 1, 2,

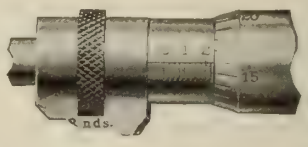


Fig. 4.—Standard graduations for measuring thousandths of an inch.

or 3, etc. ten-thousandths parts of an inch to bring these lines together.

To read—first obtain the reading for the thousandths in the manner described in the preceding section and then add the ten-thousandths, the number of which is indicated by the line on the vernier which coincides with a line on the sleeve. Example:—As shown in Fig. 6 (right) there are no ten thousandths to be added for two zeros on the vernier coincide with lines on the sleeve; the reading is .4690 in. In the lower cut the 7th graduation on the vernier coincides with a line on the sleeve, indicating that 7 ten thousandths should be added to the thousandths reading; the reading is .4690 in. plus .0007 in. which is .4697 in.

The Ratchet Stop

The ratchet stop, as shown in Fig. 8, is convenient for a series of measurements. In using it, it is necessary to move the stop only far enough to furnish two clicks of the racket. This furnishes enough pressure. In other words a short extension of the barrel is furnished. This extension is so arrang-

Cuts and information through the courtesy of Browne & Sharpe Co.

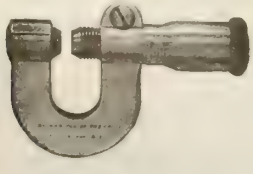


Fig. 2.—Pocket sheet metal gauge.

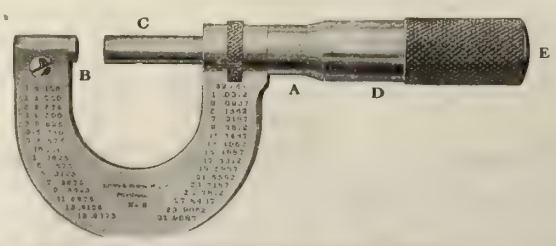


Fig. 3.—Standard micrometer caliper.



Fig. 5.—Standard graduation for ten-thousandths.

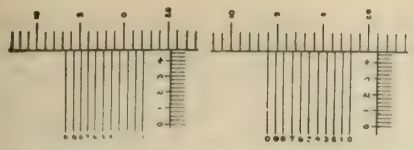


Fig. 6.—Diagram of vernier scale.

ed that it can be made to revolve the barrel, positively in a direction tended to open or increase the distance between the anvil and spindle, and in the opposite direction a ratchet slips when a predetermined pressure on any object to be gauged, is exerted. Without the ratchet stop a micrometer would be closed down on an object with a different pressure every time, which difference in pressure might result in slightly varying results being obtained.

Clamp Ring

The clamp ring as shown in Fig. 9 is a device for clamping the spindle when the desired setting has been obtained. It is useful in calipering similar pieces which are finished to the same size. The knurled ring when turned, causes an inner band through which the micrometer spindle passes, to contract, making its diameter small enough to grip the spindle from all sides and not disturb the setting for the forces all act toward a common centre. An ordinary pressure is sufficient to hold the spindle firmly. In connection with the clamp ring it must be remembered that its construction is such that it will be ruined should the clamp be tightened when the spindle is removed.

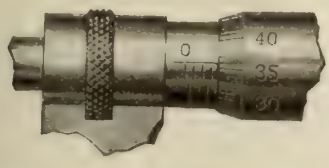


Fig. 7.—Metric graduations.

Adjustments

With ordinary treatment a micrometer caliper can be used for a long time without adjustment. However, in case it should be necessary, means are incorporated in its design for taking up the wear of the screw, and also for correcting the reading when the micrometer is set at zero. Fig. 10 shows the method of taking up wear or play in the screw. The sleeve, with the spindle, is removed and placed where it will be free from dust, preferably on a clean piece of paper. The slots in the tapered nut can be seen, and, using the special wrench furnished with the caliper, turn the nut on the thread which is also tapered. Since that part of the hub containing the threads is split, a very slight turn reduces the diameter of the thread enough to make the screw snug. The cut shows the sleeve removed and the wrench in hand for making the adjustment. The adjustment made, the sleeve should be rolled between the palms of the hands to insure the threads working smoothly. Fig. 11 shows the means of adjusting the zero on the caliper to the correct reading, should the anvil or spindle become worn.

In "trying" for adjustment it is necessary to have the measuring surfaces of the anvil and spindle clean. A good method is to bring these two surfaces together on a clean sheet of paper and then draw out the paper, which the pressure should just permit. Screw A should be turned to the left just enough to assure that the back lash in the screw will be taken up when turned to the right, (advance) for only a slight turn is usually required in bringing up the anvil. The micrometer should then be tried for its zero reading, the measuring surfaces having been first cleaned. If the anvil has not been brought up enough give another very slight turn and repeat by successive movements if necessary, until the zero reading is exactly correct. However, care should be taken not to bring the anvil up too far, for if this is done it is necessary to repeat the entire operation to eliminate back lash. Screw B should not be touched unless it is found impossible to move screw A, and then it should be turned very carefully, for it is apt to turn the anvil when moved. It is merely a binding screw.

Figs. 10 and 11 show the instrument held by a vise with leather faced jaws, and although not necessary, it gives a firm support and the effect from the heat of the hand is greatly reduced. Aside from the vise, only an ordinary screw driver is required. Although adjustments can be made as illustrated above, manufacturers maintain a staff of workmen skilled in this work which they perform under ideal conditions and if at all possible instruments should be returned to the factory for adjustment

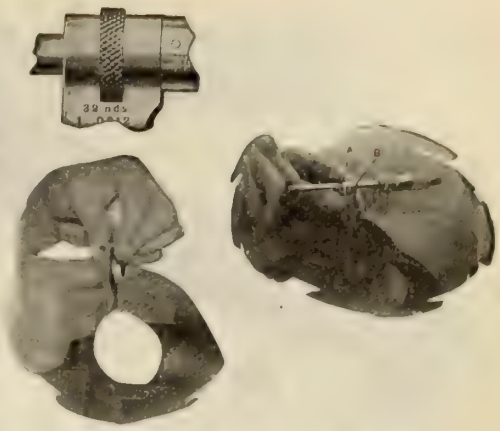


Fig. 9.—(Top left) clamp ring. Fig. 10—Adjusting for wear. Fig. 11—Correcting the zero reading.

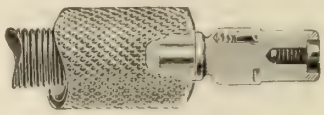
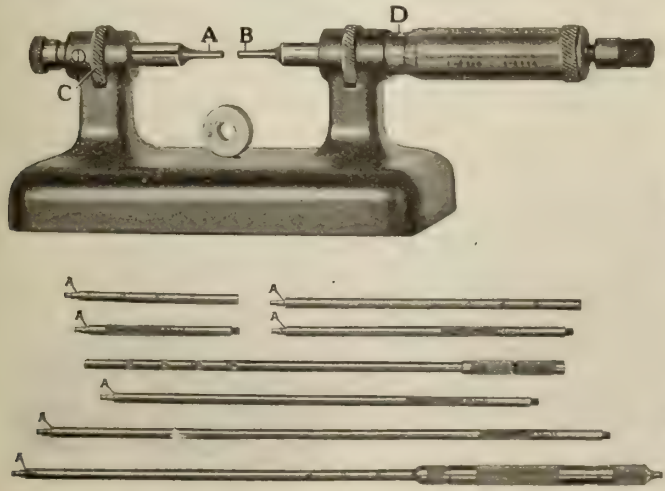
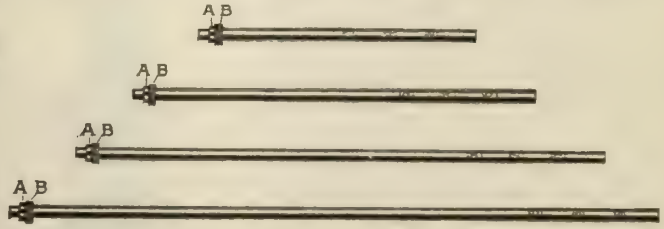


Fig. 8.—The ratchet stop.

Lubrication

In oiling, only the very best quality of a very light oil should be used, and this in a small quantity. Light sewing machine oil, or gun oil is best. It is very unwise to use a heavy oil. The spindle should be removed and the threads cleaned with pure naphtha. When the instrument is dry and free from any traces of naphtha, the oil should be placed on the threads and the spindle then turned back, the oil working into the threads as it returns. A clean tooth pick is very convenient for placing oil on the threads. Before oiling clean the spout of the oil can and shake out a few drops of oil through





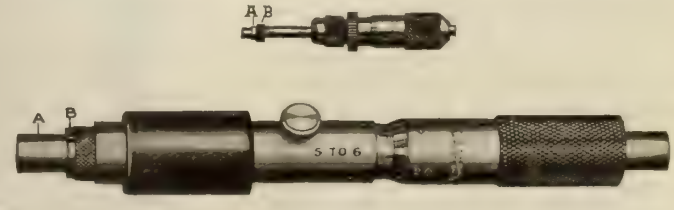


Fig. 12.—Bench micrometer. Fig. 14—Inside micrometer caliper. Fig. 13.—Inside micrometer caliper. Fig. 15.—Tubular inside micrometer caliper.

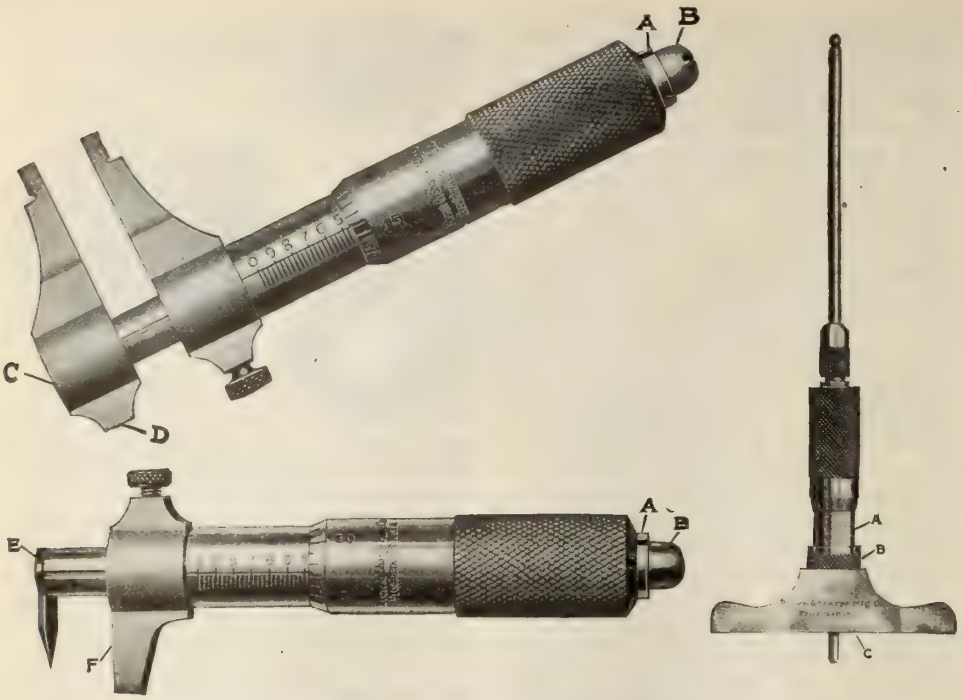


Fig. 16A.—(Top Left)—Jaw type of inside micrometer caliper. Fig. 16B.—(Bottom Left)—Depth-of-gear-tooth micrometer. Fig. 17.—Micrometer depth gauge.

it to remove any dust and dirt, as the oil must be clean.

Care and Use

The satisfaction derived from a micrometer caliper is dependent upon the care and use given it, because it requires but very little maltreatment to throw a high grade precision tool out of adjustment. The micrometer should be taken apart only when absolutely necessary, for any dirt or grit which might enter is very detrimental to its successful operation, and very injurious to the threads. In the grinding it is a very easy matter for emery to find its way into the screw which rapidly reduces its accuracy. There are in addition many other adverse conditions which the instrument must contend with and the user must be careful to protect it as much as possible in all instances.

In measuring, bring the measuring surfaces up to the work to be calipered slowly. Only a light pressure is required for accurate results. If brought up too forcibly an incorrect reading usually results. This is specially true of calipers graduated to ten-thousandths of an inch, and the use of this type of tool should be restricted to fine measurements as wear which would be of comparatively slight consequence in a caliper that reads only to thousandths, is not only perceptible but important in a tool of this class. It is well to remember that the heat of the hand, the cutter, or the work, will make a momentary difference in the reading. To avoid this, the tool should be placed in a spot unaffected by heat until it is required for actual service. In putting the tool away for any length of time, it should be thoroughly cleaned with a first quality of naphtha, and then covered with a coating of oil to prevent rust. If naphtha is used, instrument should be free from all traces of it, before the oil is applied. It is also a very good plan to wrap in oil paper also, as this excludes dust, dampness, etc.

Bench Micrometer Caliper

Fig. 12 illustrates the bench micrometer caliper reading measurements from 0 to slightly over 1 inch. The micrometer principle employed is just the same as in the portable instrument. To obtain readings much the same rules are followed. In calipering distances between 0 and ½ inch, set the caliper at zero and push the anvil A until the measuring surfaces of the anvil A and spindle B just touch. Then tighten the clamp ring C. To obtain readings from ½ to 1 inch set the caliper at zero and fasten by tightening its clamp ring. Push the anvil A back until the standard half inch gauge furnished with the caliper fits in the opening between the measuring points. Then tighten the clamp ring C and make the anvil fast. In measuring with this instrument it is just as important, as with the portable type of micrometer, to have the anvil and spindle clean, and adjustments should be carefully made. The hub D is graduated from 0 to 1 inch and this permits a range greater than 1 inch, using the standard gauge furnished. The adjustments for wear on the screw or thread are made similarly to those on the micrometer caliper.

Inside Micrometers

Fig. 13 shows a standard inside micrometer. As will be noted, rods of various lengths are provided which enables the micrometer to be used on a wide range of dimensions. The rods are easily detachable and any one can be quickly placed in the instrument. The whole inches are obtained from the known

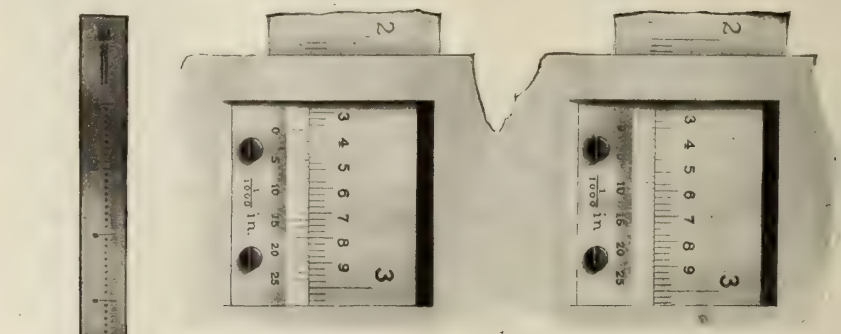


Fig. 19.—Vernier caliper. Fig. 20.—Enlarged view of graduations.



length of the rod inserted, or, expressed in another way, the distance between the measuring points when the instrument is set to zero, is known for each rod inserted and this constitutes the reading in whole inches. The reading in thousandths is obtained by the same method as employed when reading an outside micrometer caliper. The two readings, namely whole inches and thousandths, are added to obtain the complete dimension. Thread and wear adjustments are made as before described.

Adjustment of the zero on the micrometer to the correct reading is made in a slightly different manner than that described in a previous paragraph, as the method applicable to outside micrometers. This is accomplished by adjusting the nut A on each of the rods. With the micrometer set at zero, insert the rod on which it is desired to make an adjustment, and loosen slightly its lock nut B. The measuring surfaces should be clean in making adjustments. Then adjust the nut A until the correct length is obtained and tighten the lock nut B. As in the case of all adjustments to precision instruments great care should be exercised. Also care should be taken in changing or inserting rods, not to force the chuck fingers which hold the rods in the micrometer. If these become worn the instrument should be returned to the factory for repair, as its accuracy cannot then be relied upon.

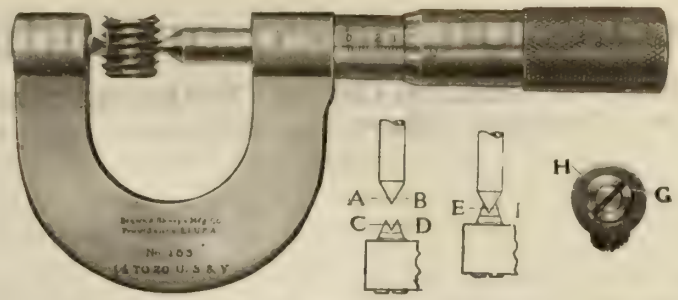


Fig. 18.—Screw thread micrometer caliper.

Fig. 14 illustrates a slightly different design of inside micrometer. It has only a few points wherein it differs from the micrometer shown in Fig. 13. Adjustments are made in like manner to the other types of micrometers just described. Adjustment of the zero reading on the micrometer is made through a different method of adjusting the measuring point A. Care should be taken when using this instrument that the effect of temperature does not cause the reading to be in error. Fig. 15 illustrates the tubular type of inside micrometers.

The readings and adjustments are largely made in the same way that have been previously referred to, except in the case of the adjustment of the zero to the correct reading. Point A is adjustable and is made with a lock nut B. Lock nut B should be loosened and point A adjusted until, with the micrometer set at zero, the correct length is obtained. When the correct position of A has been secured (it may be necessary to make more than one trial) the locknut B should be carefully tightened so as not to disturb the setting. A special wrench furnished with the caliper should be used in making adjustments. With the larger sizes, particular attention should be given to the effect of temperature in making adjustments.

Figs. 16A and 16B show another type of inside micrometer caliper and an adoption of this type to the "depth-of-gear-tooth micrometer." The method of reading these two instruments is also essentially the same as previously described, except for the fact that the graduations are inverted, that is to say that the zero is at the opposite end of the hub. Adjustment of the zero on the caliper to the correct reading is somewhat similar to the methods described. Screw C corresponds to screw A (Fig. 11) and screw D is a binding screw as screw B. This adjustment is not required on the depth of gear tooth micrometer as the surface E on which the scriber point rests, is finished flush with the measuring surface F of the jaw of the micrometer, with the micrometer set at zero.

Micrometer Depth Gauge

Fig. 17 shows the adoption of the micrometer to the depth gauge instrument. Readings in thousandths of an inch are obtained in the usual way. To this must be added, of course, the readings in inches, which is obtained directly from the depth the rod extends below the base when the gauge is set at zero. The graduations on this tool are inverted, or in other words similar to those of the inside micrometer shown in Fig. 16.

Adjustment of the zero on the gauge is accomplished by loosening lock nut B and adjusting the hub A. With the gauge set at zero insert the rod so that the gauge reads from 0 in. to ½ in. Then loosen the lock nut B and turn the hub until the end of the rod is flush with the surface C. Then tighten the lock nut B. As is usual with precision instruments, great care must be taken in making adjustments. In all such instruments where various rods are inserted, the chuck fingers must always be delicately handled, so that these parts do not become worn and destroy the accuracy.

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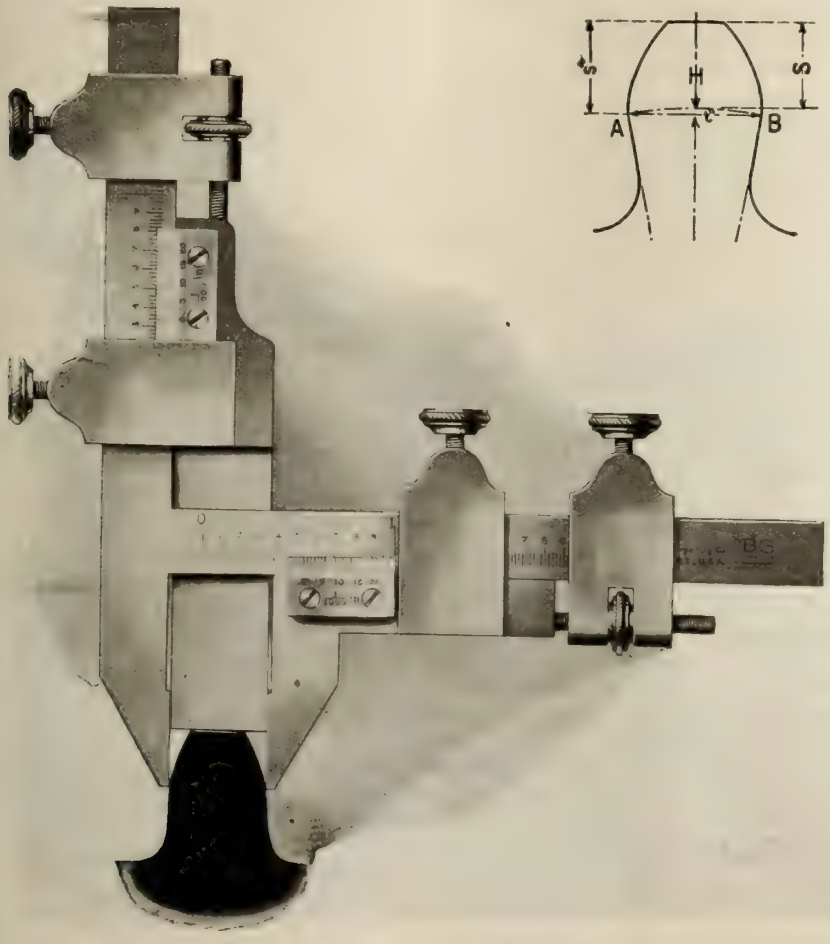


Fig. 21.—Gear tooth verniers. Fig. 22.—(Top)—gear tooth measurement.

Instruction Based on Industrial Needs

Method of Teaching Changes With Requirements—Local Laboratory Students Assisted — Satisfactory Progress Reported—Dearth of Skilled Workers in Trades

By H. W. McCANAIGH, B.A.
Principal Welland High School

WHEN THE industrial evening classes were started here some years ago, it was thought that each class would be a unit in itself and would offer a chance to make up a deficiency in earlier training, to clear up perplexities met in shop or at home, a difficult bit of measuring and figuring, a job of carpentering or plumbing, and, possibly, for women sewing or cooking. There was little, if any, notion of interdependence of classes; the idea that students would proceed from one class to another was scarcely considered; this feature, to the satisfaction of all, has developed and will exercise some influence in fixing the nature of the classes later. There was no great demand at the start for instruction of any particular sort. Some few mild requests were made for "short story writing," or "picture scenarios," but the majority showed a willingness to avail themselves of any means of self improvement. Classes were thus opened in arithmetic and English, mechanical draughting and shop mathematics, industrial chemistry, applied electricity, wood-working, dressmaking and cooking; to these were added special classes in language, teaching English to French and Italian people.

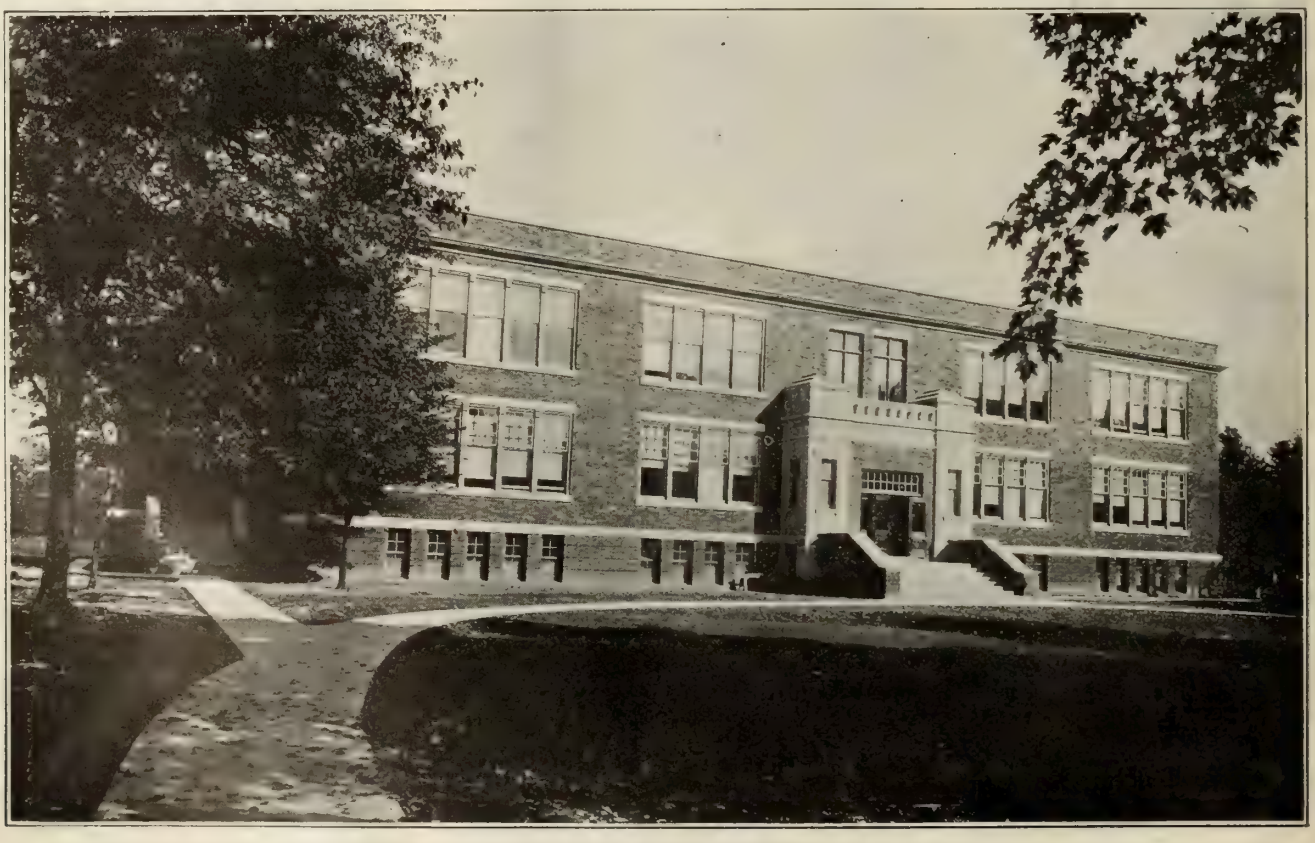
The class in arithmetic and English picks up students at about third or fourth class public school work; they study on from the simple rules through decimals and fractions such as are used on rules in use by mechanics, ½, ¼, ⅛, etc. In English, the speaking and writing of simple sentences is taught; this, of necessity, includes much spelling, some grammer and composition, and a little reading. This class is always well attended and its students show a tendency to proceed in later years to some of the other classes.

Mechanical Draughting

The class in mechanical draughting includes the mathematics required, students of the present class are much more interested in the calculations than in the work of drawing. The idea is to gain an understanding of working-drawings and blue prints. The course in mathematics includes square and cube root, the solution of triangles by geometry and trigonometry, calculating volumes and weights in different materials, steel, grey iron, brass, etc.; the calculation of pulley sizes, speeds of shafts, and gear ratios. In draughting, freehand sketches are made of machine parts, and for more advanced students there is instruction in machine design and structural engineering. Students have the use of drawing-boards, "T" square, triangles and complete and good sets of instruments; these are the property of the school.

The class in industrial chemistry was inaugurated at request of those employed in the laboratories of the local plants. The work consists of an experimental course in elementary chemistry and qualitative analysis of alloy sand salts. The apparatus and laboratory of the high school is used and, though the class is never large, it has been of great service to several students.

The class in applied electricity, intended to benefit those actually employed in electrical work, is in the main practical, but instruction is given in the theory of operating the different electrical machines, omitting, where possible, advanced mathematics and including elementary electricity and magnetism, electric currents, power transmission and distribution, direct and alternating current generators and motors, transformers, commercial measuring instruments, etc.



General View of Welland High School

The laboratory is equipped with generators, motors and other machines, and instruction is given in the method of connecting in circuit and reading the different instruments; the calibration of instruments and making of calibration curves; methods of measuring resistance and obtaining power factor; commercial tests in generators, motors and transformers; location of trouble in apparatus, and its repair.

The class in woodworking has the use of some fifteen benches equipped with the usual bench tools. Some of the students are workers at the trade, some are "handy-men" who aspire to be mechanics, while others engaged in different work wish to become "handy-men" for jobs about home. They are first taught the use of tools and then the making of the various joints. The progress is surprising. Little more than half a course shows completed a model stair-case, a medicine cabinet, bookshelves, cupboards, jardine stands and stools, some of which would be a credit to a tradesman. Strangely, the boys following the trade do not do so well as do others; they look rather to the speedy completion than to the excellence of the job in hand. It would be an advantage to this class to put in some machines, band-saw, lathe, planer, etc. These are in such general use that a knowledge of them is needful.

For the other classes, cooking, dressmaking and the English classes for foreign people there are well equipped rooms with running water, sinks, tables, cupboards, a range and hot plates electrically heated. The sewing room has tables, sewing machines, electric iron for pressing and all needed fittings.

Classes meet twice in the week and continue for two hours; this seems a long time, but many increase it by coming early and staying late. About forty classes make up the year's work, beginning in November and ending about Easter. The instruction is in all classes to a large extent individual; it must be adapted to each student. The instructor must be capable and versatile. The success of the class centers in the instructor even more than in day-school classes.

Experience in these industrial classes makes it very clear that something must be done to make up for the disappearing apprentice system if the old time craftsman is not to be a thing of the past. Many now working at a trade claim only ability to do certain classes and forms of work. The scarcity of skilled workmen will be greater in a few years; the boys are not being trained. One remedy seems to be in a school, industrial, technical, vocational or whatever called, it should train workmen for the trades indigenous to the locality in which it is situated. Too much consideration should not be given to culture or academic studies. Much culture and good citizenship comes uncalled for to the man with a trade: If attention is given to English, mathematics, and the little physics required to support practical work it will be enough.

MICROMETERS MAKE STANDARDIZATION POSSIBLE

(Continued from page 25)

Screw Thread Micrometer Calipers

Fig. 18 shows the type of micrometer used for measuring pitch diameters of screw threads. The measurements represent the distance between two parallel planes AB and CD. These two planes coincide as at EF when the caliper is set at zero. In making adjustments of zero on the caliper to the correct reading the sleeve G is used for the adjustment. The inner screw H holds the anvil in place. The anvil should be cleaned of dust with a camel hair brush before making adjustments. The caliper reads directly, the pitch diameters of all threads within its range. Tables are prepared giving the proper pitch diameters of all threads within its range. Tables are prepared giving the proper pitch diameters of screw threads, and tap threads which are usually used to confirm readings and sizes.

The pitch diameter of a standard V thread is obtained from the following calculation: The diameter of the screw expressed in inches, minus .866 divided by the number of threads per inch. An example of the calculation is herewith shown. Take a seven-eighths screw, nine threads to the inch. Now .866 divided by the number of threads is .866 divided by 9 and is .0962. Now subtract from ⅞, (which is .875), the figure .0962 just obtained, and the result is .7788 inches which is the pitch diameter of a seven eighths thread. For other types of threads the constant .866 varies. The constant for Whitworth threads is .640. Special anvils and spindles can be obtained for special threads.

The Vernier Caliper

The vernier was invented by Pierre Vernier in 1631 and from him is derived its name. It consists of a small scale on which are a certain number of graduations which equal, in combined length, a certain number of graduations, usually one more or less, on the scale of the tool. It is evident that if, in the same extreme length the vernier has divisions greater or less in number by one, than the scale, there is a small difference between a division on the vernier and a division on the scale. Upon the difference between the vernier and the scale divisions depend the readings, for the vernier is attached to one of the measuring parts, and the scale to the other. This was the principle that was employed in 1851 by the founders of the Brown & Sharpe Co., when they introduced their first vernier caliper measuring to the one thousandth part of an inch. This was their first precision measuring instrument. A modern vernier is shown in Fig. 19.

Reading the Vernier

Fig. 20 shows the vernier used with a scale that is graduated into 40ths or .025 of an inch. The vernier has twenty-five divisions which are numbered every fifth division, and which equal in extreme length, 24 divisions on the scale, or 24 x 1-40 inches and is equal to 24 x .025 inches, or .600 inches. Thus one division on the vernier equals 1-25 of .600 inches which equals .024 inches. Therefore the difference between a division on the scale and a division on the vernier is .025 in.. minus .024 in., which is .001 or the one thousandth part of an inch. When the reading is exact with respect to the number of 40ths of an inch, the zero on the vernier coincides with a graduation on the scale—either inch, tenth, or fortieth, as the case may be. This leaves a space between the scale and the 1, 2, 3, 4, 5, 6, etc. respectively, the difference increasing .001 in. at each vernier division in numerical order until at the 25th graduation, the lines again coincide (see upper part Fig. 20.)

Thus when the first, second or third, etc. line on the vernier coincides with a line on the scale, the zero on the vernier has moved one two or three, etc., thousandths of an inch past the previous fortieth graduation to bring these lines together. Again referring to Fig. 20—to read the caliper, first note the inches, tenths and fortieths of an inch that the zero on the vernier has moved from the zero on the scale and to this reading add the number of thousandths indicated by the line on the vernier that corresponds with a line on the scale. Take the example in the upper part of Fig. 20. The zero graduation on the vernier is shown coinciding with a fortieth graduation on the scale. (The second fortieth beyond an even tenth graduation.) This indicates that the reading is exact with respect to the fortieths of an inch. The reading therefore equals 2,000 plus .300 plus .050 which equals 2.350 inches. The lower part of Fig. 20, however, shows the 18th vernier graduation coinciding with a line on the scale. This indicates that .018 inches should be added to the scale reading. The reading would then equal 2.000 plus .300 plus .050 plus .018 which equals 2.368 inches.

Gear Tooth Verniers

The purpose of the gear tooth vernier caliper, as shown in Fig. 21, is to accurately measure the thickness of gear teeth at the pitch line, or the chordal thickness of the teeth. To measure a tooth, first measure the outside diameter of the gear. If this is larger or smaller than the correct diameter of the gear, allowance must be made when setting the caliper for the distance from the top of the tooth to the pitch line, so that the thickness will be measured at the true pitch diameter. The amount to allow when setting the tongue is one half the difference between the correct diameter which the gear should measure and its actual diameter, noting which is the larger and making the allowance accordingly. Then set the tongue to the amount s in. (Fig. 22) for the given pitch, by means of the scale and vernier, using the tables available to ascertain the distance s in. for the pitch and number of teeth in the gear. Care

Speeding up the Gauging of Threaded Work

Accurate Control of Size—Tap Inspection More Effective—Closer Limits of Tolerance—Gauging Tests Made at Reasonable Cost—Fine Adjustment Possible

MACHINING of plain holes and shafts to definite limits of accuracy is, to-day, a regular operation in most engineering works; it is part of the modern system of manufacture by which high quality interchangeable work can be produced on a commercial basis. In the operation of this system the limit gauge is an essential factor; by its use components are finished on machines to limits which ensure that they will assemble correctly, hand work being practically eliminated. The so-called fitter acts purely as an erector or assembler. There are a number of excellent limit gauges by the use of which the sizes of plain shafts and holes can be efficiently controlled but there is a great need of similar facilities in the production of interchangeable threaded work.

It is not yet generally recognized that the principle hitherto employed of judging the fit of a screw in a threaded hole by its feel or amount of shake is fundamentally wrong. A screw or other threaded part must fill two main requirements. First, it must assemble or, in other words, enter the threaded hole in which it is intended to fit; therefore, none of its elements must be too large. Secondly, it must have a pre-determined mechanical strength; therefore the effective diameter—the true measure of the size of a screw—must not be below a certain limit.

The ring gauge in which we can judge the fit of a screw only by the amount of shake is not a reliable limit gauge since it will pass a screw which is of bad form and low mechanical strength. Such a screw may bear only on the major diameter (which is relatively unimportant) and will be apparently a good fit in the ring gauge although its effective

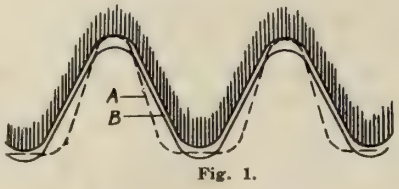


Fig. 1.

diameter is too small. On the other hand a screw which is correct in all elements and commercially perfect may show a certain amount of shake in the ring gauge but will be much stronger than the screw of bad form which shows no shake at all.

Improved Method

To obtain interchangeable threaded work we require a limit gauge system which will ensure not only assemblage but also predetermined mechanical strength in both the screw and the threaded hole in which it fits. The Wickman adjustable thread caliper gauge enables all screws and externally threaded parts to be controlled within any desired limits of accuracy in pitch, effective diameter and incidentally, major and core diameters which are dependent on the effective diameter for their accuracy.

If we can now similarly control the threaded holes we can then produce screws of any predetermined quality and fit which will assemble correctly just as in the case of plain work. It is probable that at least 90 per cent. of all threaded holes are tapped so that a satisfactory limit gauge for controlling taps is an essential factor in the production of interchangeable threaded work. Hitherto there have been no gauging appliances which could be used economically for tap inspection. The projector, the screw diameter measuring machine and the pitch measuring machine are slow and the readings which they give must be finally classified by a skilled man. This will be realized by those who have endeavored to obtain a true indication of the size of a screw from the various readings of effective, major and core diameters, graph of pitch error (making allowance for the effect of pitch error on effective diameter reading) and form of thsead.

The table shown taken from the actual readings of a four-fluted tap, will give some indication of the length of the operation required in determining the accuracy of the tap.

MAJOR DIA.		EFFECTIVE DIA.		CORE DIA.	
1st pair of flutes.	2nd pair of flutes.	1st pair of flutes.	2nd pair of flutes.	1st pair of flutes.	2nd pair of flutes.
008	0075	001	002	006	0055
0085	009	0015	0018	005	0058
009	0085	0023	0027	007	0075
008	010	003	0027	0073	007
0095	009	0027	0029	0075	008
007	0095	0025	0023	008	0078

It will be noted that six readings only were taken on each pair of flutes.

System of Measuring

The major, core and effective diameters were measured on a screw diameter measuring machine; the first was a simple micrometric test; the second necessitated the use of needles and the consequent calculations involving their diameters; the third required special anvils to bed down into the radius at the root of the thread.

Another instrument—a microscopic measuring machine—was brought into use to measure the angle, and the form of thread was obtained by projection. Pitch error was checked on a pitch

Compiled from material obtained through courtesy of the Alfred Herbert, Limited.

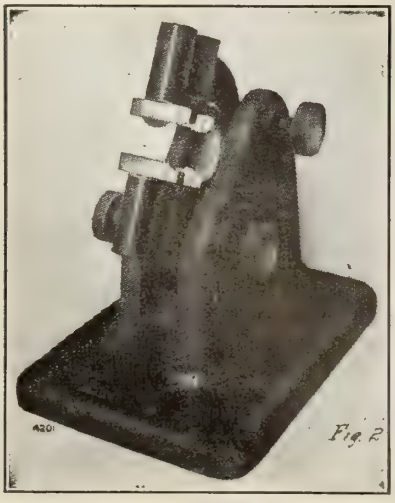
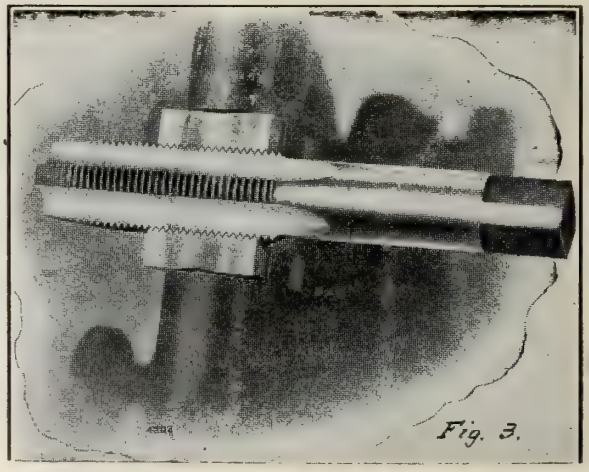


Fig. 2.—Gauging Device.



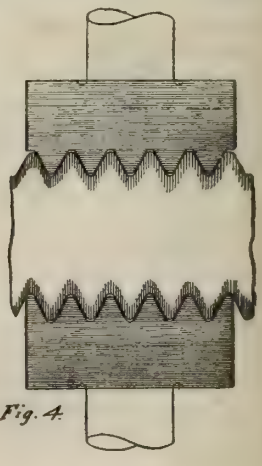


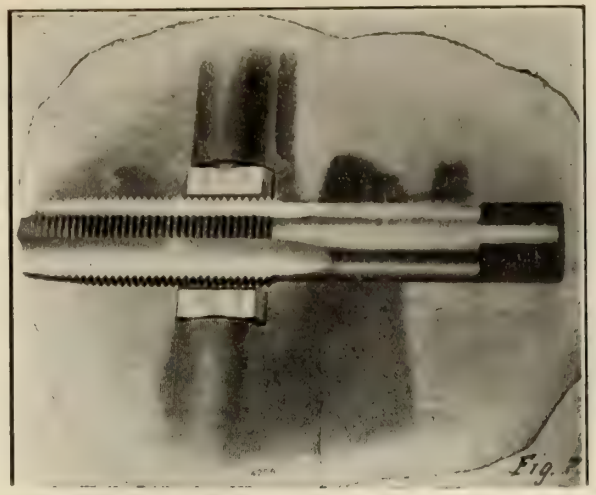
Fig. 3 and 4—Tap passing the full form anvils which are set to maximum effective diameter of tapped hole.

measuring machine and the results from this test plotted on squared paper. After considerable calculations the actual errors in the various elements of the thread on the tap were obtained. The entire test occupied about half an hour of a skilled man's time, the cost, of course, being prohibitive for checking a considerable number of taps. What is required is some form of limit gauge by which every tap used can be quickly inspected and which will reject all those in which any element is either above or below some predetermined limit.

Checking Dimensions

The gauge here described has been developed for this purpose. As shown by Fig. 2, it consists of two limit gauges; the first, which is a "go" and "not go" gauge, controls the pitch and effective diameters; the second, "not go" only, ensures that neither the major nor core diameter of the tap is too small. The operation of the gauge is as follows:—the outside or "go" anvils of the first gauge, which are full form, are set to the maximum effective diameter. No element of a tap which passes through these anvils as shown in Figs. 3 and 4 can be too large. The inside or "not go" anvils check the effective diameter only but the combined tests in this first gauge also check the pitch.

The effective diameter of a screw is increased by approximately twice the amount of pitch error, if, therefore, the pitch error of a tap exceeded the limit allowed, the effective diameter would have to be correspondingly reduced before a tap would pass the outside or "go" anvils; if, however, the effective diameter were reduced below the limit allowed, the tap would pass through the inside or "not go" anvils and would be consequently rejected. The action of these "not go" anvils is shown in Figs. 5 and 6. It will be noticed that the threads of the anvils are cleared away at the crest and root so that they check only the effective diameter of the tap. In the second gauge the outside anvils which are "not go" are set to the minimum major diameter of the tapped hole and ensure that the major diameter of the tap shall not be below the limit.



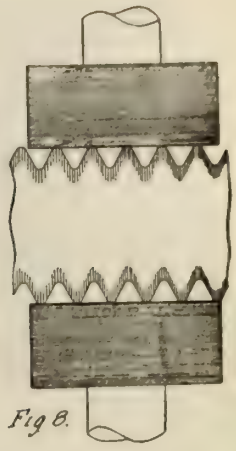


Fig. 7 and 8—Tap in "not go" dia. anvils, set to minimum major diameter of tapped hole.

Figs. 7 and 8 show this. The inside anvils, also "not go," are set to the minimum core diameter of the tapped hole. The threads shown in Figs. 9 and 10 are of a profile which bears only on the core diameter of the tap and therefore ensure that this element is not below the limit. It will be obvious that every tap which passes this inspection has undergone a searching test and that no element has escaped observation; further that the test is made very rapidly (actually in from 30 to 40 seconds) and can be efficiently carried out by anyone with ordinary intelligence. By the use of this gauge both makers and users can test their taps at a reasonable cost and no inaccurate tap need find its way into the shop. The anvils can be easily adjusted so that any desired limits may be worked to: when set, both the adjusting and locking screws are covered with a lead seal so that the gauge is tamper proof. Wear on the anvils is practically negligible but should this take place after long use, the faces can be ground back slightly and when re-adjusted the gauge is again ready for use.

Adjusting and Setting

Fig. 11 shows the details of construction. The adjusting screw is covered by a locking screw which in its turn is covered by a lead seal closed into the recess at the top of the gauge by means of a special press. This press indents the firm's monogram or trade mark in the seal, thus preventing any unauthorized tampering or alteration. The inspector, on issuing a gauge to the shop, can feel confident that he will not have spoilt work returned to him together with tampered gauges. The press, when out of use, can be locked with a padlock and the key retained by the inspector.

The adjustment of the gauge is very simple and is such as permits of extreme accuracy. The stem of the anvil, which is hardened and lapped to fit the hole, is coned out on the top end to an angle of 60 deg.; in this rests a hardened steel ball. The adjusting screw, which is also hardened, has a similar cone underneath it and presses down on the same steel ball. The locking screw, the head of which bears in a counterbore on the top of the gauge, passes through the hardened adjusting screw, through the clearance hole in the steel ball and into a tapped hole at the bottom of the countersink of the stem of the anvil. Two holes are provided in the head of the locking screw and a special peg spanner (with prongs which go through these holes and enter the slots of the adjusting screw) is used for setting the gauge.

In setting the gauge, the locking screw is first released a few turns and by inserting the peg spanner through the holes in the locking screw the pegs engage the slots in the adjusting screw. By this means the cone of the adjusting screw will push down the hardened steel ball which in its turn will push down the stem of the anvil. The gauge is adjusted until it grips the reference piece slightly tighter than is required. By giving the locking screw an extra twist with a screw driver it is possible to get any desired pressure between the anvil and the setting gauge as the hardened steel ball is elastically compressible to a few thousandths of an inch. For example, it is possible with this adjustment to pick up a set of slip gauges between the anvils; give the locking screw an extra slight turn, and the gauge will not pick up the slips. Release slightly and the anvils will grip the gauges once more. This system of adjustment is the finest possible and when once locked it is im-

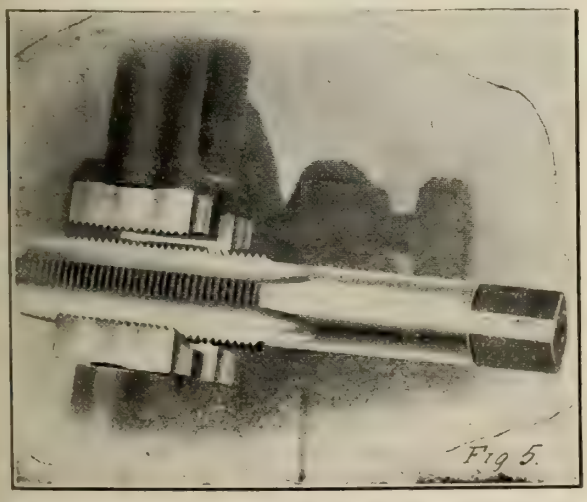
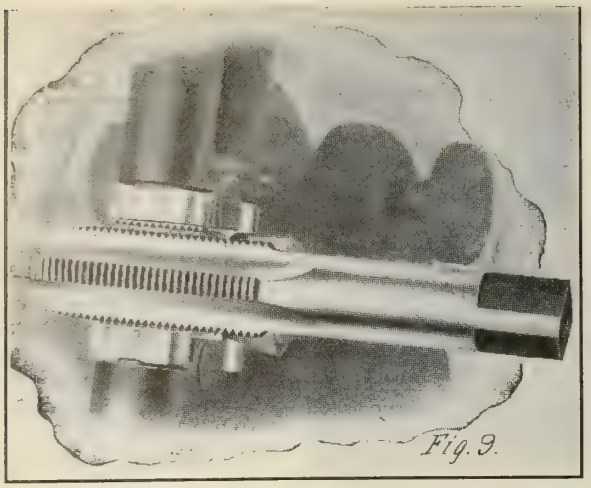




Fig. 5 and 6.—Tap in "not go" effective diameter anvils, set to maximum effective diameter of tapped hole.



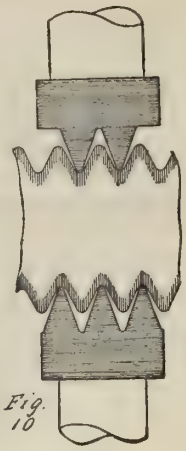


Fig. 9 and 10—Tap in "not go" core diameter anvils, set to minimum core diameter of tapped hole.

possible for any backlash to be existent. When the gauge is finally sealed, tampering becomes an impossibility and an attempt to set the gauge in a vise would result in the fracture of the frame.

Desired Limits

The limits of accuracy to which taps should be controlled are matters for determination. they will be greater than those allowed on plain work as it is not possible to produce tapped holes with the same degree of accuracy as reamed or ground holes. Once a satisfactory limit has been found, no trouble need be experienced from tapped

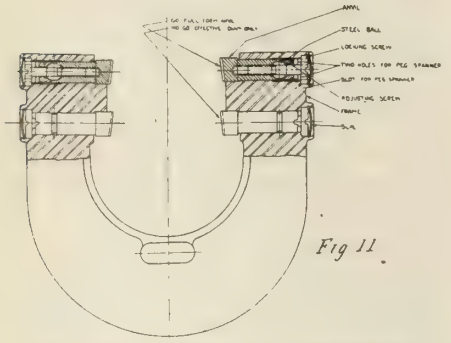


Fig. 11.—Line drawing of gauge showing internal mechanism.

holes which are outside this limit as now frequently occurs. Nothing will be gained by attempting to work to limits finer than those which will give interchangeable threaded work. The manufacture of accurate taps is not a simple undertaking but it will be greatly assisted by this simple and efficient method of inspection.

SYSTEM AS AN OBSTRUCTIONIST

By Donald A. Hampson

At a recent meeting of the Am. Soc. of Mech. Eng., one of the points brought out in a discussion of material handling systems and machinery was that each salesman, each engineer, was so anxious to get his own particular product installed in customers' plants that he overlooked entirely the adaptability of that product to the local needs and the fact that plant conditions often cried loudly for a system quite opposite to the one it was proposed to install. And there is the curse of the whole system business—be it time clocks, conveying machinery, stock indexes, job tickets, or office filing systems. Before putting in any one of these aids to business, executives should study well present conditions and costs in their plants, comparing them with the same after the installation, and strive to avoid losses such as were incurred by the plants cited in the following.

The Ideal Co., had a small fine plant but the field for their product was limited and it was decided to take in job work too. It was also decided to do things systematically, to index and cross index and to send a routing card through the machine shop with each job. It sounded fine, and they received their full share of job work for a while, people being attracted by the company's reputation in the machinery field. But after a while it began to dawn on these same customers that they lost time and that they paid more. Why? If a job was brought in, it went first to the shop office. There is was looked over by a well fed engineer who smoked good cigars (himself) and passed an opinion on the job, together with a brief resume of the causes and effect of such a break. Meanwhile a girl had been called and began to fill out the various cards. The shop foreman, having been called, arrived in due time, looked over the job, exchanged opinions with the office man, and the work passed into the shop. A splendid system!

The customer felt that his work was in the hands of men who knew, and so it was. However, it dawned on him later that a half hour was lost in the office and that he paid for that half hour at a good rate. Then, if he had a hurry job he lost that much time in starting. And if the job was a simple one, as removing a broken-off bolt, it took as long to get the system working first as it did to do the work later. Now, at the other shops in the locality, you saw the foreman or superintendent right off. No cigars and no girls and no system. The shops themselves were just as big and as well equipped—the executive looked over the work, told what he would have to do and when the work would be finished—the entire process did not take five minutes and if it was a hurry up job (that could possibly be started right away), it was in the hands of a workman at the end of that five minutes. Which is the better way?

The ..... Brake Shoe & Foundry Co. had an elaborate system in their plant. A clerk could tell you in a minute how many brake shoe heads from Patt. BM-548 there were in stock, where this or that special job was and when it would be finished, how many tons of pig iron were in the bins. Quite recently an order was received for a certain brake shoe, a pattern that the records showed they were entirely out of, and yet—three car loads were shipped out in the next ten hours, and all from stock! Somebody had neglected to make the necessary entries.

A manufacturing plant near us installed a "system" in 1914. That system is not in use to-day, though the business has grown in that time. There were a hundred men employed in 1914 and the plant covered several acres of ground. It was thought that a modern system for a business of that size would be a money saver and far better than the old method wherein one clerk did the work, spending part of the time in the office and the rest in gathering foremen's figures daily at the various desks. But it was found that the new system required the full time of three clerks and that the foremen, who were not allowed to do any more clerical work, were continually being pestered by the clerks as to technical details.

CARBURIZING HEAVY SECTIONS

Commenting on the carburizing of heavy sections, W. E. McInerney says that modern practice requires a carburization for a depth of one inch or more. "Getting the proper graduation from the surface to the required depth, and not causing excessive concentration in the surface strata is the problem that confronts the heat treater, and the carburizing compound manufacturer," comments the above writer.

He mentions that of the three carburizing agents, viz., liquid, solid, or gaseous, the solids have been more extensively used, and that there are certain requirements that must be met by the agent before it will prove satisfactory for use in heavy section carburizing, a few of which are:—

1. Uniformity as to composition and physical qualities, grain or pellet size. 2. Freedom from sulphur in injurious amounts less than 0.5 per cent. 3. Freedom from internal combustion. 4. It should not flux or fuse at any temperature up to 2,100 degrees Fahr. 5. It should not coke or cake on the plate making it difficult to remove and 6. It should also have a good bearing value and minimum shrinkage so as not to crush excessively in use.

Home made carburizers, says Mr. McInerney, have not proven any more economical than the commercial ones, and are not as satisfactory due to the difficulty in properly mixing them.

Heat Treatment Not Always Cause of Failure

Sharp Corners Should be Avoided—Fillets Are Very Necessary —Change In Design Will Often Solve Hardener's Difficulty— Various Causes for Tool Failure—Co-operation Is Necessary

By CHAS. A. BROOKS

IN ONE particular pneumatic rivet die which came to the attention of the author recently, four defects were discovered. The end which the piston plunger struck, was not sufficiently crowned, the fillet at the shoulder was entirely too small, machine tool lines were in evidence at this point, and there were sharp shoulders where the spring retainers gripped. These defects were a result of faulty design or ignorance, yet when the set proved inefficient, the difficulty was assigned to an improper temper by the man who used it. But the steel treater was not at fault. In another case of intricately shaped car molding dies, failure was also given as an improper temper. Here the true trouble was a slight difference in the oversize thickness of metal rolled, insufficient space between the male and female die, as well as the failure to reheat the metal after the oxyacetylene weld before continuing the operation. Second heatings at a slow gradual cooling down would have relieved the hard state of the metal. In fact, the metal was as hard after the weld as was the small raised sharp edged ring-shaped part of the third step finishing dies. Most steel treaters appreciate the hard condition of 1-16 to ⅛-inch steel plate after oxyacetylene welding. Until careful attention was given to a second heating with slow cooling down, difficulty was experienced. This with a closer inspection of gauge size of stock to be rolled overcame all trouble with roll die failures.

The Value of The Fillet

Punches operating on ship plate up to 1-inch thick gave good service but when extra heavy plate 1⅛ to 1½ inch thick was placed under the punch, trouble arose. This was assigned to faulty heat treating, but examination showed that the greater part of the breakage occurred at a point close to the sharp shoulder where the machine chuck gripped the punch. The punches were annealed and returned to the machine shop to be turned back ⅛ inch, leaving a fillet where the sharp shoulder was before. After this change and the identical heat treatment as before, the punches stood up well on the heavier plate. This proved that the original heat treatment was not in error. In a similar instance of a tool for bellying out large boiler tubes before beading them, design was at fault. This tool, which was of the pneumatic type, was of a cut off cone shape with the bellying end considerably out of proportion to the plunger part that fits into the riveting machine. Each die had a short life and several kegs of broken ones had accumulated. A new shape of tool was suggested and although apparently of an impractical nature six of them were forged. After months of service, the same six are still being used. A record was kept up to 20,000 tubes processed on one die, this being a sufficient number to prove that the new type was practical and efficient.

A paper presented before the Philadelphia Chapter. The author is foreman steel treater, Bethelhem Shipbuilding Corp., Ltd., Wilmington, Del.

Change of Design

Changes in design of an offset die used for bucking up rivets also proved beneficial to a previously unsatisfactory tool. The changes consisted of generous fillets and providing a longer taper between the heavy and light body parts of the tool, as well as holding the body end of the tool to as small a diameter as possible to overcome difference in weight resistance. These modifications overcame practically all trouble and discredited the theory of improper heat treatment. Making the reacting hammer pistons from 16.5 per cent. tungsten steel instead of high carbon steel overcame wear and breakage on this type of tool. A more recent change of using a slightly shorter piston of the same weight of the longer carbon steel piston has resulted in a faster stroke and rivets driven quicker. Sticking in the chamber of the machine, such as often occurs with carbon tool steel however tempered or crowned, has been eliminated entirely.

A general rule of the average steel treater seems to be the giving of extreme hardness consistent with no breakage. It is also a common belief that the frequent grinding necessitated in high speed steel is an indication that the tools are too soft. This is not always true. With a high speed tungsten steel, the hardest point possible for production may be obtained together with the necessary hardness, but the cutting edge may not have a satisfactory edge retaining property, thereby requiring frequent grinding. A good tool must not have this latter property. A high speed steel containing 16 or 17 per cent. tungsten in its hardest state shows edge crumbling but a lower hardening heat with oil quenching ending at flash and a slow cooling will produce a tool, which although considerably softer, will require less grinding and give longer service. The author recalls one steel salesman, who in demonstrating a good high speed steel, lost the sale because he did not understand the practicability of obtaining a lasting cutting edge along with the highest degree of hardness.

Of course, there are various causes for tool failure such as grinding too great a clearance, pressing too hard on a dry wheel and then dipping into water, and taking too heavy a cut in the machine. More care must be used as to the service required from the tool; pneumatic vibration, rigid holding for machine service or punch or shear service. The tools must be designed suited for each service. This is just as essential as the steel used and treatment given. The heat treater, toolroom foreman and superintendent must co-operate closely to this end. Many failures will be offset by making a study of the tool or machine part prior to making the design. Tools may be forged or machined easily but they will not always do the work expected. In following old standards, we are too prone to neglect possible causes of failure other than heat treatment.

Too many failures are laid at the door of the steel treater. Thus it is essential that he state explicitly his views when he knows failures are not the result of heat treatment. For the advancement of science his views must be considered. It is impossible to make tools or machines stand up in service unless they are given proper care.

THREAD CUTTING POINTERS

In a recent issue of "Threads" appear the following questions and answers on thread problems.

Can you tell me what causes chasers to pick up or load up with brass between the threads, also what is the best lubricant to use for brass, if any?

As a rule we find that chaser teeth becoming clogged with chips is due to chasers being dull so that they do not free the chips properly. We would suggest that you look into this, and should you be unable to overcome your trouble, suggest that you return a set of the chasers to us for examination. We strongly recommend the use of a lubricant for all threading. However, most manufacturers thread brass without any lubricant. For brass work it is not necessary to use a heavy oil, but simply a liquid that will cool the cutters, preventing the drawing of the temper.

Why is it that certain chasers will not thread straight? Die Head is practically new? It is possible that the chasers may not be inserted into the die head properly. The machine may be out of alignment. The turret may be forced faster than the chasers can cut, or it may be held back. All of the chasers of the set may not be cutting properly. That is, one or more of the chasers may be cutting ahead or behind. It might be well to test the chasers on a trial piece of stock by stopping them on the cut to see if all chasers of the set are cutting properly. All the cutting should be done on the chamfer, and not back on the chasers.

Recent Developments in Mechanical World

Power Transmission By Chain

THERE is no doubt that the use of the toothed chain is not taken full advantage of by works engineers and others. Very often its installation will solve transmission difficulties, and although it is an expensive article to produce, in many cases it would be a cheap investment. There is, writes a correspondent in the Manchester Guardian Commercial, one essential to successful operation, and that is an oil-bath gear case. These cases are built of sheet steel, and are cheap. Usually they have a simple pump which delivers a stream of oil on to the working side of the chain, the consumption of oil being quite small. They may under certain circumstances have to run exposed; if so, a periodical soaking is essential. In motor car work they would run in the general oiling system. Outside the foregoing adaptations there would appear to be a good field for the chain in intricate machines as a substitute for gearing, and the suggestion is commended to designers and inventors. It should be noted that a toothed chain can be made to transmit power to several wheels confined in a very small space.

* * * *

Increasing Output of Drilling Machines

IF A CORRECT record of the actual running times of drilling machines were obtained it would be found in many cases to be but a small proportion of the working day. This, of course, is due to the antiquated methods so often employed when fixing and changing the work, and the disparity is very marked on the modern machine where the employment of high-speed steel makes the actual cutting time of very short duration. This question of the provision of suitable means for quickly handling and changing the work to be drilled, says a writer in Engineering and Industrial Management, has in certain quarters received more attention of late, judging by the number of angle plates, machine vices and work tables now in use and arranged to swivel in one or more directions. Their application is, of course, suitable not only to the drilling machine, but to the majority of machine tools. In the modern drilling machine, where the drill is forced to its utmost limit, if increased output and the consequent reduction of production costs is desired, it is imperative to effect economies in fixing the work and so keep the machine fully employed and running the maximum percentage of cutting time.

* * * *

Pyrometers and Heat Treatment

THAT THE best results will never be obtained with a pyrometer unless the operator knows something about its construction, principle, and intricacy, is pointed out in the Edgar Allen News, the house organ of the Imperial Steel Works. Heat-treatment plant workers should know how to tell temperatures by color tints. The pyrometer, it must be remembered, indicates the temperature of a limited portion of the furnace interior only, and a correct estimate of the heating chamber's temperature cannot be formed unless the eye is used to compare the color of that portion with that of the rest. Surprising ignorance is often shown in regard to pyrometers. In one case, an operator had noticed that the thermo-couple of this instrument was broken, but instead of welding the elements, he had merely twisted them together and carried on. He had had the pyrometer for some years without once having it tested or regulated. In another instance the thermo-couple was inserted without protection into the heating chamber through a top-vent near the centre, and the furnace heat was kept at 1800 deg. Cent. for some hours. Reckless heating of this kind simply invites inaccurate results.

Lubrication of Air Compressors

ONE OF THE most important items in running an air compressor is lubrication. In modern machines the running parts are usually inclosed in a crank case and run in oil. The oil is made to circulate from the bottom of the bed over all the bearings, pins and guides and then runs back into the bottom of the bed again. The air cylinders are sometimes lubricated by a sight-feed oiler, so designed that the pulsation of the air pressure assists the feed of the oil. Also, sometimes the air cylinders are lubricated with a positively driven oil pump. Two principles should be maintained in lubricating an air cylinder, says a writer in the Engineering World. The first is to use only the right kind of oil, and the second is to use it sparingly. To be the right kind, air oil should be rather light-bodied and have a flash-point above 260 deg. Fah. for compound compression to 100 lb. pressure and 360 deg. to 375 deg. Fah. for single-stage to the same pressure.

* * * *

Melting Metal With Fuel Oil

ALTHOUGH crucible furnaces have received considerable attention in regard to heating with both gas and oil, there has not been much effort made in respect to the use of oil in furnaces where the metal is melted in contact with the fuel as in cupola melting. The ordinary reverberatory air furnace can be adopted for either oil or gas heating. To melt metals heat only is needed, no matter from what source derived, as melting is a matter quite apart from the reduction of metals from their ores, in which solid fuel is probably necessary for other than its heat producing properties. In the production of the necessary heat from oil combustion, continues The Practical Engineer, it would seem very much as if the oil should be injected into the furnace with the necessary amount of air, to ensure complete combustion the oil necessarily being in a very finely divided state and that probably the combustion chamber should be preheated at first to assist the automizing of the oil.

* * * *

Cobalt Magnet Steel

A NEW formula for making magnet steel is coming into use, the principal change from the ordinary practice being the employment in its composition of cobalt instead of tungsten. Hitherto, such steel has contained about 5½ per cent of tungsten, and the substitution of about 15 per cent of cobalt raises the coercive force of the material from 60 to 250, making it possible to use smaller magnets. The London Ironmonger states that the use of the new steel necessitates a new form of magnet, consisting merely of two small flat plates of steel placed on the sides of the armature, hence if it should come into general use the familiar horseshoe-shaped magnet will disappear. As yet, however, cobalt magnet steel is only in the experimental stage. Cobalt magnet steel costs three or four times as much as tungsten steel, but a much smaller magnet is required to do a given amount of work.

* * * *

INVESTIGATIONS at the Pittsburgh Experiment Station on the technology of aluminum include studies of causes for and prevention of cracks in aluminum-alloy castings; disintegration of aluminum-manganese alloys; analysis of aluminum and aluminum alloys; the contraction and shrinkage of aluminum alloys; and the effect of remelting aluminum alloys.

Practical Ideas for Shop Executives

MANUFACTURE OF VALVE RODS

By G. Blake

Sketch No. 1 illustrates the type of valve rod under consideration. It was during the latter part of the war, early in 1918, that the writer was called upon to increase production of the above rod. Previously the rod was machined as follows: (1) Rough, and finish diameter (full length of rod) to diameter of screwed portion, form ball on end, screw, and part off on capstan. (2) Centre screwed end, undercut and finish diameter from A to B on centre

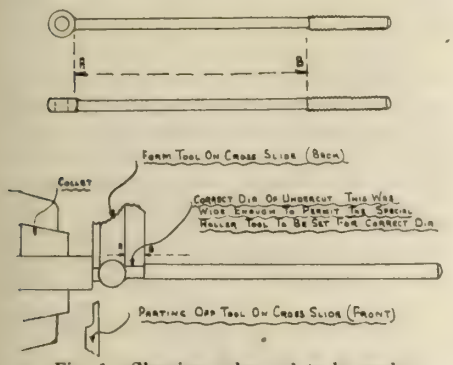


Fig. 1.—Showing valve rod to be made.

lathe. (3) Mill flats on head in gangs, using straddle cutters on milling machine. (4) Drill and ream eye in head in jig, using floating reamer on drilling machine. (5) Trim up heads on bench.

It took two men working full time to keep up with operation 1, as the undercutting was important and the finished diameter was less than 9-32 in. and the length 8 in. Only light cuts could be taken, even when using the travelling steady, in addition to tying up two men and two centre lathes. The operation was very costly in comparison to the other operations which were performed by boys and the writer decided that the centre lathe operation could be dispensed with and the undercutting done on the capstan in operation.

A special adjustable roller steady tool box was designed. Sketch No. 2 shows the idea, the aim of the toolholder being that by turning the small handwheel A, the rollers and tool could be advanced or withdrawn simultaneously by means of the screw B which was threaded right and left handed, the roller holders in addition could be adjusted independently from their own slide. The sequence of operations on the new method is as follows:

(1) Round the screw end, open collet and set rod to length, rough and finish turn diameter (full length) and while finish turning diameter, form ball end, using cross slide; the form tool (circular) was made as per sketch, the part at A B was for turning the rod to its proper diameter, when undercut. The reason for this was that the special tool box could be adjusted by means of the handwheel A to the correct diameter. The sketch of the rod after the forming process illustrates what is meant, then when the toolbox was set, the capstan traverse was reversed so that the tool moved away from the headstock of the machine, the cutting edge of the tool being inside the box, instead of outside, as is the case in ordinary tool box turning; a hardened guide bush E in the toolbox guided the rod and kept it steady during the undercutting process. The shank of the toolbox was hollow. The end was then screwed with a collapsing die head and this with the parting off completed the first operation. The other operations were as before, cutting out of course the undercutting on the centre lathes, the ultimate result being that production was considerably increased, and the releasing of two centre lathes and their operators for other work and in addition to the increase in production the manufacturing cost per rod was decreased by over 25 per cent. However, before the firm could benefit by the new method, the contract was cancelled and other work taken in hand, yet the methods described go to show the adaptability of the capstan when tooled up properly.

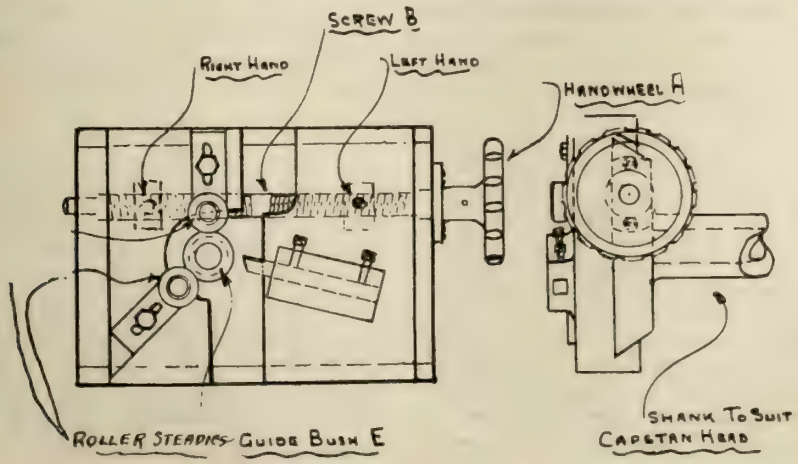
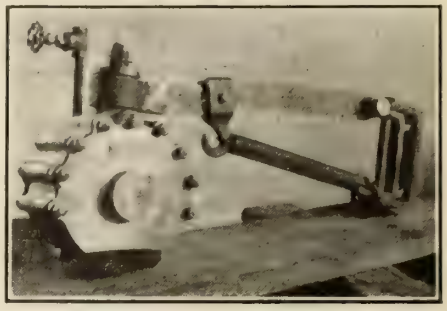


Fig. 2.—Adjustable roller steady tool box.

FLANGE AND CABLE OILER

By G. L. Ingram

An interesting device for continuous lubrication of car wheel flanges, cables, etc., is shown in the accompanying illustration. It consists of a cast steel wheel hollowed out on each side with a fitted flange groove, the portion bearing on the flange or cable being perforated with small holes. The wheel rotates on a ball race, cones are supported on a stationary axle through which the oil feeds to the centre of the wheel.



Flange and cable oiler.

The wheel is propelled by rolling contact and the centrifugal force thus created passes the oil through the holes on the surface requiring lubricant. It is automatic in its action, insofar as it feeds only when the object is moving and ceases when flange or cable stops.

The wheel is enclosed in a housing suspended to a bracket with spring connection. The purpose of the spring is to take care of the various movements that the oiler may be subjected to. The hinged bracket prevents lateral play and keeps the oiler in position. The device is satisfactory in operation and lessens, considerably, the friction and wear on rails and driving wheel tyres, and insures longer life to cables. The wheel is enclosed on each side with plates to hold oil as it is fed in through the axle.

DO BELTS SLIP AS SUPPOSED?

By W. F. Schaphorst

A machinist wrote an interesting article some time ago under the above title. His analysis was correct as far as his formulas were concerned, but he didn't fully answer his own question which he used as a heading. The correct answer is:—Yes, belts slip when they are overloaded.

One would infer from this machinist's answer, or analysis, that belts don't slip at all and that the difference in pulley speeds, if there is a difference at all, is due entirely to belt thickness. In an article of mine published some time

ago, I gave this formula for computing the percentage of belt slip:—Per cent. of belt slip equals:—

$$100 - \frac{100\ r\ (d + t)}{R\quad (D + t)}$$

r = r. p. m. of the driven pulley;
R = r. p. m. of the driving pulley;
d = diameter, inches, of driven pulley;
D = diameter, inches, of driving pulley;
t = thickness of belt in inches.

If a belt is not pulling any load the pulley speeds may be accurately computed by the use of ordinary formulas, but just as soon as the belt is loaded one side of the belt becomes tighter than the other, it stretches, and we have a longer belt going onto the driving pulley than comes off. The compensation for this difference in length results in "belt creep." A good formula for computing belt creep will be found in Goodman's excellent treatise, "Mechanics Applied to Engineering." In that formula the co-efficient of elasticity of the belting material is included.

TURNING RADII WITH SPECIAL ATTACHMENTS

By J. Homewood

I have herewith shown on three different drawings, methods to produce radii when the quantity to be machined is sufficient to cover the cost of attachments. There are three different kinds of jobs under consideration in this article, one is a shallow spherical surface to be turned out, one is a shallow spherical end to be put on a corresponding piece, in this case a punch and die to produce a spherical pan. The third is a method used to turn out dies to produce deep round work. In the first case, Fig. 1 shows a method that can be used. This consists of a link C that is pivoted on a piece B which is fastened to the ways of the lathe between the carriage and the head of the lathe. A small bracket is secured to the cross slide of the lathe. The compound rest is turned around, as shown, to facilitate feeding the tool to the work. A cam of the radius to be turned on the piece can be substituted for the link if desired. When different radii are to be turned, either individual links can be made up or else one can be made with a turnbuckle to be adjusted to the different lengths of the radii.

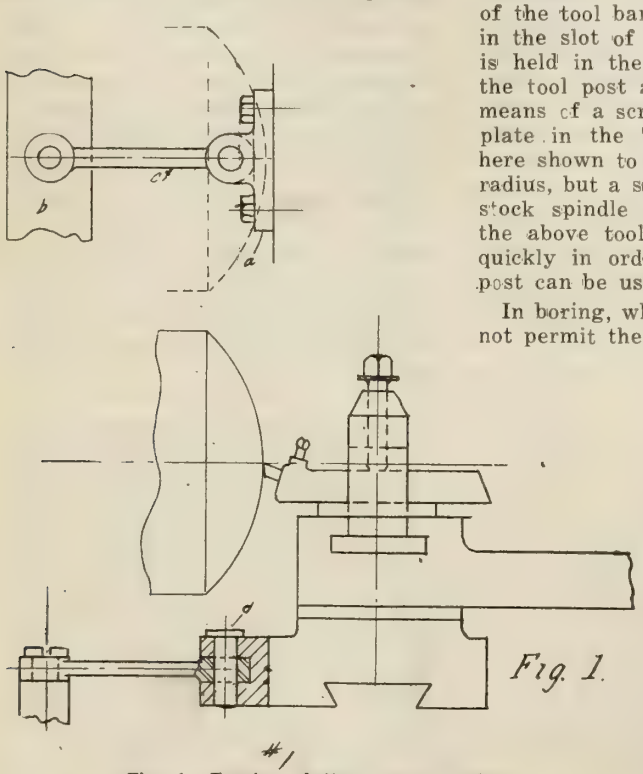


Fig. 1.—Turning shallow convex surface.

Here we have a case where a concave spherical finish is desired. The tool bar A pivots from the support held in the tailstock with a taper shank. This tool bar can be made to provide for slight adjustment if desired. On the bottom of the tool bar is a pin C which slides in the slot of the plate D. This plate is held in the slot usually allotted to the tool post and is fastened down by means of a screw going through to the plate in the T-slot. No provision is here shown to adjust the length of the radius, but a slight advance of the tailstock spindle will provide feed. Like the above tool, a pin can be removed quickly in order that the regular tool post can be used.

In boring, where the conditions would not permit the use of the device shown in Fig. 2 owing to interferences, the method illustrated is the one where the nut is disconnected from the cross-slide and a link A attached thereon which is fastened to a rigid bracket with provisions for adjustment. This link can be substituted by a cam located at the back of the lathe where a roller is guided through the proper raidus.

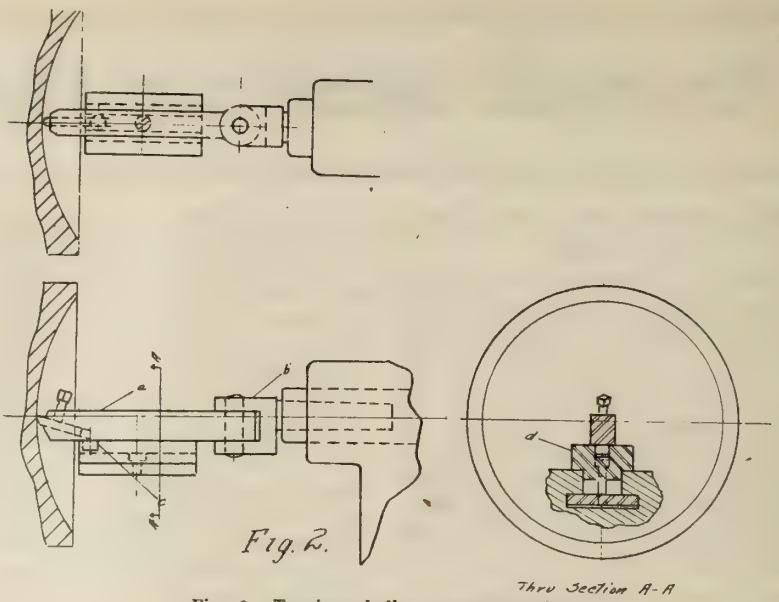


Fig. 2.—Turning shallow concave surface.

GAUGING 15-TOOTH CUTTER

By D. J.

A reamer with 15 teeth is to be ground to ream a hole 2 in. in diameter. What will the reamer measure across the diagonal, or is there a better way to gauge it?

Weights of steel rounds, squares and hexagons, in lb. per ft., are given in a blue-printed wall chart issued by the Betz-Pierce Co., Cleveland. Rounds are covered from ⅛ in. to 6½ in.; squares, from 3-16 in. to 4 in.; hexagons, from 3-16 in. to 2¼ in. In all cases the metric size is given alongside its inch equivalent. Copies of this chart will be furnished by the company on request.

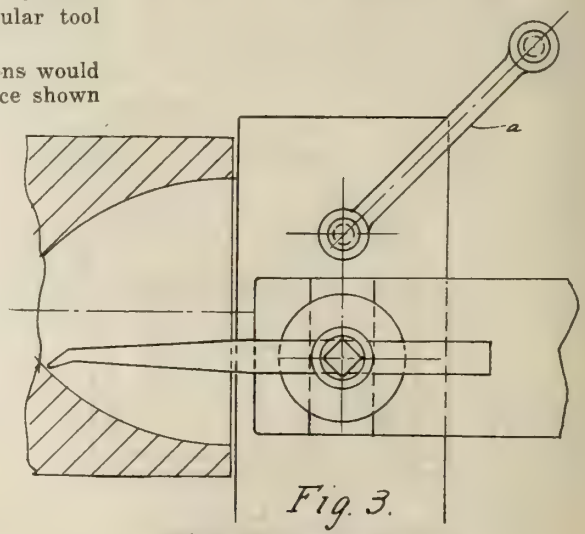


Fig. 3.—Deep concave turning.

New Things in Shop Equipment

PLUG AND TEMPLET THREAD GAUGES

Another line of adjustable templet thread gauges has been recently marketed. The templet gauges are made in two styles, either with one half-way slot on the inside of the gauge or two half-way slots on the outside which lead to the periphery. The latter style furnishes a fuller contact for the threads of the work, a feature which is especially interesting to small gauge users. The plug gauge is fitted at one end with a thread plug, and at the opposite end with a plain plug equal in diameter to that of the root of the thread that it is intended to gauge. Both the threaded and the solid plug are readily replacable as they become worn. The gauges are made regularly for all sizes of standard threads, United States standard, Whitworth, S. A. E., etc., from 3/16 inch diameter upwards. Special threads can be obtained if desired. The manufacturers of the gauges are the Superior Thread Gauge Mfg. Co., Inc., of Brooklyn, N. Y.

FOUR WAY DRILLING MACHINE

The original idea of a four way drilling machine appeared some time ago, but recently a new application of the old principal has made its appearance in the form of a machine for drilling four bearing holes in the upper and lower sections of tractor rear axle housings. A special work holding fixture is necessitated, which is in reality a part of the machine. One-half of the housing is placed in the fixture and located by means of guide pins which engage two holes that have been drilled previously. The other half of the housing is then placed in the fixture and the two parts are held together firmly while the drilling operation takes place. When the housing is removed, the gripping jaws of the fixture are released and the upper half lifted out. The lower half is ejected by means of a lever operated mechanism. The machine and fixture are manufactured by the Reed-Prentice Co., Worcester, Mass.

NEW AIR GUN

A brass compressed air gun for use in machine shops for blowing chips and dirt from the tables of machines, and for cleaning taps, dies, and other tools has recently been placed on the market. The design is such that the loss of air by leakage is practically eliminated, as the gun has a disc that can be readily renewed as it becomes worn. The disc acts as a valve and is accessible through the removing of a small plug which screws into the bottom of the frame. The gun is operated through the depressing of a knob by thumb pressure. When the air is shut off a spring keeps the disc pressed firmly against its seat. The stem of the bottom does not need to be packed as it is in the discharge side of the gun. The gun may be used with any sized hose by simply selecting a proper nipple. The gun is manufactured by Jenkins Bros., New York City.

TILTING ARBOR WOOD SAW

A wood cutting saw on which the arbor can be tilted to any angle up to 45 degrees, and which is therefore particularly adapted for pattern shop work has recently been placed on the market. The table of the machine is always in a horizontal plane. The tilting and locking of the arbor is accomplished through the medium of a hand-wheel. A second hand-wheel is employed to raise, lower, and lock the table. The motor is mounted on the saw arbor which is in turn mounted in a sliding bracket, which is supported by a yoke. The yoke is hinged to the housing. The motor has a speed of 3,600 r. p. m. and is controlled by an enclosed safety switch mounted on the outside of the housing. A complete set of graduated switches forms part of the regular equipment. The saw is manufactured by the Tannewitz Works of Grand Rapids, Mich.

ADJUSTABLE BORING BARS

A new line of adjustable boring bars has recently made its appearance, in which the principle of scroll adjustment has been employed. The bars have been designed for rough boring, finish boring, reaming and line reaming operations. Several combinations of standard cutters may be included in one bar for boring to different diameters, counterboring and facing in one operation. By the combination of angle and straight cutters several sets can be spaced close together on a bar. The thread of the scroll engages curved teeth which are located on one side of the cutters. The scroll is revolved by placing a wrench in a square hole located at its centre. Graduations on the scroll permit of accurate settings to be made. There are also provided two locking screws that are used to keep the cutters in position after setting. The inner ends of the cutters overlap each other which permits of greater expansion and rigidity. The cutters are backed metal to metal and it is practically impossible for them to work loose. The design of the angle cutters, coupled with the method of adjusting them both radically and longitudinally, makes them particularly well adapted to counter-boring operations. The faces of the cutters can be ground after they have been set, which enables them to be always kept in their original relative positions. The angle cutter also lends itself nicely to the boring of blind holes. With a combination of straight and angular cutters adjusted to a common diameter, a four point boring or reaming tool can be obtained. Cutters can be removed from, and replaced in the bar without taking the bar out of the machine. A number of designs of this type of bar are being manufactured together with accessories such as pilots, extra and special cutters, etc. The bars are manufactured by the Hannifin Mfg. Co., of Chicago, Ill.

DOUBLE-HEAD HOLE GRINDER

A semi-automatic double-head hole grinder has receently been placed on the market. This machine was primarily designed for finishing wrist-pin holes in internal combustion engine pistons, but may be adapted for double grinding of holes on which hubs, cluster gears, bearing cages, and other similar work where concentric holes are required on opposite ends of the same piece that is within the range of the machine. Both holes are ground at the same time, with only one setting of the work, and the dressing of the wheels assures duplication in size of both ground holes, and in accurate alignment no evidence of bell-mouth appears in the holes. The chuck has a range, for piston work, 4½ in. dia. by 4½ in. long. For other work the dia. may be increased to 6 in. Work revolves at 250 r. p. m. Wheel spindle drive shafts are mounted in ball bearings of enclosed type. The machine occupies a floor space of 3 ft. by 7 ft. and weighs about 2,300 lbs. The machine is manufactured by the Bryant Chucking Grinder Co. of Springfield, Vt.

BACK-FACING ATTACHMENT

A universal back-facing attachment that is power operated has recently been applied to an engine lathe. The attachment is particularly adapted for the turning of bevel gears. It is a simple matter to set the device for machining the gear at any desired angle, and the bevelled surfaces can be machined simultaneously with the turning of the gear hubs. Nine in-feeds are obtainable, ranging from .003 in. to .050 in. per spindle revolution. The feeds are secured through gearing connected to a splined shaft at the rear of the machine. Reversal of the mechanism is accomplished by sliding positive clutches which engage with worm gearing. There are twenty-seven automatic reverse feeds,

ranging from three to fifteen times the forward feed that happens to be engaged. These feeds enable the operator to secure the proper timing necessary for back-facing, necking, undercutting, and grooving work. The infeed stop causes the mechanism to reverse automatically while the out-feed also stops automatically at the completion of a cycle. The relation of the back-facing feeds to the turning and facing feeds of the lathe permits innumerable combinations and puts the lathe into the semi-automatic class, because when equipped with this device, several machines may be run by one operator. The lathe and attachment are made by the Seneca Falls Mfg. Co., of Seneca Falls, N. Y. The lathe is marketed under the trade name of the "Adams Short Cut" lathe.

TURRET LATHE ATTACHMENT

Automobile manufacturers have been faced with a trying problem in endeavoring to rapidly turn forged bevel gear blanks, owing to the special metal that was in these blanks. To facilitate such operations an attachment has been brought out by a manufacturer of turret lathes which enables a higher production to be maintained. The attachment has tool slides and one of these interchanges with the top slide of the regular carriage, so that the machine may be used either for bevel gears or for the other classes of work regularly handled on the turret lathe. The attachment is suitable for machining work up to 14 inches in diameter, and to all standard angles. The two tool slides are operated by the hexagon turret and the saddle and they work simultaneously. Racks and pinions are the mediums used to operate the slides. The attachment is manufactured by the Warner & Swasey Co., of Cleveland, O., and fits their regular No. 3-A hollow hexagon turret lathe.

DOWN-STROKE GEAR SHAPER

Recently a gear shaper that had been marketed in only the up-stroke design has been developed in the down-stroke type and has made its appearance in several sizes. The teeth are cut on the down-stroke and the tool head is placed beneath the ram. The ram can be elevated by power to a sufficient height to enable an arbor filled with gear blanks to be inserted in the machine. The tapered arbor is drawn into the socket, and ejected from same at the completion of the operation, by power. The machine is electrically driven throughout, and is started and stopped by a push button. The machine is manufactured by the Stevenson Gear Co., of Indianapolis, Ind. It is very similar, in many ways, to the up-stroke machine put out by this firm some months ago. The new machine, however, has a wider range of adaptability. Cutting tools are interchangeable with the older machine. A number of sizes of the new machine are being built.

UNIVERSAL SHAPING SAW

A machine that is one step ahead of a power hack saw has recently made its appearance. It has been designed along lines that adapt it for many operations impossible to perform with the ordinary hack saw machine. The machine tool principle of design enters into the construction. The saw blade is carried in a four-sided frame which permits ample tension being applied to the blade without fear of distortion in the bearings. The saw frame is supported on the horizontal bearings or ways of a vertical slide, which, in turn is mounted on vertical ways on the main frame of the machine. The saw frame is reciprocated through a crank and connecting rod mechanism. A quick-return motion is incorporated in the design. A speed box having a cone of gears provides three changes of cutting speeds. A positive adjustable power feed mechanism is provided, and also on the return stroke the saw blade is lifted free of the work. An automatic feed regulator is provided. If hard spots are encountered the feed is correspondingly reduced. But if the metal is homogeneous, a positive and regular feed is maintained. When a cut is completed the feed worm is automatically disengaged, and after this a spring lifts the saw frame to its upper position and stops the machine.

For the performance of angle-cutting operations, a special fixture is furnished on which the work may be clamped to either a horizontal or vertical face. Another convenient feature which adds to the usefulness of the machine is a cross feed mechanism secured to the table. A piece of work can be placed in this fixture and fed transversely under the reciprocating action of the saw, the latter acting like a shaper tool and producing a smooth finish on the surface machined. A cooling system is provided. The machine has a capacity for work 6⅝ inches square, takes blades from 10 to 14 inches in length and has a stroke of 5½ inches. The maximum number of strokes per minute is 132 and the minimum 50. When equipped with a standard vise the machine weighs 750 pounds. The saw is manufactured by the Peerless Machine Co., of Racine, Wis.

COMBINATION BENCH MACHINE

A combination bench lathe, for ordinary lathe work, drilling and milling has recently been developed and placed on the market. The base and column have the ear marks of a radial drilling machine equipped with a floor plate. The lower part of the column is circular and fully machined. The upper part is a segment of a circle with ways, along which a head, carrying the spindle slides. The spindle can be set horizontally or vertically, or at any point between these limiting positions. A knee with a double deck tool slide on its upper machined surface, is clamped to the circular column and operates very similarly to that of a milling machine table. An outer support, which is removable, can be arranged to support the outer end of the knee or table. It extends above this point and can be used as an outer support to the spindle of the machine, when used as a plain horizontal milling machine, or as the tail centre of the machine when used as a lathe.

Vertical milling can be accomplished by placing the spindle in a vertical position. End milling can thus be accomplished at any angle from 0 to 90 degrees from the horizontal. Drilling can be accomplished by inserting the drill chuck in the spindle and this operation can be taken care of at any angle. The table can be swung to one side and the outer support removed, allowing large work to come under the spindle, for drilling. For lathe work the spindle is in a horizontal position and face plate, collet, or chuck, may be attached. The tail centre is provided by the outer support. The table becomes the bed and ways of the machine, and the main tool slide, the carriage and the saddle. The top tool block becomes the cross slide.

The machine is motor driven by a ¼ h.p. motor mounted in the spindle housing and driving the spindle through the medium of a belt on a top step cone. Thus the drive is always in the same relative position to the spindle. The motor is reversible, and right or left hand tools can be used. There is a final three speed gear drive to the spindle. Thus six spindle speeds are obtainable, varying between 90 r.p.m. and 1150 r.p.m. The head is counter-balanced, and the spindle has a feed of three inches. All feeds are by hand except when it is desired to cut threads, automatic feeding being provided in this instance.

All parts of the machine are graduated, and a Jacobs drill chuck, having capacity up to ½ inch is regularly supplied. Some of the specifications of machine are as follows: Longitudinal feed of carriage, 10 inches; transverse feed of carriage slide, 6 inches; vertical feed of bed, 4½ inches; maximum swing over carriage, 8 inches; maximum swing over bed, 14½ inches; maximum centre distance, 14 inches; maximum height with spindle in vertical position, 43 inches; weight of machine, about 450 pounds; and bench space required 16 inches x 25 inches. These machines are manufactured by the Triplex Machine Tool Corp. of New York.

Gould and Eberhardt of Newark, N. J., have just received from the printers a folder that illustrates and describes in an interesting manner the many features of their shapers.

* * * *

The Oliver Machinery Co. of Grand Rapids, Mich., are distributing a bulletin which illustrates and describes their lines of circular sawing machines, and the care of the same.

* * * *

The Black and Decker Mfg. Co. of Baltimore, Ind., are distributing a small catalogue, covering their line of portable electric tools, which include electric drills, screw drivers, socket wrenches, grinders, safety cleaning machines and valve grinders.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Things Look Brighter

GENERAL business is on the upgrade. The improvement may seem slow to those longing for a return to normal, but a slow and steady improvement is preferable to an ephemeral boom which only results in a further setback. The steel trade in Canada is picking up slowly but steadily and with the season opening up we can look for further improvement in this field.

Residence building is strengthening, and several public buildings, roads and bridges are either being contemplated, or are in course of erection. The machine tool trade, while still quiet, shows signs of strength and confidence, so that even this line can be expected to record a fair amount of improvement as the year proceeds.

To a great extent, conditions in the United States reflect in due course of time on Canada, and the latest business reports from the former country say that the activity in building operations is an outstanding feature at the present time. As building in that country ranks second to agriculture, many million workmen are directly or indirectly dependent upon it. Many other lines show increased activity, and there appears to have been some decrease in industrial unemployment.

Unfortunately there still exists in both countries disturbing factors which militate against further improvement, high labor charges, high transportation rates and strikes being the chief trouble-makers. To clear up these difficulties will take time, but all things considered, the period of depression and discouragement is safely passed, and there is good cause for confidence in the future.

* * * *

A Disgraceful Suggestion

"CUT DOWN production to a point where all profits vanish." This, briefly, is the suggestion made by J. B. McLachlan, secretary of the United Mine Workers of America, to the mine workers in the Nova Scotia district.

Mr. McLachlan not only admits publicly that he made this suggestion, but he claims to see nothing dishonest about it. In fact, he says that this traffic, as a method of retaliation, is a good one. He openly defies the minister of labor, and remarks that he will continue to preach this doctrine, knowing that the miner has a perfect right to work with his coat on if he wants to. He proudly points to the fact that previous to the reduction in wages, a certain mine produced coal at a labor cost of $2.02 per ton, but that since the wage cut, the labor cost of coal production has increased to $2.25. Concluding, he remarks that "add the overhead charges on that miserable tonnage of coal, and you may be able to guess why the miners are singing as they fight against the unjust wage."

It is time these highly paid agitators were made to understand that there are limits to freedom of speech. A suggestion such as this man makes fairly reeks of anarchism. True Canadians will not tolerate this policy for it is dishonest to work for a full day's wage, giving in return only partial and grudging service.

Apart altogether from the recent wage reduction and dealing only with the point at issue, viz., the question of a fair day's work, it is to be regretted that by a vote of four to three the executive board of district 26 have adopted this disgraceful suggestion, calling upon the 12,000 miners of Nova Scotia to cut coal production to the profit-vanishing point. Already several men have been discharged for loafing, and the mine-owners should take a decided stand in this matter. It is to be hoped that Canadian common sense will override the new policy and that the Canadian miners will turn down this diabolical suggestion and see that it is to their own interests to give a fair day's work for a fair day's pay.

* * * *

Good Things Are Ahead

GOOD THINGS are ahead for our readers during the next four weeks. On April 6th we will have a story on the "Small Job and How Profit Can be Made on it," while in the April 13th number we start a most important series by an expert on "Lighting as a Manufacturing Asset." The following week the question of "Vertical Milling" will be discussed showing how money can be saved, while in the last issue in April we will tell of "Inspection Methods Which Have Proved Successful." Altogether a good month and one which readers cannot afford to miss. Watch for these articles and if the renewal of your subscription is about due be sure to renew.

* * * *

Will It Benefit The Workers?

CONSIDERABLE interest has been aroused in manufacturing circles by Ford's latest five day work schedule. The daily papers as usual rushed around haphazard asking offhand opinions regarding the feasibility of the new scheme. The result was that none of the opinions published showed anything vital to base judgment upon.

From Ford's point of view it may be all right, but to adopt the same principle to the average manufacturing plant is practically impossible. In the Ford plant, in fact, in any highly specialized factory, the workers are almost machines in themselves. Machinery speeds up production, and it is an altogether different proposition from machine tool building or general manufacturing. The Saturday afternoon off is a mighty good thing for any plant and a man needs this time for home duties and home life, but there is such a thing as having too much leisure.

If every Ford employe took advantage of the extra time given to better himself, then something of a really creditable nature would result, but for every one that devotes his added time to study, there will be ten who will take the opportunity to go joy riding or visit the many places of amusement. Should the employes all suddenly decide to study for better positions, Ford would soon have a new problem on his hands. After all is figured out, five days at the minimum wage of six dollars, is only $30. If a vote were taken among the workers themselves, it is more than likely they would favor the six day ruling with the added weekly wage. Money as well as leisure is essential, if home comforts are to be secured.

Iron and Steel Demand Shows Slight Increase

Prices on Steel Have Stiffened—Small Tools and Supplies are Selling at a Fairly Good Rate—Scrap Metals and Pig Iron Are Dull—Other Lines Merely Holding Their Own

MARCH SHOULD SHOW UP AS GOOD MONTH

COMPARING March business with that of last month there is a steady upward tendency on the Canadian market which cannot be ignored. Some branches show a greater gain than others, while a few sections merely hold their own.

The demand for pumping machinery has increased 25 per cent. over the corresponding period of last year, and using this same comparison, here is how other lines stand. Railway equipment and tractor supplies 25 per cent. increase, pipe fittings and valves 10 per cent increase, machine tools about 40 per cent. decrease, and machine shop supplies 10 per cent. increase.

Pig iron is still down, and scrap metals also remain weak. Boiler tubes and blue annealed sheets are in good demand, and an average amount of seasonable business exists in all other iron and steel lines. Orders are coming in more freely and are easier to secure, as manufacturers seem to have allowed their stocks to get to the low point. The average business closed is for immediate delivery and prices are stiffening all round. Dealers feel that the total business closed this month will exceed February by at least 10 per cent. Several good orders have been secured during the week, but no increase in quotations has taken place.

Larger discounts are being offered in wrought iron nipples these coming into effect immediately.

The small tool and supply business has picked up quite a bit during the week and one dealer reports more business during this week than any other similar period within the last six months. Several dealers felt sure that March business would be below the February mark, but an influx of orders during the last seven days has changed the situation so that an increase of at least 10 per cent. is expected.

Machine tools are much about the same, and no gain over last month is expected. Steel pipe is strengthening, and makers of this commodity have advised users that owing to orders on hand at the mills, they should place their requirements at as early a date as possible in order to secure service.

Oils, greases, and waste are in fair demand, no price changes having taken place in any of these lines.

Steel prices in the United States remain firm, and bars, shapes and plates show the greatest stiffening tendency. At present quotations range from $1.40 to $1.45 but there is quite a bit of talk to the effect that $1.50 will be the rate within the next week or two.

Wire nails are firmer and the sheet market is stiffening. One firm announces an advance of $3 per ton commencing April 1. Tubular goods are still being shaded, while tin plate remains steady. Steel ingot production is between 29,000,000 and 30,000,000 tons, which shows there has been no material change during the last month.

Furnace coke is firmer, $3.50 flat being the price for spot or prompt. Demand is rather light, but foundry coke is in slightly better demand and continues at $4.25 to $4.75 depending on brand. Pig iron is firmer and buying is light, although a slight improvement has made itself felt during the week.

Toronto

March 29

TAKING everything into consideration, March, locally, will show itself a better month than February. Some of the improvement which has occurred has been seasonal, but in other fields the upward trend has been a slow but gradual process since the start of the year.

Iron and Steel:—This branch of the trade has shown a steady gain during the month, and in the past week a decided tone for the better has made itself felt. Boiler tubes and blue annealed sheets are decidedly active, while other lines such as bars, small shapes, etc., are all moving at a fairly good rate. Orders for iron and steel goods are coming much easier, and there is not so much bickering about prices. In fact, all prices are stiffening, and while there has been no advance, there is some talk of a slight increase. Should the United States Steel Corporation put their price up to $1.50, it is almost certain local quotations would go up in sympathy. The orders being received are from a very scattered territory, which is a healthy sign. To show how business is picking up, we know of one salesman who secured orders for over 750 tons in less than a day, and without any sensational effort.

The annual report of the Steel Co. of Canada shows that while the surplus was drawn on to meet dividends, the company is in good shape in spite of the depression period they have been passing through. Even Mr. Hobson, the president, is satisfied with the showing, and while he refuses to voice any opinion regarding the outlook for the current year, he feels that business is improving, and that in all probability a moderate uptrend will continue. The new alloy steel company which may be located in Sarnia is discussed in another column. Following are present quotations:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron:—The demand for pig iron remains very light with little chance of immediate improvement. Prices are unchanged, $21.75 being the figure quoted on ordinary business. Foundries refuse to stock up until they see orders ahead, and as this is impossible at present, things must remain quiet. Another two months should see a slight improvement at least, according to several interested.

Non-Ferrous Metals:—No improvement can be reported in this section. Demand is still light, and there is no sense in altering prices for even such a move would have no results. Following are present quotations:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	26 00

Scrap Metals:—The demand in some lines is picking up slightly, cast iron borings and mixed turnings being featured. This material is being sold to outside points, but the margin of profit is very low owing to high freight rates. In many cases the freight cost is the highest item of all. As far as other lines of scrap are concerned, a certain amount of material is moving, but nothing to elaborate on. Following are present prices:

Copper, light per 10 0lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	15 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools:—The demand for all sorts of machine tools remains much the same. Several dealers may have an extra good week, while others recede a little. Taking an average, February and March will be about equal. Compared with the corresponding period last year, present business would be about 40 per cent. lower. Pumping machinery

shows an increase over last year of 25 per cent., while railway equipment and tractor supplies are up a similar amount.

Small Tools and Supplies:—Owing to the good business received during the week, dealers have a better story to tell than expected. It now looks as if March will show a 10 per cent. increase over February, and low stocks held by manufacturers seem to be the answer. One dealer told Canadian Machinery that he received more orders last week than he has done in any week during the last six months. Of course this cannot continue at such a rate, but averaging up the months since the start of the year, a steady upward trend can be noted. Pipe fittings, valves, etc., show a 10 per cent. increase over last month, so that in this field also an improvement was felt.

Steel Pipe:—This market is finding a good demand. In fact one mill has notified its customers that owing to the present orders on hand they suggest that firms requiring steel pipe place their requirements at as early a date as possible in order to secure service and protection. Prices remain firm.

Miscellaneous:—Oils, greases, and waste are in fair demand and there has been no changes in call or price during the week. The automotive trade is responsible for some of the betterment in several lines, but owing to lack of funds, the railways have not yet entered the market.

Montreal

March 29.

REPORTS FROM various sources regarding volume of business offering locally are varied and conflicting. However, in no instance does it appear that the past week fell below the previous one. The points along which reports differ seem to be in the amount of increased business, but no particular article is in special demand. Local business men attribute the better trend of business to the natural seasonable demand, and they point out that in a climate as rigorous as ours, certain activities are bound to be held up during the winter months, and that lack of activity in certain lines in the winter months is not a positive indication of the situation from a business point of view.

The centre of spring activity is still along the waterfront. In addition to the ordinary work of fitting out shore and floating equipment, there are several new buildings and quite a lot of new equipment that will be in use for the first time this spring. The Grand Trunk is increasing its elevator capacity and the Harbor Commissioners are rushing to completion their new cold storage warehouse, etc. In the local elevators there is a large quantity of grain awaiting overseas shipment. In fact there is every reason to believe that the record business of 1921, that passed through the Port of Montreal, will at least be equalled, if not exceeded in 1922.

Iron and Steel.—Several firms report that all lines have been moving more freely this week than last. Inquiries have been coming in more freely and office staffs are busier than they have been in some weeks, taking care of orders and prospective business. Throughout the Island of Montreal building activities are most marked. A large proportion of this building is to relieve the housing shortage, but there is sufficient building of a large nature, such as factory extensions, warehouses, office buildings, etc., to create an increased demand for structural steel. Reinforcing bars are moving more freely, and most of this business is being received from contractors and contracting companies. Firms such as the Dominion Bridge Co. claim they are figuring on a reasonably large number of jobs, but that only a few are expected to turn into real business. For the first time in many months the demand for merchant bars is making itself felt. This line has been practically dead for the best part of a year. The connection with British firms has not yet been reestablished, as prior to the war a great percentage of the merchant bars handled locally were imported from British mills. These quotations have not been as low as the American for some time past, and for that reason all bars produced outside the country that are handled locally are of United States manufacture.

Sheets and plates are still moving, and the only steel product imported from British mills to any great extent is galvanized sheets. Prices in all lines are firm. No actual advances have been made, but conditions in the States are being closely observed. The independent mills have agreed to a base price of $1.40 but some are agitating for a further increase to $1.50. The United States Steel Corporation is not increasing prices, up to the figure that the independents have agreed to maintain, but they have shown that they are in sympathy with a rising price. These factors are having a definite influence on local quotations, and there is every indication that the present firm prices will be revised upward in the near future. Most jobbers and dealers are not carrying heavy stocks, therefore any further increased mill quotations will be promptly reflected locally. The present quotations are as follows:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—The pig iron situation is not at all satisfactory from the producers' point of view. Quotations for No. 1 iron, 2.25 to 2.75 Silicon, rule at $29.80. United States conditions have a very definite influence with this commodity, and although it has been definitely determined that the cost of producing pig iron at Buffalo is from $21 to $23, yet the prices asked run from $18 to $18.50. It is illegal to import goods into Canada that are invoiced below producers' cost plus a fair profit. Thus pig should not be shipped into Canada at Buffalo quotations, but nevertheless iron is coming into the country. Some firms, with international connections, flatly state they cannot comply with recent Canadian Customs regulations and will not accept Canadian business. At present local quotations the Canadian firms are said to be losing money. The demand has fallen off a little during the week, and there is no immediate chance of any improvement in the near future. Foundries do not look forward to anything but a nominal increase in business, so that present quotations will no doubt be maintained.

Machine Tools and Supplies.—A little better demand is evident in the machine tool field, but dealers are not satisfied with the present volume of business. Recent price reductions have had the effect of interesting a larger number of prospects, but it is still difficult to close business. Supplies are somewhat improved. Quite a volume of repair work is being given out and contract shops are coming into the market for supplies in a more satisfactory manner. There are no radical price changes, and orders are being aggressively sought.

Non-Ferrous Metals. — Very little change has occurred in the non-ferrous metal market. No change in price has been made, and the small demand for the past few weeks is just about holding its own. Local quotations are:

Lake Copper	16 75
Electric Copper	16 50
Castings, Copper	16 25
Tin	34 00
Spelter	7 00
Lead	6 50
Antimony	6 50
Aluminum	23 00

Scrap Metals.—A slightly better tone in the scrap metal market is evident. Prices are not changed. Contract shops are responsible for the increased demand, but this is not large enough to influence the market.

Copper, light ..... per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	18 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	3 00

Pittsburg

March 29.

PITTSBURG.—(Special to Canadian Machinery.)—Enough time has not elapsed since the last softening in price of any steel product to make it clear

that the long decline in prices has ended. Prices may decline any number of times in the future history of the steel industry, but this one decline is over. Steel prices are now stiffening, rather than advancing, but the stiffening is likely to merge into actual advances of greater or less importance. Bars, shapes and plates, which led the decline, and went farther relative to cost of production than any other steel commodity, show the greatest stiffening. In the past fortnight or so 1.40c has been the minimum of the market, whereas for awhile this price was shaded in numerous cases by $1 to $2 a ton, perhaps a trifle more in some cases. In the past week the less desirable orders, including carloads, have been going largely at 1.45 and 1.50c. Predictions are freely made that in a short time, perhaps a week or two, the minimum of the market will be 1.50c. The mills are very anxious to get the price up at least to the price of production, though at the same time they are anxious to book all the tonnage they can.

In wire nails the price situation is much improved from the mill standpoint. A month ago, shortly after the market had declined to $2.40, shading of this price developed and it appears that almost all large buyers were able to get concessions down to $2.30 or even $2.25. In the past three weeks there has been no shading at all in evidence, the market being firm at $2.40.

Sheets Improve.—On the surface at least the sheet market looks stronger. That is, the Wheelin Steel Products Co., announced on March 22, that on April 1, its prices would be advanced $3 a ton, and the trade has been looking for other producers to make somewhat similar announcements. However, it is not certain that such episodes really prove the sheet situation to be stronger, for in some quarters it is said that the mills in general are booking little business at current prices and announcements of advances to be made in future may have as their chief object the driving in of business at current prices.

In tubular goods there is shading still, but there is no evidence that the shading is greater than a month ago, and it may be somewhat less. In tin plate there is a very steady market. large lots going at $4.60 and small lots at $4.75.

From the points mentioned, and other considerations, it is plain that the decline has ended and steel prices are in general presenting a stiffening tendency. It is out of the question, of course, for there to be any large advance. Before the war it was held that steel prices could not advance to any extent if mill operations were at under 85 per cent., while the operation now is about 55 per cent. and the most sanguine estimate is that the rate will be up to 70 per cent. by June 1. Small advances, to get prices up to the full cost of production, are another matter.

The Future of Demand.—There is much more divergence of opinion as to the future of the steel market than there has been at any time for a long while. The lines of division are clear cut. The difference is not as to the actual facts so much as to the interpretation of the facts. Some assert that steel demand will continue to increase, because it has been increasing since the first of the year and spring has now arrived. Others assert that the increase in demand lately has not been in keeping with the general industrial and financial situation and claim part of the buying has been for replenishment of stocks, hence does not need to be done over again. Some observers with long experience contend that it is plain the country is not actually consuming steel at the rate at which deliveries from mills are being taken.

April will undoubtedly tell which party is right. If there has been much stocking, part of it at least has been prompted by fear that after April 1, on account of the union walkout at the bituminous coal mines, the production and shipment of steel might be interfered with. Such buyers would not take steel with equal freedom in April. As a matter of fact it is entirely improbable that the coal strike will have any direct influence in curtailing mill or railroad operations. The continued softening in the coal market in the past three weeks, with lighter and lighter demand, shows that consumers are satisfied with their stocks of coal, and there is no reason to suppose they have underrated the strength of the walkout, which has been very well advertised for months past. There is direct testimony as to the steel mills, that they have good stocks of coal, while there are likely to be fairly heavy shipments from the Connellsville and other non-union regions.

On the whole there has been no material change in the general rate on mill operation, though some lines are doing a little better and others not as well. Current estimates are that the rate of steel ingot production is between 29,000,000 and 30,000,000 tons a year, which would mean that there has been no material change for four weeks. From January 1 until about four weeks ago the rate was rising rapidly. However, the Carnegie Steel Co. recently announced that it would blow in six more blast furnaces by April 1, giving it 35 in operation out of 59, and that would make quite a change though of course there may be decreases elsewhere.

Connellsville furnace coke is quotable higher, at $3.50 flat for spot or prompt. Demand has been light in the past week, but previously there was good absorption, taking up all coke offered at under $3.50, some of it at down to $3.25. Between 400 and 500 additional merchant ovens are going in, largely perhaps because the coke market looks so promising while it has been increasingly difficult of late to sell coal. Foundry coke continues in good demand at former prices, $4.25 to $4.75, depending on the brand.

The pig iron market seems quite firm now, with prices stiffly maintained at $19.50 for Bessemer, $18 for basic, and $19 for foundry, f.o.b. valley furnaces, freight to Pittsburg being $1.96. Buying is rather light, but seems to have improved somewhat, while shipping instructions against old contracts are better. Predictions continue that Lake Superior iron ore prices will be down about a dollar a ton, f.o.b. Lake Erie docks, for the 1922 season, following the dollar decline for last season, but no early action in the market is expected.

EXPECT ANNOUNCEMENT OF MACHINE TOOL MERGER

Plans have almost been completed for the amalgamation of a number of machine tool manufacturing companies in the States. Details are now being arranged. The companies mentioned are the Betts Machine Company of Rochester, N. Y. The Colburn Machine Tool Co., Cleveland; the Newton Machine Tool Works, Philadelphia; the Modern Grinder Manufacturing Company, Erie, Pa.; the Carlton Machine Company, Cincinnati; the Lodge & Ship Machine Tool Company, Cincinnati and Hilles & Jones Company, Wilmington, Del. In addition to those mentioned several other companies are involved. The new corporation will lean particularly toward the manufacture of equipment for railroads, at the same time turning out a fairly complete line of machine tools for all purposes. It is thought the American Locomotive Co., is behind the movement.

NEW PLANT IS PLANNED

The Dominion Alloy Steel Corporation has been incorporated with an authorized capital of $15,000,000. The intention is to establish a plant at Sarnia, Ont., and undertake the production of alloy steel in Canada. Among the men interested are Geo. A. Simpson, sales manager and special representative of the Steel Co., of Canada; Harry R. Jones, president of the United Alloy Corporation, Canton, Ohio; C. Harold Wills, president of the C. H. Wills Motor Co.; J. J. Mahon, formerly chief engineer of the Crucible Steel Co. of America; Sir. Wm. Mackenzie, Toronto; Wallace Jones, Toronto, and others.

Reports published to the effect that Sir Frederick Becker, representing an English syndicate, is negotiating for the purchase of a large percentage of the pulp output of the Riordon Co., Kipawa Mill, were declared by officials of the Riordon Company, to have been unfounded. In denying the truth of this rumor, A. W. Killam, pointed out that a very vital reason why the Kipawa Mill would not be likely to enter the overseas export business, lies in its geographical position in relation to the seaboard. Mr. Killam further stated that under normal conditions, the established clientele of the Riordon company would require the entire pulp output of the mill in question for the manufacture of high-class papers and artificial silk. He also stated that the Kipawa plant had been running from half to full capacity all this year, and that at the present it is running at capacity.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 4
Tank plates, Pittsburgh mill price	1 40
Structural shapes, Pittsburgh mill prices	1 40
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 3 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 00
Castings, copper	16 25	17 00
Tin	34 00	34 50
Spelter	7 00	7 25
Lead	6 50	6 75
Antimony	6 50	6 75
Aluminum	23 00	26 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.55	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 00	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 50	3 50
Medium brass	4 50	4 50
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00
	Per Ton	Gross
Boiler plate	$9 00	$9 00
Heavy melting steel	9 00	10 00
Axles (wrought iron)	17 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	18 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	18 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 24½
Solder, guaranteed	0 26
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 25	...
Galvanized sheets, No. 28	5 55	...
Queen's Head, 28 B.W.G.	7 00	....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 35
Linseed oil, raw, single bbls.	1 00

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets, 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored.13

Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

The Timkin Roller Bearing Co., have taken a floor in the Walker building, Walkerville, Ont.

The Universal Wrench Co. of Windsor, Ont., plans to move its plant to Amherstburg, Ont.

Tudhope & Ludgate, Parry Sound, Ont., is in the market for equipment for a proposed saw mill at Deer Lake, Ont.

The United Auto Supplies Ltd., Montreal, is in the market for machine tools and lathes for general auto repairs.

The Air Reduction Co., have purchased all assets, trademarks, including patents and trade names of the Davis-Bournonville Co., Newark, N. J.

The Goderich Salt Co., Goderich, Ont is in the market for special salt handling equipment and additional equipment to double its capacity, estimated cost $30,000.

The article appearing in last week's issue on "Controlling the Cost of Labor and Output" was compiled from information obtained through the courtesy of the International Business Machines Co.

Canada's total imports last year were valued at $799,394,598 of which $123,-149,000 represented the United Kingdom and $555,308,193 the United States. The exports totalled $802,699,820.

The partnership between Edward Woods and A. Ouellette, of the Wood-Ouelette Machinery Co., Amherstburg, Ont., has been dissolved and in the future the business will be carried on by Mr. Woods.

The city council of Chicago, has designated the week from April 2nd to April 8th as Canadian week, to celebrate the 104th anniversary of Peace and uninterrupted social and business intercourse.

Leslie H. Taylor, formerly sales manager of the machine tool division of the Greenfield Tap and Die Corporation, at Greenfield, Mass., has resigned to accept a position as sales manager with the Williams Tool Corporation at Erie, Pa. The Canadian branch of the latter company is located at Brantford, Ont.

The Waterloo Board of Trade is making an active effort to bring another large foundry to the city. The foundry now employs 60 men and if brought to Waterloo it is the intention of the company to secure additional capital, double the capacity and give employment to over 100 hands.

The members of the Woodstock board of health have come to the conclusion that Woodstock, Ont., needs an incinerator for the disposal of its garbage. An incinerator to meet the city's needs would cost $38,500 and the city council will be asked to submit a by-law on the subject at the next municipal election.

Official figures of newsprint production show that in January and February of this year, Canadian mills produced 159,712 tons as compared with 135,125 tons of the similar period of 1921. Shipments stood even better, showing 164,-031 as against 128,935 tons a year ago.

In the event of restricted coal production in the States, as a result of the miners ceasing operations, it is expected that adequate supplies will be received from Britain to take care of Canada's needs. Inquiries are now being made in London freight circles as to rates on coal shipments to Canadian ports.

R. Hermer, president of the Sawyer-Massey Co., Hamilton, Ont., in commenting on the general conditions of the company, stated that the company's plant is being operated at about 50 per cent. of its capacity; efforts are now being centred on the manufacture of engines and road making machinery, the sale of which is encouraging.

During the month of February, according to the regular monthly statement of R. C. Coffey, manager of the Lake Shore Mill, Kirkland Lake, Ont., the mill reduced 1.961 tons of ore and produced $44,082. The mill ran 97.17 per cent. of the possible running time, and treated an average of 70 tons of ore daily. The grade of the ore continued high at $22.48 recovered from each ton treated.

A. G. Pounsford, manager of the Port Arthur division of the Provincial Paper Mills, has announced the actual commencement of work on the construction of a paper mill extension of the company's present plant. The extension is to be completed by May 1, 1923, and at an estimated cost of $1.500.000. The first contracts for machinery, for 700 tons of structural steel and for the building have been let.

The report of the E. W. Bliss Company of Brooklyn, shows a small increase in net profits in 1921. Its net earnings were $2,925,125 after payment of expenses. Federal taxes and inventory adjustments, or $9.28 a share earned on the 300,000 shares of its no par common stock. In 1920 its net profits were $2,376,338 or $7.53 a share. The company's surplus was increased from $18,925,133 in 1920 to $19,368,409.

Large additions will be made to the cold storage plant at Grimsby, Ont. For several seasons this warehouse has been operated under the direction of the Dominion Department of Agriculture as an experimental plant, but has been turned over to the Growers' Cold Storage and Ice Co. Under the new arrangement the capacity of the warehouse will be quadrupled, and improved refrigeration will be installed, as well as mechanical facilities for the manufacture of ice.

White and Henderson of Sudbury have just completed the installation of a pumping system for the water supply for the town of Sturgeon Falls.

George Valentine, vice-president of the Massey-Harris Co., has been appointed president of the Bain Wagon Co. The latter company is now controlled by the Massey-Harris Co.

Henry E. Brennan, recently mechanical superintendent of the British American Nickel Corporation at Nickelton, Ont., has become associated with the firm of White and Henderson of Sudbury, Ont.

Canada Illinois Tools, Ltd., 163-187 Dufferin St., Toronto, has been incorporated for the manufacture of hobs, milling cutters and small tools. Harold C. Smith, president of the Illinois Tool Works, Chicago, is president, R. L. Danielson, treasurer and assistant secretary, Donald J. Noble, secretary and J. D. Sherman, vice-president and managing director.

A statement just issued by the Dominion Bureau of Statistics shows that in 1919 there were 38,344 manufacturing establishments in Canada, with an invested capital of $3,230,686,368. At that time Ontario headed the provinces in the number of establishments, the total being 16,438; Quebec was second with 11,061.

More men are to be put to work almost at once on sections one and two of the Welland Canal, according to the contractor, who says dredging work will be resumed soon at Port Waller Harbor. The big dredge Sandy is to be taken over from Port Dalhousie and set at work soon. A big force of men will be needed. Mr. Porter said on sections one and two only a hundred or so men worked all winter.

A. B. Muddiman, assistant trade commissioner in London to the Canadian Government, has temporarily taken over the trade commissioner's office at Bristol, in succession to Norman Johnson. Mr. Muddiman has recently completed a tour of Canada and is therefore well informed as to the prevailing trade condition. Mr. Muddiman's brother, Alexander Phillips Muddiman, C.S.I. has the distinction of being the first president of the Indian Council of Trade.

Because of work upon industrial establishments, the building outlook in Brockville, Ont., is brighter than for some years past. The major work to be carried out this season will be the construction of the plant of the Eugene Phillips Electrical Works, which is moving from Montreal. The Bank of Toronto is about to commence the erection of new premises and there is a marked increase in the number of permits for the building of business and residential properties.

The new asphalt plant at Windsor will be ready for operation early this spring. The opening of this plant will mark a new era in the construction and upkeep of city streets, because it will mean the advent of sheet asphalt as a surface metal.

Employment is improving. At the beginning of February 1922, according to returns which will shortly be issued by the labor department, the percentage of unemployment in Canada among members of trade unions, stood at 13.9 as compared with 15.1 at the beginning of January, and 13.1 at the beginning of February 1921. According to reports received from over 6,000 employers, employment registered expansion during February, as compared with January, but the situation was somewhat less favorable during the corresponding period of last year.

Mr. Geo. Valentine, vice-president of the Massey Harris Co., who is in charge of the manufacturing, and a director of the company, was recently appointed president of the Bain Wagon Co., of Woodstock, Ont. The Bain Wagon Co. is controlled by the Massey-Harris Co. Mr. Valentine is a remarkably able manufacturer and one of the young captains of Canadian industry who has come forward rapidly in the past few years. It will not be necessary for Mr. Valentine to leave Toronto, according to a statement made by representatives of the Massey-Harris Co.

Sherbrooke, Que., weathered the storm of industrial depression in 1921 in excellent shape, and, so far from witnessing a falling off in production, saw new industries added to her total. Among these was an addition to the cotton mills representing an investment of $5,000,000; a plant to manufacture gloves, hosiery and underwear, capital $3,000,000; a plant to manufacture super heaters for locomotives, costing $250,000; extension to plant making pulp and paper machinery, costing $200,000; jewellery manufacturing establishment, costing $50,000; establishment for manufacturing piston rings, costing $25,000.

Robert J. Magor, president of the National Steel Car Corporation, while paying an inspection visit to the Canadian plant at Hamilton, spoke very encouragingly of the prospects for business in car repair and construction during the present year. Mr. Magor said he based his opinion on the fact that during the first two months of this year the larger railways of the United States had purchased no less than 50,000 cars, a number that was equal to the entire output of car building companies during 1907. Another encouraging fact as regards the immediate future was that the large number of idle freight cars in the United States was being rapidly absorbed. At present these idle cars had decreased to 50 per cent. of what they were a few months ago. This fact proved that business was improving. There were few if any idle cars during good times.

OBITUARY

Robert Patterson, for many years master mechanic of the G. T. R. shops in Stratford, died last week after a prolonged illness. Deceased was born in Brantford, 62 years ago and commenced his railway career as an apprentice in Montreal in 1874. He assumed the position of general foreman of the shops at Toronto in 1888, when the Grand Trunk took over the Northern and Northwestern Railway. In 1897, he was made general foreman of the shops at Port Huron, Mich., and the same year master mechanic of the Grand Trunk lines west of the St. Clair River. In February, 1893, he was transferred to Stratford and assumed the position of master mechanic, which he retained until 1917. In 1917, he was loaned from the Imperial Munitions Board to the General Car and Machinery Co., at Montmagny, Que., to re-organise the shell plant at that place.



The late Robert Patterson, formerly Master Mechanic of G.T.R. Stratford Shops.

A manufacturer's representative in Brisbane, Queensland, Australia, can give good business to manufacturers of gas taps for stoves and grillers, etc., and invites export price lists and all particulars. Quotations and samples of bolts and nuts are also invited, with C. I. F. prices and guarantees as to deliveries. Firms making cash box locks should send samples and prices and discounts of all grades of locks. Brush manufacturers not already represented may secure good business, and are invited to send quotations and samples of scrubbing, laundry and nail brushes. In this case an agency agreement would be required. (R 102 S)

A fair amount of industrial building in Welland is forecast by the Industrial Commissioner, B. J. McCormick. He specifies an addition to Empire Cotton Mills, a plant for the newly formed Welland Cotton Mills; a plant 400 ft. long for the production of seamless tubes by the L. R. Weeks Co.; an addition 400 ft. long to the Electric Steel and Metal plant. In addition to these four building enterprises that will be proceeded with inside the city, Mr. McCormick stated there were three proposals to construct plants outside the corporation limits, two of which would probably be closed before the end of March.

Fire of an unknown origin started in the basement of the Packard Electric Co., St. Catharines, Ont., on March 22, where a quantity of oil was stored. Six large completed transformers for the Hydro-Electric Commission were in the cellar which was flooded with water. Until the effect of the water on the transformers is known the damage can not be determined.

A contract for 8,500 tons of girder and high T-rails has been placed by the Toronto Transportation Commission. This order was secured by the Toronto office of United States Steel Products Co., and the price is stated to be very satisfactory for the purchasers. The above quantity will cover Commission's rail needs for the season. Delivery will be made in 1,000 ton lots at intervals as required until September. The business is placed subject to the provision of funds by city council. Tenders have been called for accessories and this additional business will probably be placed within a few days.

Little or no change in the operation of the steel industry in Canada in recent weeks is reported by W. F. Franz, president of the Algoma Steel Corporation who was in Toronto recently on his return from the regular monthly directors' meeting of the Lake Superior Corporation in New York. Mr. Franz stated that his company's plants were operating at about 60 per cent. of capacity, and while there were no new orders of importance immediately in sight, he had expectations that coming months would bring new orders and larger business. There was a distinct improvement in feeling, he said, among steel interests in New York, and the impression was general that the worst had been experienced and a gradual improvement could be looked for.

In an address recently James Cormack, of Ottawa, who has just been appointed junior trade commissioner to South Africa, stated that it was the business of the trade commissioner to report to Ottawa all possible opportunities for the sale of Canadian products in the countries in which he was stationed. The trade commissioner would also advise exporters on all questions having to do with packing and documentation of goods shipped to the country to which he was accredited. Another service that was performed for the Canadian manufacturer or producer by the trade commissioner was the introduction to him of persons who would be suitable to act as representatives of the Canadian enterprise in the other country.



IMPROVEMENT IN THE EAST

The Royal Trust Co., of Halifax, is receiving tenders for the Davison Lumber lands and equipment.

The Eastern Trust Co., of Halifax, is taking tenders for the Broughton Hardwood Products, Ltd., machinery and fixtures.

The Yarmouth, N. S. Light and Power Co., have an application before the Public Utilities Commission for permission for a $150,000 bond issue, the money to be expended on completion of the plant.

One of the old industries of Yarmouth, N. S., which has been dormant for twenty-six years, the Milton Iron Foundry, has been taken over by Yarmouth parties and started in operation.

Boring for oil is to commence at Bert McDonald's farm, Meadowville, Pictou County, N. S., the latter part of April. Pictou and Stellarton men are the promoters. A hole was sunk in the same vicinity some years ago, but was eventually abandoned.

The town of Truro, N. S., wants hydro electric power and the secretary and consulting engineer of the N. S. Power Commission will be there this week to look into the situation as to possibilities and requirements and attend a meeting of parties interested at the Truro civic building.

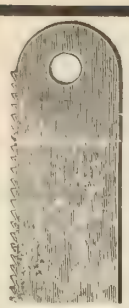
At the annual meeting of Thompson & Sutherland, Ltd., North Sydney, H. T. Sutherland was re-elected president and general manager, Henry McArel, vice-president, and W. S. Thompson secretary-treasurer. The company's foundry is at present working four days a week with a staff of about sixty, a third less than in normal times.

At this month's meeting at Sydney, of the Cape Breton branch of the Engineering Institute of Canada, S. C. Mifflen, A.M.E.I.C., read a paper on the operation and equipment of the iron ore mines at Bell Island, Newfoundland. On the island five distinct seams of iron ore crop up, but only three are known to be workable. Within the past year the Dominion Iron and Steel Co., put in commission a turbo-electric power station of over 3,000 horse power. The power house is built on the sea shore line and a pier for storing coal is built about it, the foundations being laid in 18 feet of water.

The dispute in connection with the development of power at St. Margarets Bay, near Halifax, has been settled, and the Tramways Company have commenced operations; excavations have been begun for concrete bases for a line of towers to carry the power from Armdale, a city suburb, where the receiving station had been built, to the Tramway's station, a distance of about a mile and a half, and large transformers are to be installed at the Tramway station. This station is at the south end of the city harbor front, and at the north end of the water front the Halifax Shipyards are installing transformers to handle the power coming to the plant from the Tramways. It is expected the power will be coming into use here next month.

The St. Thomas Packing Co., of St. Thomas, Ont., one of the most prominent packing companies of Western Ontario, has decided to erect at Welland, Ont., a storage plant for the handling of its rapidly growing business in the Niagara Peninsula. The company will put up the plant at a cost of $50,000 on a location, for convenience, near the city market, and three or four sites are under consideration.

The development of the power plant of Manitoba Power Co., it was stated at the annual meeting held in Winnipeg, is progressing very satisfactorily, over 500 men being employed on the works. The transmission line from the Winnipeg Electric Company's hydro-electric plant to the work, a distance of 17 miles, has been completed, and power is now being used in connection with the construction work. The orders for the hydraulic and electrical equipment have been placed. The turbines are being made by the Dominion Engineering Co. at Lachine, Que., and the generators by the Canadian General Electric Co. The switchboard and the Kingsbury bearings are being made by the Westinghouse Co.



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SIMONDS

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"The Saw Makers"

Montreal, Que.

St. John, N.B. Vancouver, B.C.

GETTING READY FOR INCREASED BUSINESS

"THERE is not much business moving in machine or wood-working tools at the present moment," according to R. M. Hamilton, works manager of the Canada Machinery Corporation, Galt, but this fact does not prevent Mr. Hamilton from displaying a good amount of sane optimism. He feels that things are bound to right themselves, and as he says, "we have in Canada one of the finest countries in the world. In fact the only country whose possibilities have not yet been fully discovered, therefore why should we be pessimistic?" Among many other things, Mr. Hamilton mentioned the gold mines which are now an established success in Canada, as compared with the present mining trouble in South Africa. "If we can successfully produce gold in Canada," he said, "we can likewise compete in other manufacturing lines with the markets of the world."

Continuing, he pointed out that while they had expected an improvement in wood working machine demand this spring, it had not developed as yet. He felt, however, that perhaps it was merely a little delayed, and that it would come along later on in the season. So far, although building of homes and furniture is improving, they have not felt any better tone, as wood-working factories were still taking up the slack. "Let building and furniture making continue," remarked Mr. Hamilton, "and in a short time we will be bound to feel the benefit."

The Canada Machinery Corporation has been doing considerable development work recently, and speaking to Mr. Neill, sales manager of this concern, Canadian Machinery secured the following information:—Standard lines of wood working machines are rather slow just now, but special tools, are becoming in better demand, although usually only one, or a very few machines are required at a time. This involves a great amount of drafting and pattern work, and at present these two aforementioned departments are working 55 hours a week developing and designing new tools. Four new machines have been brought out this year, and more to follow. Among the special tools developed is a planer for planing the curves on school desk seats. Then there is a special planer and cutting machine for making battery box separators, this calling for very accurate work as the separators are made very thin. Briefly, the piece is 5/64 in. at the thickest portion and less than 1/32 in. at the thinnest point. Ribs occur about every ½ in., these being about 3/16 in. wide. It is a very difficult piece to make, and calls for careful design in the machine itself. Ball bearings form a part of the equipment, and incidentally, this firm is devoting a great deal of time to research work, planning the proper type of bearing to use for various purposes. They have also brought out a Ryerson friction saw, this machine carrying a saw 50 in. diameter. This is a high speed machine which is fully patented.

The chief feature, which impressed Canadian Machinery, is that this firm has absolute faith in Canada and its possibilities. They feel sure things are bound to pick up to normal again, and are directing every energy to getting ready for the improvement when it does arrive.

Oil Tempered
Steel Springs



for every purpose and the best for each use.

Special styles of all kinds to order.

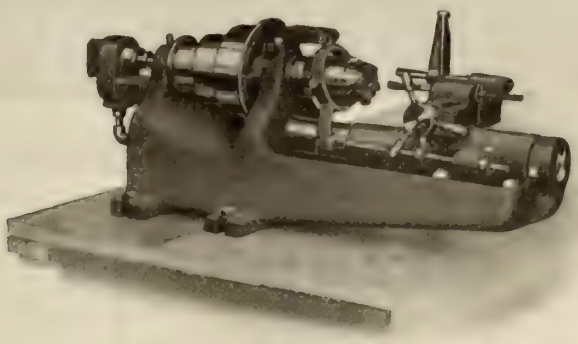
THE CLEVELAND WIRE SPRING COMPANY

Cleveland, Ohio U.S.A.

STRENGTH IN STEEL IS LOOKED FOR

Without definitely committing himself, E. H. Gary, chairman of the U. S. Steel Corporation, intimated that there was a strong possibility of an increase in the price of steel products. He believed that the business trend at the present time was upward. Corporation plants are operating at about seventy per cent. of normal.

Mr. Kerr, of the Preston Woodworking Co., says that they are finding business as good as can be expected under the circumstances. He feels they are getting a good share of any orders that are going, and is firmly convinced that aggressive sales methods are essential to-day if work is to be secured. This firm is developing several new machines, and are embodying ball bearings as part of the equipment. Another feature on one machine being designed at present is a grinding attachment which permits the grinding of the knife blades without their removal from the cylinder. The roll feed on this same tool is made in sections, rather than in one piece, this guaranteeing that work being fed into the machine at any position on the table will be securely gripped.



Geometric Bench Threading Machine

Compact
Sturdy
Complete

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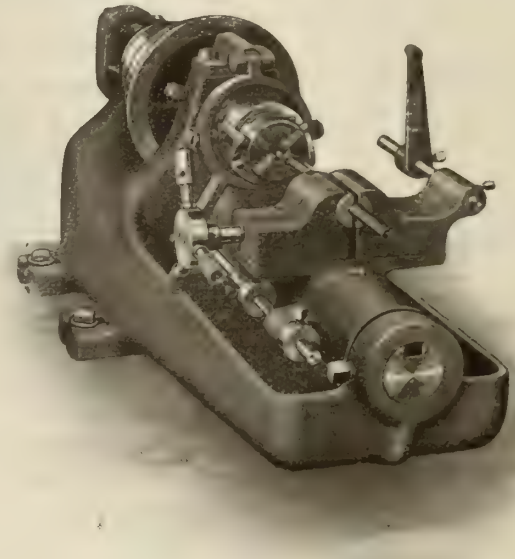
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ANOTHER GEOMETRIC LEADER

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The Geometric Bench Threading Machine is a wonder on small threaded work. It weighs but 90 pounds and takes bench space of only 9½″ x 29 inches. The 5/16″ Geometric Rotary Die Head with which the machine is fitted cuts threads of standard and finer pitch on diameters 1/16″ to 5/16″ inclusive. The machine is arranged for bolting to a bench, or it may be mounted on a separate pedestal for floor use.

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Two cents a word, including "Canadian Machinery' box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

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IF YOU ARE LOOKING FOR A HIGH-GRADE firm to handle through the hardware jobbers and consuming trade throughout the Dominion, write us. It will be worth your while to investigate the special features of our marketing proposition. We know what co-operation means. Write to Box 860T., Canadian Machinery.

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WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (etfm)

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ASK US.
THE KATIE FOUNDRY, GALT, ONT.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

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ONE J. & J. TAYLOR SAFE, INSIDE DIMENsions 15 inches deep, 2 feet 6 inches wide, three feet 11½ inches high and fitted with a ouilt in compartment. Price $250.00.

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FOR SALE:—ARCWELL ELECTRIC WELDing outfit, Heald Internal Grinder, 10 Pyrometers, Portable Crane, 5 Elevating Trucks, 1 four spindle drill, Sandblast outfit, several tool grinders, Warner Swazey screw machine 300 feet Matthews' Gravity Conveyor, 3 Tool Furnaces. This equipment almost new will sell cheap. Box 802L.

SITUATIONS WANTED

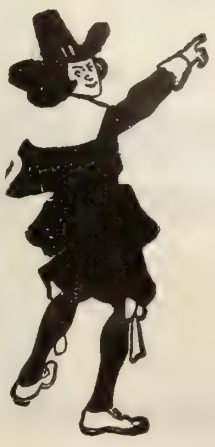
SALESMAN, 6 YEARS' MACHINE TOOL EXperience, 10 years general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery, (c23m)

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Two cents per word. Minimum for one insertion $1.00. Box numbers can be had for 10 cents extra. Replies are forwarded immediately, and without additional cost.

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Tallman Brass & Metal, Ltd.
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Brass, Bronze and Aluminum.

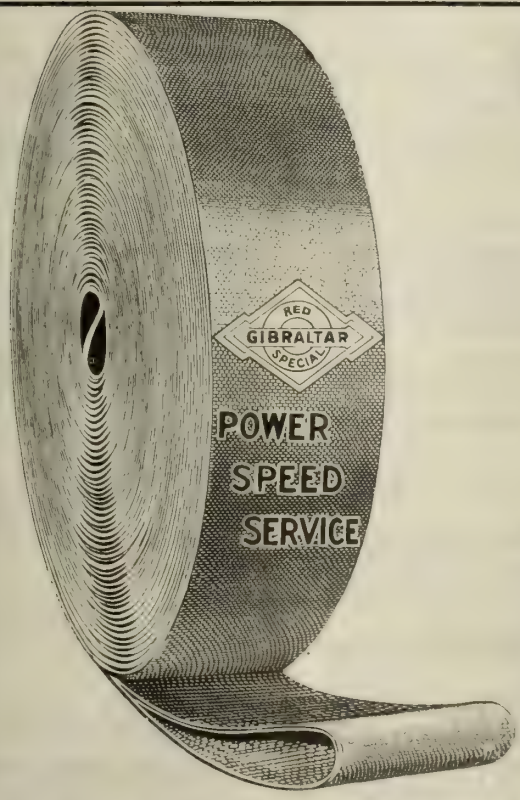
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Oakey & Sons, Ltd., John London S.E., Eng.

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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Petrie, Ltd., H. W., Toronto, Ont.

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Kempsmith Mfg. Co., Milwaukee, Wis.
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Skinner Chuck Co., New Britain, Conn.

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Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Band Saws,
Oliver Machinery Co.
Preston Woodworking Machinery Co., Ltd., Galt, Ont.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
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United Alloy Steel Corp., Canton, Ohio
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Belt Dressings and Fillers
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
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Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
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Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
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McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

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National Acme Co., Montreal, Que.
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Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Boring, Drilling and Milling Machines, Horizontal
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Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

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Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

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Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

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Can. Link-Belt Co., Toronto, Ont.
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Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

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Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
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Jacobs Mfg. Co., Hartford, Conn.

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Canadian SKF Co., Toronto, Ont.
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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
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Chucks, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
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Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
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Chucks, Tapping
William I. Procunier, Chicago, Ill

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn

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Brown & Sharpe Mfg. Co., Providence,
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Oakite Chemical Co., New York, N.Y.

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Clocks, Time
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Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

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Can. Link-Belt Co., Toronto, Ont.
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Can. Link-Belt Co., Toronto, Ont.

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Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

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Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E. Eng.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

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Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

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Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

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Canada Metal Co., Ltd., Toronto, Ont.

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Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

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Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Bliss Co., E. W., Brooklyn, N.Y.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Limited, Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd. Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill
Pilot Steel & Tool Co., Montreal, Que.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Die Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drilling Machines, Bench
Burke Machine Tool Co., Conneau Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

Drilling Machines, Multiple Spindle.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Stemie Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Northern Electric Co., Montreal, Que.
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Equipment, Elevator Safety
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan
Goldie & McCulloch Co., Ltd., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filing Machines
Williams Machinery & Supply Co., A. R., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings, Limited, Oshawa, Ont.

Flexible Shafts
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

Foundry Equipment
McDougall Co., Ltd., R., Galt, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que

Furnaces, Electric
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Johannson Inc., C. E., Ploughkeepsie, N. Y.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Thread
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Limited, Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd, The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiten Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Ford-Smith Machine Co., Ltd., Hamil-Hamilton, Ontario.
Hamilton Gear & Machine Co., Toronto, Ontario.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Gravity Carriers
Mathews Gravity Carrier Co., Port Hope, Ont.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont
Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
Modern Tool Co., Erie, Pa.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cincinnati Electrical Tool Co., Cincinnati, Ohio.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Wheels
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co. of Can., Ltd., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis

Hack Saws, Power
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

Hammers, Drop
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Williams Machinery & Supply Co., A. R. Montreal Que.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.
Crescent Machine Co., Ltd., Montreal, Q.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

BUYERS' DIRECTORY

Lathes, Bench
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dalton Mfg. Corp'n, Sound Beach, Conn.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Cowan Co. of Galt, Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Lighting Fixtures
Northern Electric Co., Montreal, Que

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Manganese Steel
Can Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence,
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Fairbanks-Morse Ltd., Montreal, Q.
Ford-Smith Machine Co., Hamilton, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Brown & Sharpe Mfg. Co., Providence.
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence.
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery & Supply Co., A R. Montreal, Que.

Milling Machines, Vertical
Brown & Sharpe Mfg. Co., Providence.
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Pattern Shop Equipment
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Crescent Machine Co., Ltd., Montreal, Q
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Limited, Oshawa, Ont

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Crane Ltd., Montreal, Que
Rice Lewis & Son, Ltd., Toronto, Ont

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planing Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
J. R. Baxter & Co., Ltd., Montreal, Que
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Ferrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Stoll Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

BUYERS' DIRECTORY

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal Q.
Hepburn Ltd., John T., Toronto, Ont

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Limited, Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto

Saw Frames and Blades, Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.
Preston Woodworking Machinery Co.,

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R.I.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co.
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Dominion Sheet Metal Corp., Hamilton, Ont.

Sheets, Nickel, Reaist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber
Crescent Machine Co., Ltd., Montreal, Q.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

BUYERS' DIRECTORY

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Switches and Switchboards
Northern Electric Co., Montreal, Que.

Tachometers
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. I. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H., Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio
Geometric Tool Co., New Haven, Conn
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis.
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Tool Work
Brown Engineering Corp., Ltd., Toronto.
Crescent Machine Co., Ltd., Montreal, Q.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Montreal

Unions, Pipe
Crane Ltd., Montreal, Que
Fittings, Limited, Oshawa, Ont.

Universal Joints
Ford-Smith Machine Co., Hamilton, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal Q
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.
Northern Electric Co., Montreal, Que

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto
Davis-Bournonville Co., Jersey City, N.J
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont
National Electro Products Co., Ltd.

Welding Machines, Electric.
Lincoln Electric Co., Toronto, Ont.

Welding Machines, Oxy-Acetylene
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Supplies
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Company, Wallace, Hamilton,
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton,

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Shuster Co., F. B., New Haven, Conn.
Sleeper & Hartley, Inc., Worcester, Mass

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery Co., A. R., Toronto Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co Montreal, Que.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

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WEST PENN. BY-PRODUCTS CO.

HIGH GRADE
COAL AND COKE

Mines and Coke Ovens
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McKINNON BUILDING TEL. MAIN 7815 TORONTO

Getting The Best of a Big Cleaning Job

A CERTAIN gear manufacturing plant makes large reduction gears measuring up to 30 feet in diameter, and weighing up to 20 tons each. The cleaning job is to remove the glass or silica and the mineral oil left on the gear teeth by the grinding operation.

THE OLD WAY—2 MEN, 2 DAYS

Two men, using kerosene, worked on an average of ***two entire*** days to clean the gears so the job would pass muster. This was considered satisfactory time.

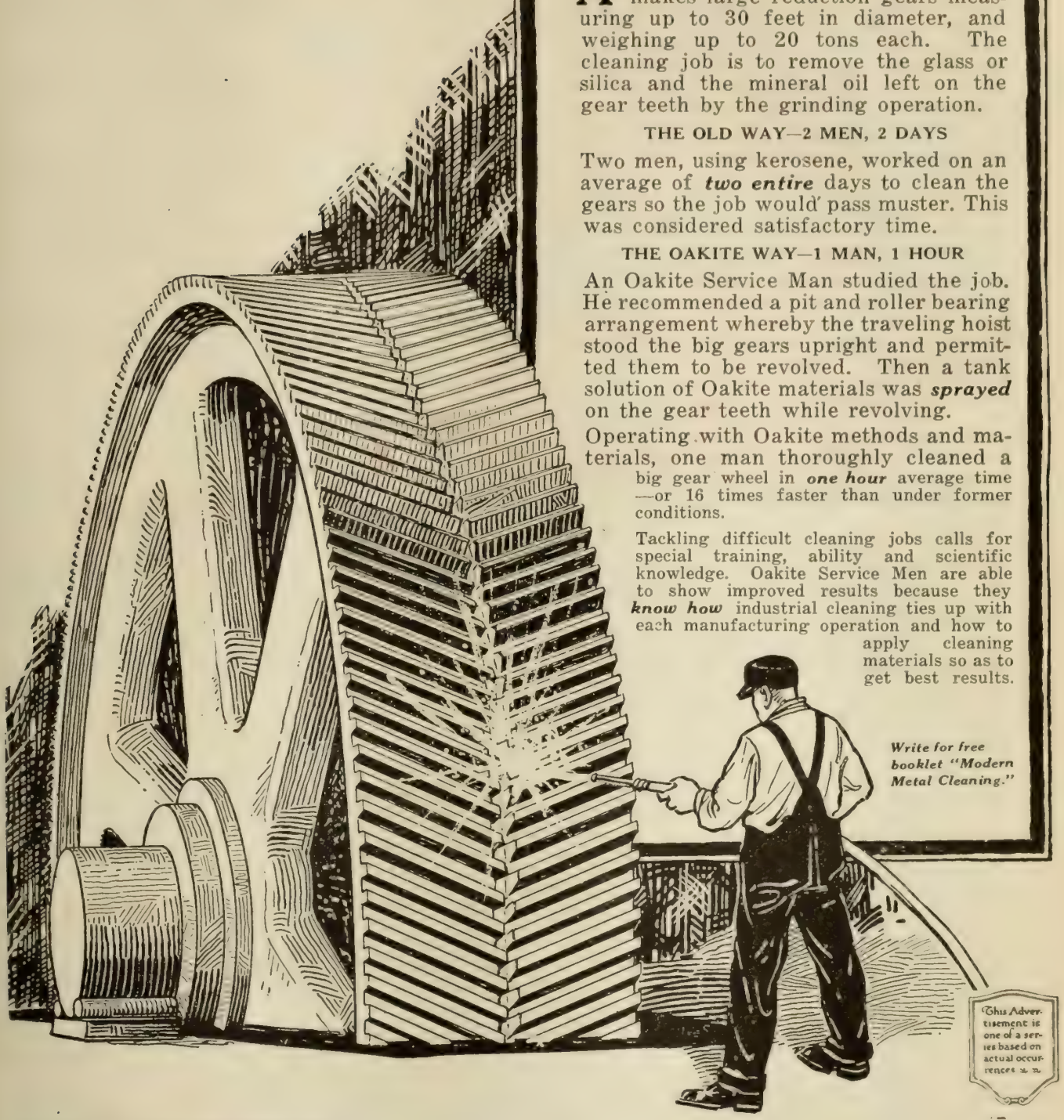
THE OAKITE WAY—1 MAN, 1 HOUR

An Oakite Service Man studied the job. He recommended a pit and roller bearing arrangement whereby the traveling hoist stood the big gears upright and permitted them to be revolved. Then a tank solution of Oakite materials was ***sprayed*** on the gear teeth while revolving.

Operating with Oakite methods and materials, one man thoroughly cleaned a big gear wheel in ***one hour*** average time —or 16 times faster than under former conditions.

Tackling difficult cleaning jobs calls for special training, ability and scientific knowledge. Oakite Service Men are able to show improved results because they ***know how*** industrial cleaning ties up with each manufacturing operation and how to apply cleaning materials so as to get best results.

Write for free booklet "Modern Metal Cleaning."



This Advertisement is one of a series based on actual occurrences

Resident Canadian Representatives:
Mr. C. Burgin, Montreal.
Mr. C. P. Murphy, Toronto.

OAKITE MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES STREET · NEW YORK



When the S.M. talks costs with the G.M.

When the wise General Manager asks his Sales Manager for a bigger share of the business, he explains how lessened factory production costs and a smooth working plant reflect themselves in uniform quality and low prices. That leads right up to the question of correct lubrication.

Correct lubrication with Imperial Lubricants is the one sure way of reducing operating expenses. There is a grade of Imperial Lubricants exactly suited to ***every bearing*** and ***every unit*** around industrial plants. All grades of Imperial Lubricants are scientifically tested and are of uniform high quality.

The service and advice of Imperial Lubrication Engineers is always available whenever needed. Write to 56 Church Street, Toronto.

IMPERIAL OIL LIMITED

Canadian Company—Canadian Capital—Canadian Workmen

Branches in all Cities

IMPERIAL Lubricants

For Manufacturing, Mining and Milling

CYLINDER OILS

Imperial Cylinder Oil
Imperial Valve Oil
Imperial Capitol Cylinder Oil
Imperial 20th Century Cylinder Oil
Imperial Beaver Cylinder Oil

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Imperial Bayonne Engine Oil
Imperial Polar Machine Oil
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Imperial Cutting Oils
Imperial Tempering Oils
Imperial Cordage Oils
Imperial Wool Oils
Imperial Greases.

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVII. No. 14 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | April 6, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page



Genuine Oak Tanned Belting

OF ALL the factors that enter into the making of D. K. McLaren's Belting there is one of first importance—the tanning. Money will buy machinery, buy tools, men and raw materials, all, perhaps, of the best. But only experience can buy the right process. Only years of doing, of testing, investigating and proving, can determine how leather should be treated.

Service on the pulley, hard work under adverse conditions, have demonstrated the value of the D. K. McLaren's process of Genuine Oak Tanning.

Genuine Oak Tanning—the long-time process—is the secret of our success, and on any drive and every drive you designate will prove the secret of service to you.

D. K. McLaren, Limited

GENUINE OAK TANNED

Leather Belting

Head office and factory

351 St. James St., Montreal, Can.

VANCOUVER, B.C. 324 Cordova St. West

TORONTO, ONT. 194 King Street West

ST. JOHN, N.B. 90 Germain Street

Look for this GENUINE OAK *Oak Leaf*

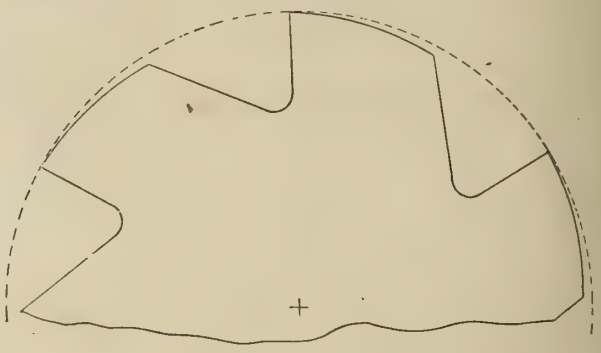
PRATT & WHITNEY

Reamers

With Eccentric Relief

THE cut below shows our patent eccentric relief which is an exclusive Pratt & Whitney feature. Eccentrically relieved Reamers, as made by us, have the distinguishing advantage that they can be sharpened by grinding on the face of each flute, thus retaining a true working size for a much longer period than is otherwise possible.

Pratt & Whitney Reamers are the only reamers having this eccentric relief, which should not be confused with the so-called "Eccentric tooth," which is nothing more than unequal spacing and adds nothing to the life of the tool.





--a stronger tooth--a smoother hole
--no chatter--maintained size

All P & W Adjustable Reamers have **eccentric** relief, can be set to size without regrinding and can be made to **face the bottom of a hole.**

In order to set these reamers, it is only necessary to loosen the shoes and run back the nuts. The blades can then be pushed back and the shoes tightened slightly. Then, upon coming up with the adjusting nut, the diameter will gradually decrease until the desired size is obtained. Lock-nut and shoes are now firmly tightened and the reamer is ready for use. Quick, positive and convenient.

These reamers are made with 12 different sizes of bodies, giving an adjustment from .020 to .060 in., according to the diameter. Shell, hand or chucking reamers with the same number of body have interchangeable nuts, shoes, screws and wrenches. Shell and chucking reamers with the same number of body have interchangeable blades also.

Be Sure They Are Stamped Pratt & Whitney

PRATT & WHITNEY CO.
OF CANADA

MONTREAL
723 Drummond Bldg.

TORONTO
32 Front St. West

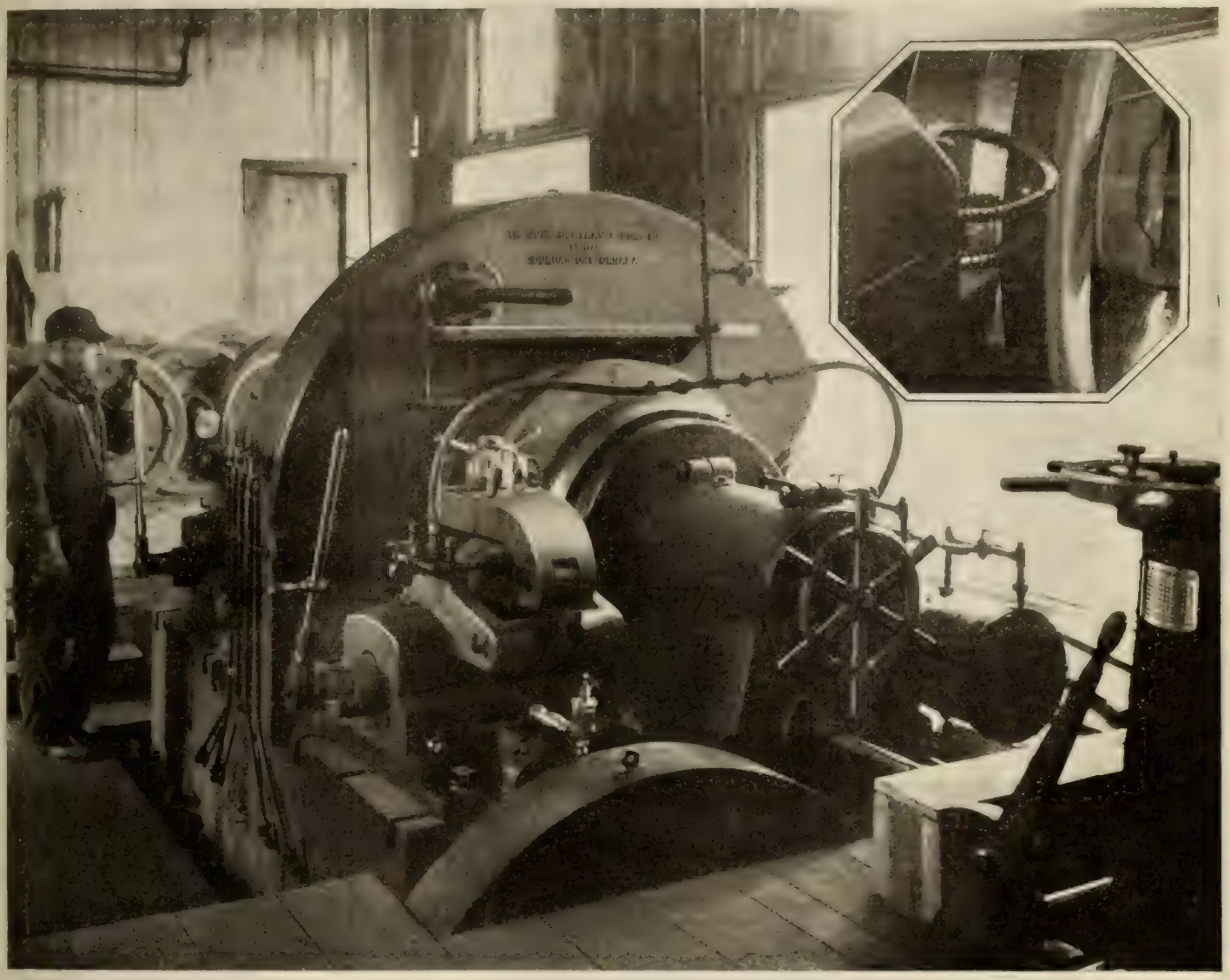
WINNIPEG
1205 McArthur Bldg.

WALKERVILLE
103½ Sandwich St.

VANCOUVER
B. C. Equipment Co.

HALIFAX
Roy Building

BERTRAM MACHINE TOOLS



Shop View of No. 5 CAR WHEEL LATHE, a number of which we have recently furnished to Canadian Railways. (Inset—enlarged view of cut on wheel.)

Note these features:

Pneumatic Tool Clamps,
Movement and Clamping of Tailstocks, by Air Cylinders,
Automatic Gap in Driving Gear,
New all-steel Herring-bone and spur gear drive,
A.C. Motor Drive through Speed Box,
Hardened, ground and lapped shoes on Tool Slides,
Full magnetic lathe controller with "start," "stop" and "slow down" push button control stations,
Maximum Feed on Work 5/8" per revolution of wheel.

If interested, write us for photos and specifications.

The John Bertram & Sons Co., Limited

DUNDAS, ONTARIO - CANADA

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THE three newspapers you see illustrated here belong to the MacLean Technical Group.

If you are a manufacturer of equipment that can be used in machine shops, metalworking plants, power plants, or foundries, one or all of these papers can give you effective cooperation in increasing sales. Tell the consumer about your products in the columns of these publications. The men who buy industrial equipment read them. Your products may have advantages over other products of their kind. Tell the consumer what they are. Create a desire in his mind to buy your lines when ordering from the dealer.

An effective message in MacLean Technical Newspapers will prove effective cooperation for the promotion of sales, and the group you can use to greatest advantage includes:

CANADIAN MACHINERY
AND MANUFACTURING NEWS

POWER HOUSE

CANADIAN FOUNDRYMAN
AND METAL INDUSTRY NEWS

Canadian Machinery serves the iron and steel and general metal working industries.

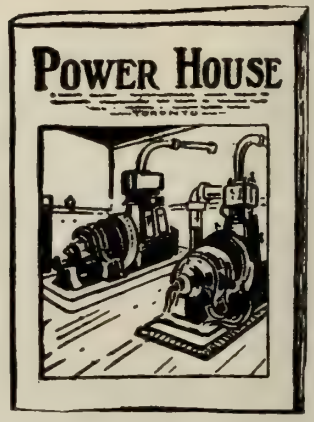
Power House serves steam, electrical, water and gas power plants.

Canadian Foundryman serves the grey iron, steel and non-ferrous foundries.

Each of these papers covers their respective fields almost exclusively. They are "Canadian National" in scope and are read by the men you are anxious to reach—proprietors, managers, superintendents, purchasing agents and foremen. Attract the attention of these men with a strong appeal in their favorite technical newspaper—the MacLean service staff will assist you.



Weekly



Semi-Monthly



Monthly

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153 University Avenue

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Complete information respecting circulation, advertising rates and other data promptly furnished.

Standard Dimensions

Something New in Machine Screw Design

For the first time in the history of the Machine Screw business there has been established by us a definite **standard** as to dimension. This new feature makes it "easy" for the user. "Easy" because he is always certain of the correct style and make of taps to insure uniform fits.

If your screw machine operating costs are running high, get in touch with us. A great many parts can be produced by our process at a substantial saving.

A few of our parts are shown at the right. We make a high quality, long-established line of standard and special machine screws, rivets, threaded wires and specialties in headed work.



MADE IN CANADA

Torrington

MACHINE SCREWS

The Torrington Co., Limited

Upper Bedford, Quebec.



Have You this Book in your catalog file?

It is something more than a catalog or list. It is a handy reference book for you to use when you need **Standard** or **Special Screw Products** up to 2¼-inch diameter. If it's not in your file, just let us know.

STANDARD

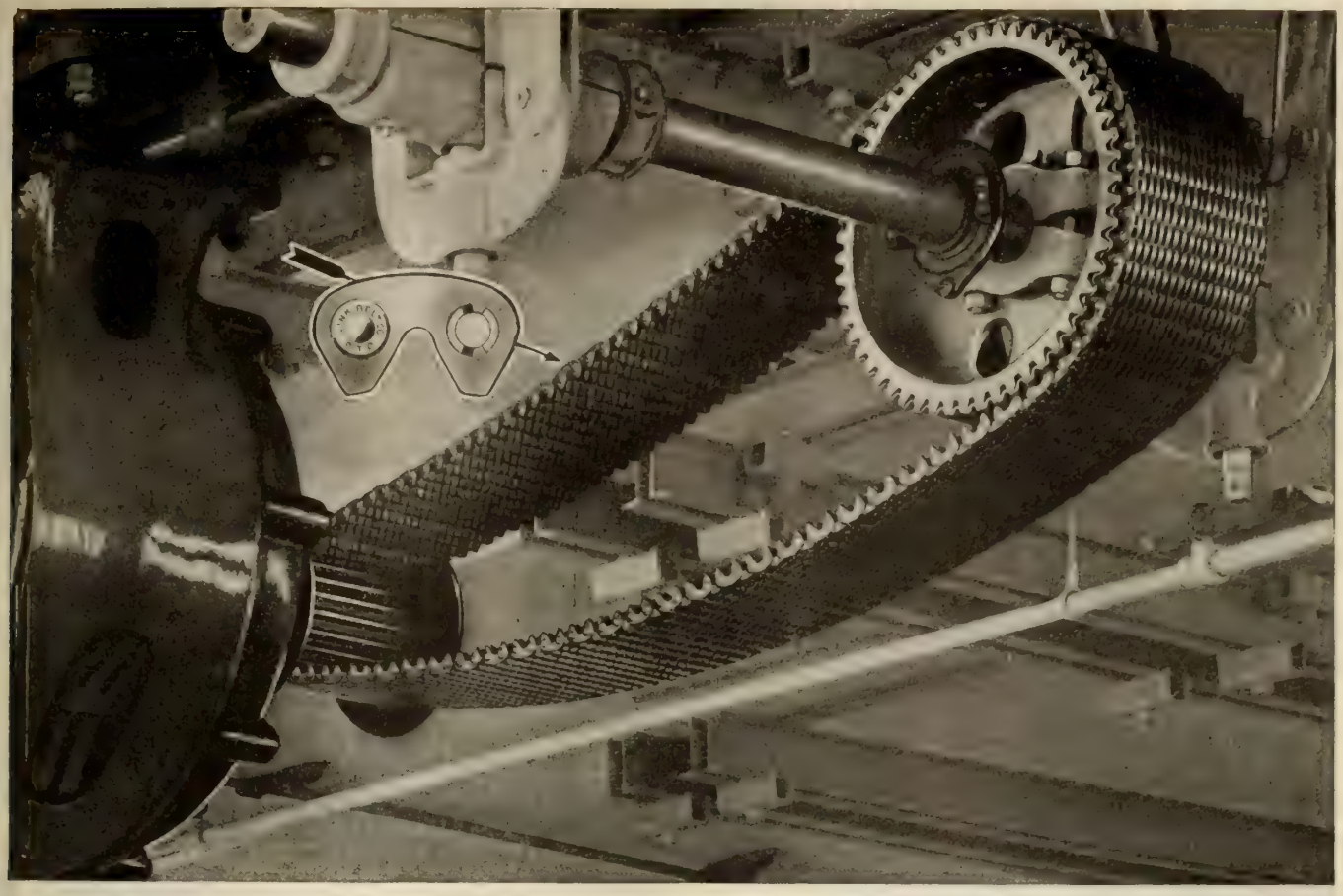
V. & U.S.S. Semi-Finished Nuts
V., U.S.S. & S.A.E. Cap Screws
V. & U.S.S. Set Screws
S.A.E. Plain & Castellated Nuts

SPECIAL

Screw Machine product up to 2 1-4" diam.—to specifications. Hardened and ground screw produet—to specifications.

THE NATIONAL ACME COMPANY

MONTREAL, P.Q.



Link-Belt Silent Chain Drive operating lineshaft Flexible as a Belt Positive as a Gear—More efficient than either.

ALTHOUGH great care is usually exercised in the purchase of machines, small consideration is generally given to the selection and design of the transmission.

In spite of the extremely high relative importance of the transmission and its great influence upon both cost of production and quality of product, it is often selected at random from one of the old forms of transmission, such as gears, belts and pulleys, etc., without consideration of the possibility of vastly superior results that could be obtained from the most suitable drive for the particular service.

Unfortunately, losses from such a source seldom show themselves directly to the management of a concern. Wherever conditions are such that the results produced by the transmission are recorded or noticed, Link-Belt Silent Chain will replace the older and more familiar drive in a large majority of cases.

If you desire to improve the character of work turned out by your machines or if you want to increase their output, give consideration to Link-Belt Silent Chain as the means of transmitting the power.

CANADIAN LINK-BELT COMPANY, LIMITED

TORONTO - Wellington & Peter Streets **Montreal - 10 St. Michael's Lane**

LINK-BELT



"Hisco" Machine—Molded Gears

The fact that "Hisco" Machine Molded Gears require no pattern is a factor of considerable importance when the price of lumber and labor is so high. "Hisco" quality insures accurate, dependable gears. Remember — **the price of "Hisco" gears does not include the cost of patterns.**

We are also manufacturers of Steel, Chrome, Manganese and Nickel Steel Castings, Annealed and Unannealed; Cement Mill, and Mining Machinery; Castings; Stamp Mills; Crushing Plants; Excavating Outfits; Steel Car Wheels; Locomotive Driving Wheels and Frames, etc.

Let us know your requirements—we do the rest.

Hull Iron & Steel Foundries, Limited
HULL, Quebec

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(ELECTROLYTIC)

National Electro Products Limited is the largest manufacturer of Electrolytic (pure) Oxygen and Hydrogen in Canada.

WE PRODUCE GASES EXCLUSIVELY BY ELECTROLYTIC DECOMPOSITION OF WATER. We are, therefore, in a position to furnish Oxygen and Hydrogen far superior to like gases made by any other process.

After Exhaustive Tests We Have Decided to Handle The Well-Known

The Torch for Welders PUROX (OXYGEN / HYDROGEN) Who Want the Best!

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Our entire organization—technical and sales—is always at your service.

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Cast Iron Propeller Hub cut with Oxy-acetylene Blowpipe.

DOMINION OXYGEN CYLINDERS

LIGHT IN WEIGHT, SAVE FREIGHT

A real money-saving opportunity is offered to you in Dominion Oxygen Service.

For instance, the cylinder while of ample strength to withstand the use and abuse of much handling and transportation, is exceptionally light in weight, which greatly reduces freight and handling charges. The capacity is sufficient to make constant reordering unnecessary.

The green-colored cylinder adopted by Dominion Oxygen is a familiar sight wherever oxygen is used. It is the symbol of oxygen service that represents an outstanding success in the industrial field.

Uniform purity, a system of reliable immediate deliveries, a conveniently handled cylinder of large gas capacity and a liberal policy of cylinder loans make Dominion Oxygen and Dominion Oxygen Service the choice of oxygen users.

Be certain to obtain our price before placing your oxygen order. Order a sample cylinder —it will go forward the day your order is received.

Dominion Oxygen Company, Limited

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In Quebec City, order from our warehouse at Grant and Defosses Streets. D-26

THE JOHNSON FRICTION CLUTCH

Friction Clutches From Stock

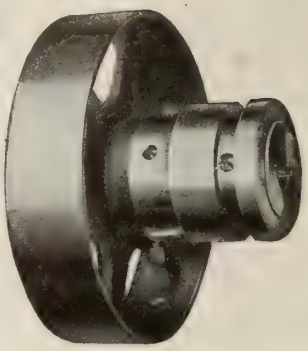
Johnson Clutches, both single and double, can now be obtained from stock in our standard slow speed type to fit all common shaft diameters and all standard pulley bores, within the range of light and medium horse powers that we cover.

State definitely —

Just what the clutch must drive.
Actual maximum horse power.
Speed of clutch shaft.
Diameter of shaft.
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We Will Select the Proper Clutch and Make Immediate Shipment on All Ordinary Requirements.

Friction Control Means Better Machinery



And the Johnson Clutch is supreme among friction clutches. Adopt it as your standard — always dependable and always promptly obtained.

Complete engineering service to consult on your problems and to handle special installations of any kind.

Write for our stock list and Yellow Catalogue

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860



No More Broken Taps *with the* "PROCUNIER" Safety Tapping Attachment

THIS feature is made possible by a balanced reversing mechanism, an exclusive "PROCUNIER" invention. Broken taps become a thing of the past when you adopt the "PROCUNIER" Safety Tapping Attachment.

"PROCUNIER" means speed! Backing out is a necessary time-consuming operation, but the "PROCUNIER" cuts this time in half by reversing at twice the forward speed.

You can secure greater production by adopting "PROCUNIER" Tapping Attachments, Safety Tapping Chucks and Tap Holders.



May we have the opportunity of presenting the full details about "PROCUNIER" economy? Write for full information.

The above is an actual photograph of a man that tapped regularly 1,200 control rod clevises per day, using a 5/16" x 18 tap going ⅞" deep.

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Ontario Distributors : **H. A. HARRISON, 220 King Street West, Toronto, Ontario**



TRACKWORK

FOR STEAM AND ELECTRIC RAILWAYS OF ANY STANDARD SECTION

MANGANESE-STEEL SPECIAL WORK

Frogs, Diamond Crossings, Crosses, Switches, Mates and Complete Intersections to meet any traffic requirements.

Makers of Balkwill Artículated Manganese-Steel Crossings

CANADIAN STEEL FOUNDRIES LIMITED

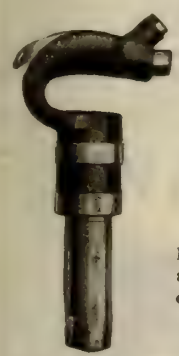
Transportation Building, Montreal

Cleveland Sand Rammers

FOR FLOOR, BENCH, PEIN AND FLASK RAMMING

Cleveland Sand Rammers are made in several sizes and weights, and are adapted for all kinds of Foundry Ramming.

The Piston Rods are packed with a resilient packing which prevents any dirt from entering piston chamber and working parts—They are fitted with either Round or Flat Rod as required. Cleveland Rammers are light in weight, have high speed and practically no vibration, making them ideal foundry tools.



CLEVELAND CHIPPING HAMMERS

For Foundry Work. Are furnished in any required size or weight for grey iron or steel castings; they have high speed, and are adapted for fast chipping now required by piece-workers.

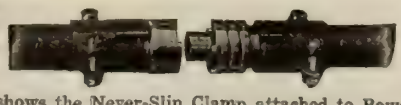


CLECO PRESSURE-SEATED AIR VALVES AND BOWES AIR HOSE COUPLINGS

Are Standard Equipment Everywhere

Both Valves and Couplings are pressure tight.

Bowes Couplings are instantly connected or disconnected.



Bowes Couplings are absolutely air tight under all pressures.

Above cut shows the Never-Slip Clamp attached to Bowes Coupling.

IN STOCK:—RIVETING HAMMERS, DRILLS, REAMING, TAPPING AND FLUE-ROLLING MACHINES, CORNER DRILLS, PORTABLE AND BENCH GRINDERS, PRESSURE-SEATED AIR VALVES, ETC.

Write for Bulletins Nos. 50 and 51

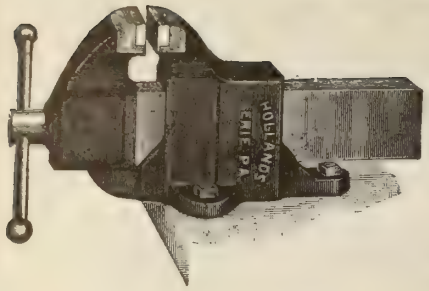


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CLEVELAND PNEUMATIC TOOL CO. OF CANADA, LIMITED

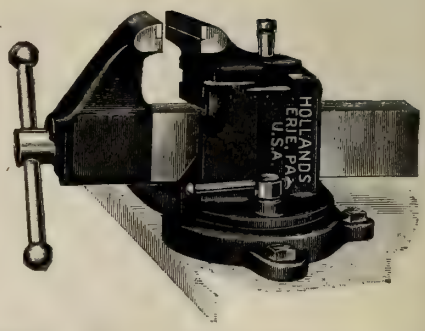
84 CHESTNUT STREET, TORONTO, ONT. **337 CRAIG ST. W., MONTREAL, QUE.**

HOLLANDS VISES



Have a record of thirty-five years of satisfactory service.

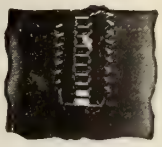
If your dealer cannot supply you, write direct for circular No. 25.



HOLLANDS MANUFACTURING CO.

Established 1887 Erie, Pa., U. S. A.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some make-shift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.

Hartford, Conn.

HEATING AND HANDLING OF SPRINGS



AUTOMATIC SPRING TEMPERING FURNACE
Discharging End
Conveyor is adapted to the characteristics of the individual piece

Interesting data on improved methods, with an outline of the factors governing the intelligent selection of equipment and fuel, are given in Bulletin 240-T

Typical heating and handling problems are considered, with illustrations of stationary and continuous furnaces and a variety of handling equipment.

Write for Bulletin

W. S. ROCKWELL COMPANY

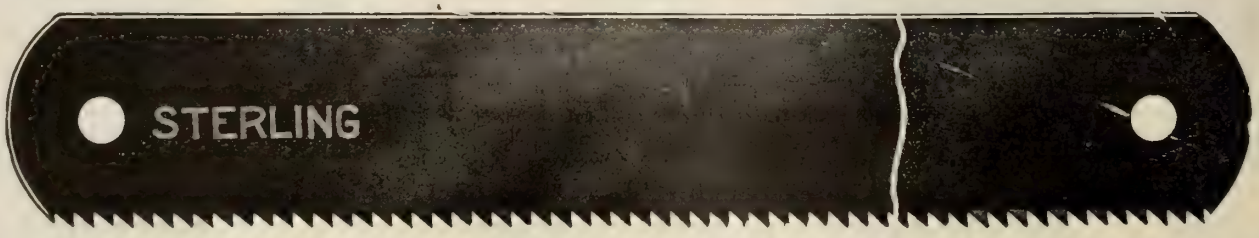
Furnace Engineers and Contractors

50 Church St., (Hudson Terminal Building) New York.

WE MAKE INDUSTRIAL HEATING FURNACES
FOR EVERY REQUIREMENT
COAL—OIL—GAS—ELECTRICITY
"FURNACE AND FUEL TO SUIT CONDITIONS"

British Representative: Gibbons Bros., Ltd., Dudley, Worcester, England.

HACK "STERLING" SAWS

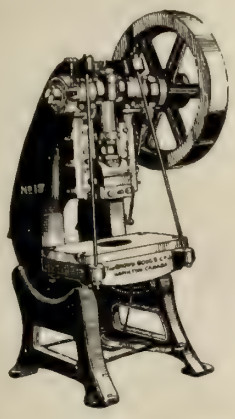


MANUFACTURED BY

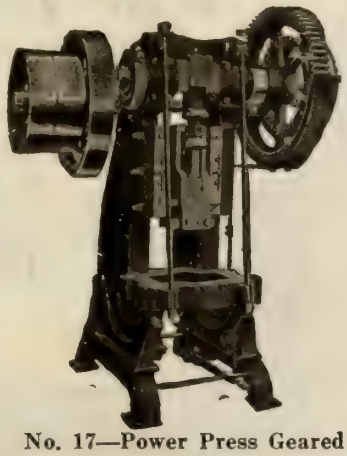
DIAMOND SAW & STAMPING WORKS -:- BUFFALO, N.Y., U.S.A.

BROWN-BOGGS

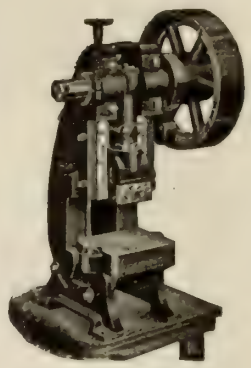
B B



No. 15—Plain Power Press



No. 17—Power Press Geared



No. 10—Bench Press

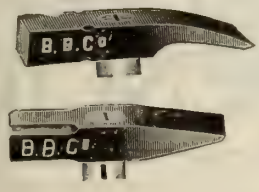
Putting Your Shoulder to--What?

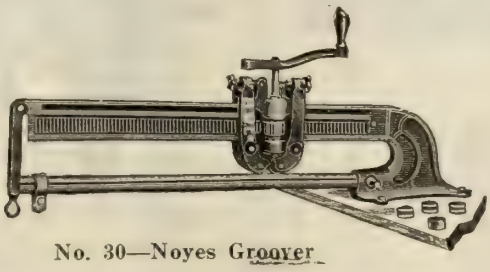
The man who first said: "For greater prosperity everyone must put his shoulder to the wheel," certainly had the needed solution.

There is only one objection so far as we can see. That lies in the kind of wheel used; for pushing against the wrong wheel is wasted energy, pure and simple. Prosperity then depends equally as much on the machine as on the workman.

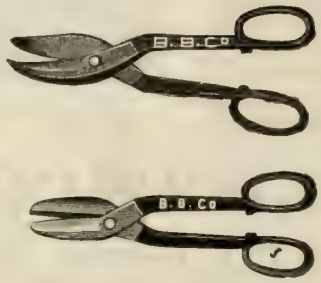
In the Sheet and Metal Working Field the "B-B" trade-mark guarantees you long dependable service. It is stamped on the machinery listed below.

Dies	Hammers	Evaporating
Presses	Canners	and
Shears	Processing	Special
Small Tools	Machinery	Machines





No. 30—Noyes Groover



THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.



HENDEY

For 1922 Dividends

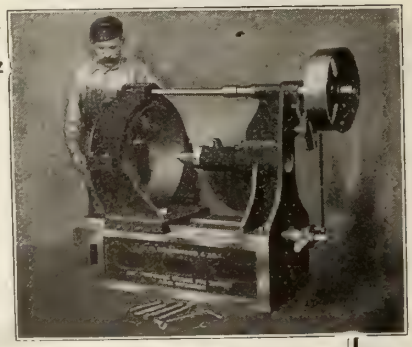
This year there is going to be more of one kind of lathe used than ever before—those which produce **absolutely** accurate work. Only this class will pay dividends.

"For accurate production work there is none better than the Hendey," says a prominent user. Almost every user says the same. Hendey Engine Lathes are built in 12, 14, 16, 18, 20 and 24 inch sizes. Every size is a dividend builder. Keep in mind the Hendey reputation.

The HENDEY MACHINE Co.
Torrington, Conn., U. S. A.

Canadian Agents:
A. R. Williams Machinery Co., Toronto, Ont.; A. R. Williams Machinery Co., 260 Princess St., Winnipeg, Man.; A. R. Williams Machinery Co., Vancouver; A. R. Williams Machinery Co., St. John, N.B.; Williams & Wilson, Montreal.

Lathes---Millers *Shapers and Centering Machines*



Crank Pins Trued to Original Accuracy

with the

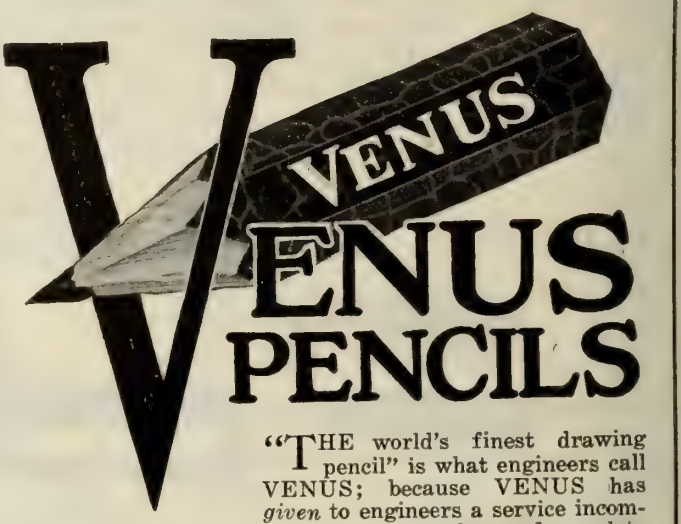
UNDERWOOD
Crank-Pin Turning Machine

Crank pins (disc or bell shaped) on side crank engines can be aligned to the original true, smooth, accurate finish with this Underwood Portable Tool.

Work is always in full view of the operator—a distinct advantage. And the tool is really portable, saving time.

An oil-bathed driving mechanism running in dust-proof housing and other practical features recommend this tool.

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"THE world's finest drawing pencil" is what engineers call VENUS; because VENUS has *given* to engineers a service incomparably more perfect and complete than that of any other pencil.

For sketch, plan or blueprint VENUS is the pencil of precision.

17 black degrees, 3 copying

For bold, heavy lines	6B-5B-4B-3B
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Plain Ends, per doz.	$1.50
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At Stationers and Stores throughout the World

American Lead Pencil Co.
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CONDENSITE CELORON NOISELESS GEARS

"Make Good"

Condensite Celoron marks a new era in silent gears. It is high in dielectric strength and to all practical purposes chemically inert. It is practically water, oil and grease proof. Ordinary solvents such as alcohol, acetone, benzine, etc., do not affect it. It will not absorb the atmosphere nor deteriorate with age. It is highly resilient and amply able to withstand shocks and jars. **Condensite Celoron is self-supporting.** Gears and pinions cut to standard sizes require no shrouds or end plates and can be used under conditions where the use of the average non-metallic gear would be prohibitive.

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Diamond State Fibre Company of Canada, Ltd.

Head Office and Works

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Metal Spinning Lathes



Tools and Accessories for round and Oval Work

A range of sizes from 15 to 60-inch swing. Illustration is 22-inch Ball Bearing Lathe with 6-inch Oval Chuck and Compound Rest.

P. Pryibil Machine Company

New York City

Established 1859

Strength in the Part that takes the Blow



Keen buyers of equipment find in

"JARDINE"

Power Hammers

much more than tools built to meet a price. Every "Jardine" Hammer is built for long service. The great strength of the anvil block explains why this is so. Built in sizes for every job —light, heavy and exacting work. Ask for Catalogue No. 18.

REGISTERED J TRADE MARK

MADE IN CANADA

A. B. JARDINE & CO., Ltd.

HESPELER, ONTARIO

Announcing—

"LION" Grinding Wheels

MANUFACTURERS OF HIGH GRADE GRINDING WHEELS

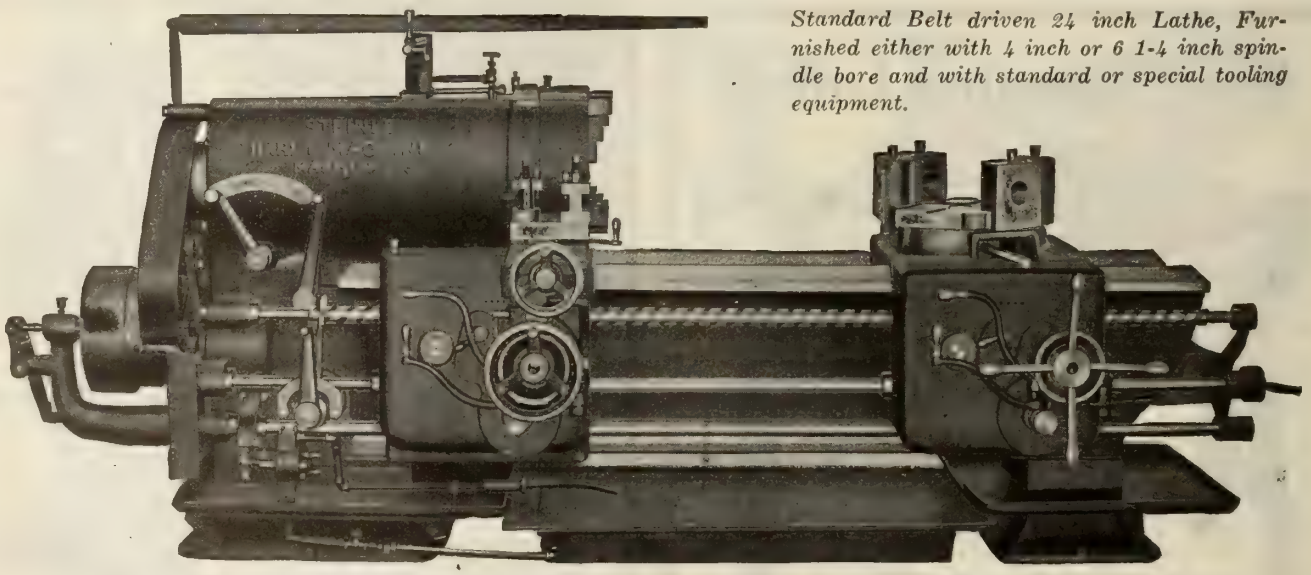
We will be operating our new plant by May 1st, 1922, with modern equipment, manufacturing high-grade grinding wheels for all purposes. Vitrified and Silicate processes used.

Your enquiries are solicited and will receive our most careful attention.

Lion Grinding Wheels Ltd., Brockville, Ont.

Province of Quebec Agents: J. R. Baxter & Co., Ltd., Montreal, P.Q.

Standard Belt driven 24 inch Lathe, Furnished either with 4 inch or 6 1-4 inch spindle bore and with standard or special tooling equipment.



STEINLE TURRET LATHES FOR BAR OR CHUCKING WORK

Send us drawings of your work so that our Engineering Department can estimate STEINLE production, or ask to have a qualified representative call upon you to determine what work can be produced to advantage on our machines.

STEINLE TURRET MACHINE COMPANY

MADISON, WISCONSIN, U.S.A.

When you consider the cost of Power and the fact that the Belting on Machinery is the means of transmitting that Power, with or without loss, doesn't it make you want the Belting that loses least and saves most?

GUTTA PERCHA & RUBBER, LIMITED
TRADE P.M.S MARK
TORONTO, CANADA

This Belting has fairly turned the manufacture of Belting upside down. Imitations of P. M. S Belting can never equal the genuine, and don't you ever think they can.

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Head Offices and Factory: TORONTO

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"The PHOTOSTAT Put These People On Our Books"

"UP to six months ago we were never able to 'land' any of Judson Company's contracts, because we couldn't make the deliveries they asked for. Then I happened to read Floyd W. Parson's article in the Saturday Evening Post called 'The Labor Savers' in which he described the PHOTOSTAT. This machine makes photographic facsimiles directly on sensitized paper of drawings, pencil sketches, blue prints, small machine parts, reports, shipping lists, contracts, catalog pages, maps, production charts, telegrams, advertising layouts and business papers of all kinds.

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"The PHOTOSTAT has not only made thousands of dollars for us by helping to get new customers; but has also saved us a great deal of time, money and worry in the office. It relieves the stenographers of a lot of copy-work; does it in far less time and NEVER MAKES A MISTAKE. It also saves our advertising man much time in making layouts. And we use it to reduce drawings to convenient size for filing and to copy important documents when we don't want the originals to leave our files. You know PHOTOSTAT copies are legal evidence in court."

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Photostat Corporation

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COLUMBIA

THE BRUSH IT NEEDS!

WHICH is the most suitable brush for any machine depends on correct analysis of all the relevant facts. That is why the Columbia Data Sheet Service improves motor and generator efficiencies.

The essential facts are ascertained by Columbia Brush Specialists. These facts are carefully analyzed by the Columbia Board of Engineers. The Columbia Pyramid Brushes specified as correct for each unit are guaranteed to give satisfactory service.

Columbia Data Sheet Service is at your command. It does not matter whether you have one brush equipped unit or a thousand. Avail yourself of it.

COLUMBIA Data Sheet Service Solves Your Brush Problems. Write the address below.

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LIMITED
MONTREAL TORONTO WINNIPEG

4920

If You Want HOLES,

Straight HOLES and the last HOLE to be as Accurate as the first use "MORSE" DRILLS



Morse Twist Drill & Machine Co.
New Bedford, Mass., U.S.A.



—and when the cutter was taken from the furnace he found—

That its cutting edges were hard and clean—no scale—and could not be ground. It meant much to have their edges clean and true to shape.

That's the kind of results you can get with Hoskins Electric Furnaces. The heat is clean and the temperature control is right under your thumb. The man who does the heat treating does not have to fuss around trying to get the right temperature—he takes care of the **tools,** and **not** the **furnace.** He gets greater production and better tools.

Hoskins Electric Furnace will save you money. Not just for tool rooms are they an economy but wherever metal is heat-treated.

Tell us the work you want done and ask for catalogue No. 122.

MADE IN CANADA

Hiram Walker & Sons Metal Products
LIMITED
Walkerville, Ont.



A Sure Foundation

CLAMPS and **LATHE DOGS** are essential tools in all machine shops; they form an important part of the foundation on which is built economical production. Build *your* foundation strong and sure—use the dependable, sturdy strength of Williams' Superior Drop-Forged Clamps and Lathe Dogs. They'll never fail you and will last a life time.

CLAMPS—11 patterns, in a wide range of sizes for every clamping purpose.

SAFETY LATHE DOGS, Bent or Straight Tail, 1 or 2 screws, 16 sizes.

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J. H. WILLIAMS & CO., Limited

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Formerly Canadian Division of
The Whitman & Barnes Manufacturing Co.

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It pays to watch closely for signs of wear.

Discard the file then ---a new file costs less than the labor-time wastefully expended on an old one.

Long efficient service from every file is ensured by ordering one of these famous brands:

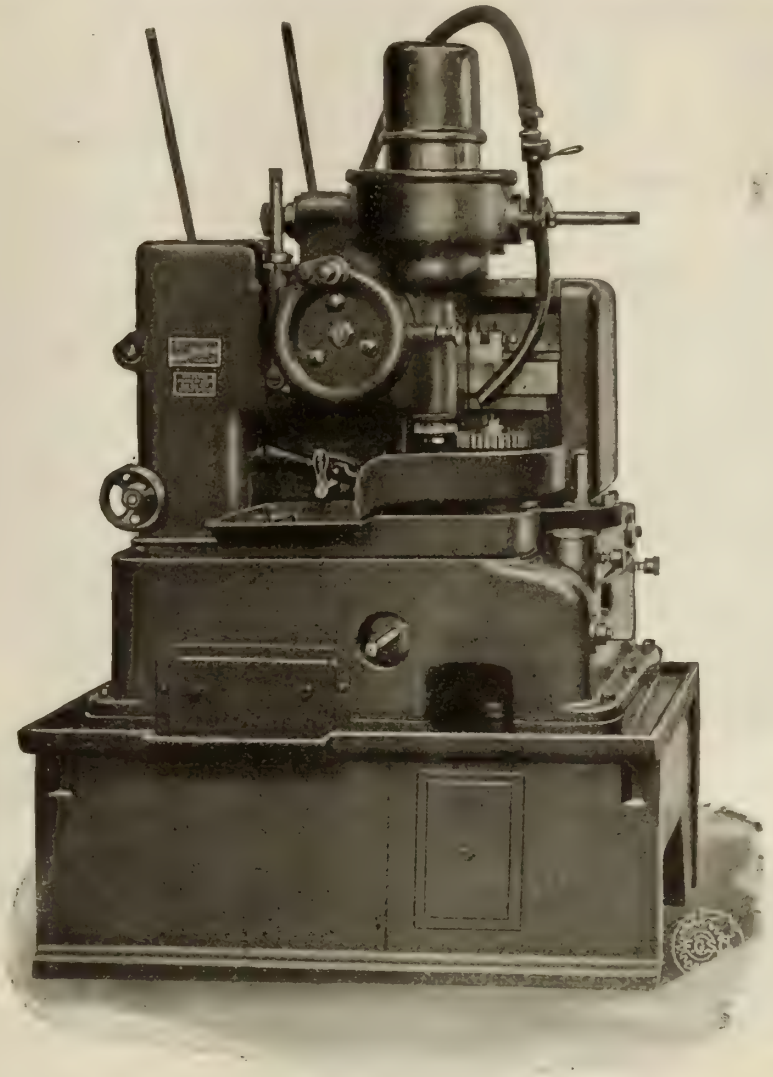
Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario

CUT GEAR COSTS
WITH THE
New Production Gear Shaper



The new production Gear Shaper, illustrated, has been designed to cut gear costs. It incorporates every feature necessary in a gear cutting machine to obtain this result, and still one of the outstanding features of the Gear Shaper principle—accuracy—has been maintained.

It is designed to cut one gear at a time and at a speed which eclipses all other methods.

All operating levers are at the front of the machine, permitting a number to be bolted together and operated as a unit, one 6 H.P. motor furnishing ample power for **10 machines.**

It incorporates to the fullest extent the three principal requirements of production—high speed, accuracy and simplicity of operation.

See illustrated article in all technical **magazines.**

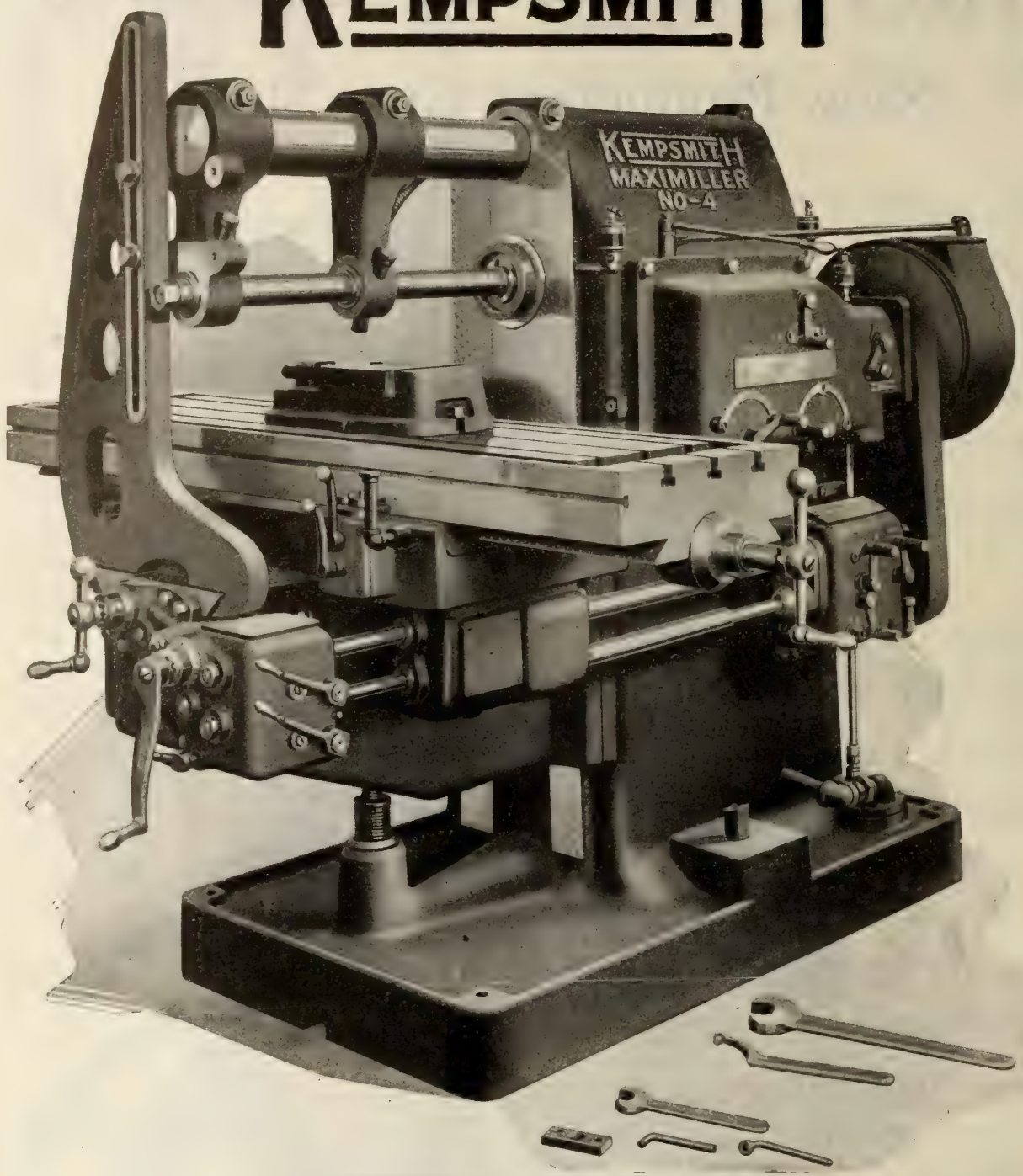
Send for our booklet, "A New Development in Gear Cutting," which has been prepared for the benefit of Engineers and Production Managers interested in the best gear cutting equipment available.

Write for your copy now.

THE FELLOWS GEAR SHAPER COMPANY,
SPRINGFIELD, VERMONT, U.S.A.

Foreign Agents:—Alfred Herbert, Ltd., Coventry, England; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Ltd., Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert (India) Ltd., Head Office, Calcutta, India.

KEMPSMITH



KEMPSMITH No. 4 Plain Maximiller

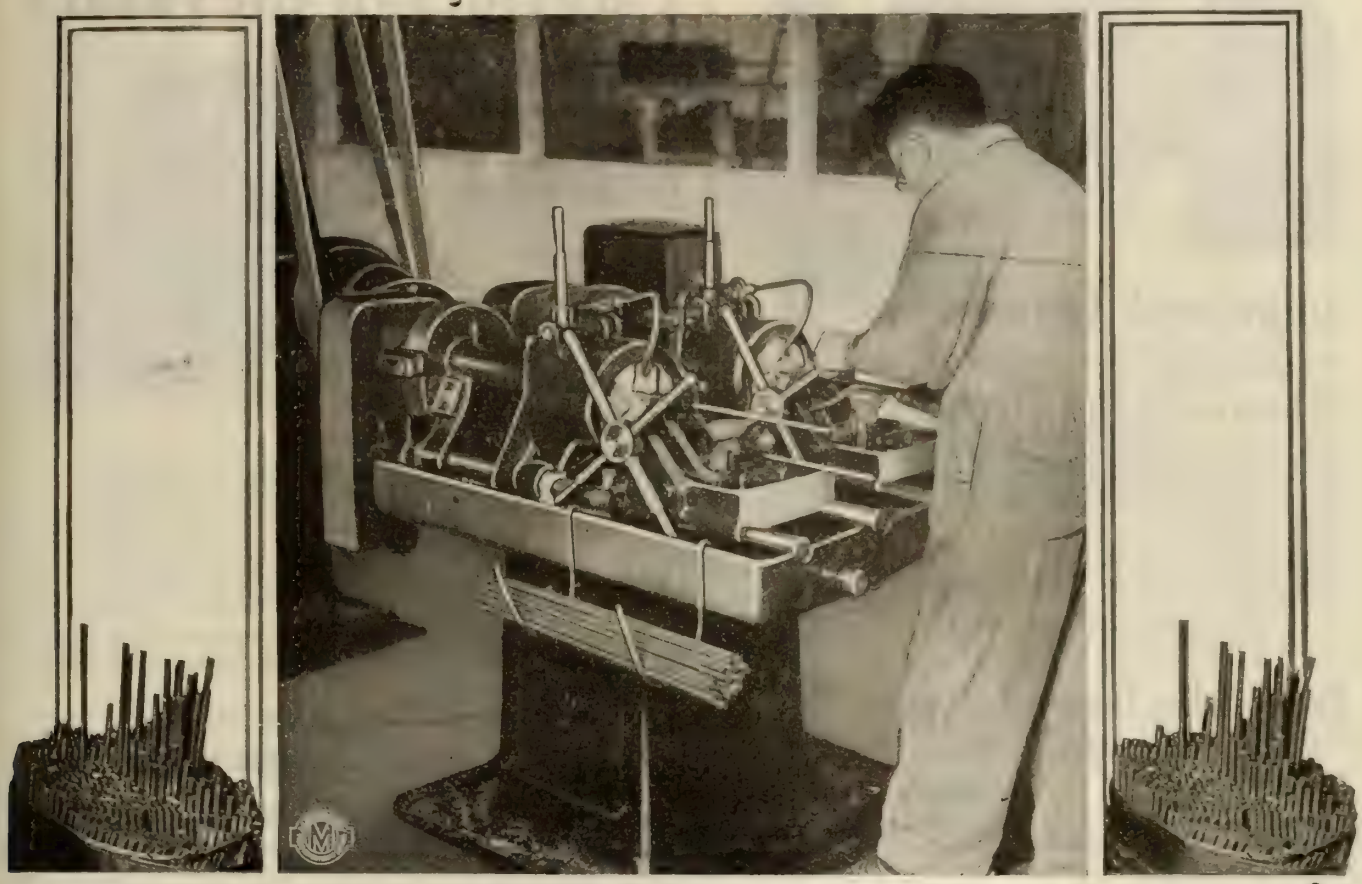
A veritable maximum in milling machines embracing all Kempsmith patented features, permitting a maximum in production and efficiency. Write for particulars as to this machine.

THE KEMPSMITH MANUFACTURING CO.

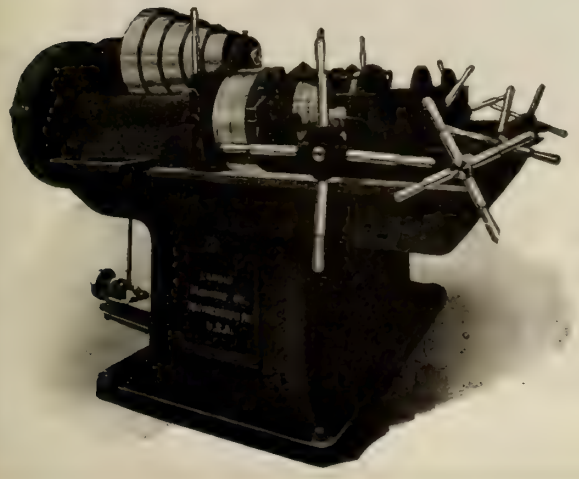
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Rods! Little rods, big rods, short rods, long rods; auto rods of all descriptions are quickly and accurately threaded on Landis Threading Machines in the Detroit Plant of the F. L. Jacobs Company.

You would be astonished at the number of rods in a modern automobile which are threaded on each end and fitted with drop-forged yokes or eyes.

Material is low-carbon steel, the diameters of which run from 3/16 in. to ½ in. Threads must be straight, and are usually cut .001 in. to .003 in. under standard diameters.

Landis Threading Machines and Landis Die Heads have speeded production, bettered quality and lowered costs in a host of industries. May we show you what Landis equipment will do for you?

Landis Machine Company, Inc.

Waynesboro, Pa., U.S.A.

LANDIS





Improved Grinding!

by the aid of Desmond-Stephan

Diamo-Carbo Dressers

At small cost they keep the wheels dressed and trued. Greatly increase grinding results. They take the place of a Diamond on many jobs such as rough grinding precision wheels, hand forming special shapes, etc.

Diamo-Carbo Dressers consist of a steel tube entirely filled with an intensely hard abrasive. They are stocked in four diameters. Easy and simple to use.

There is a Desmond-Stephan Dresser for every job. Ask for our catalogue.

The Canadian Desmond-Stephan Mfg. Company, Limited

Hamilton - - Ontario

Roelofson Elevators

Reduce Freight Handling Costs



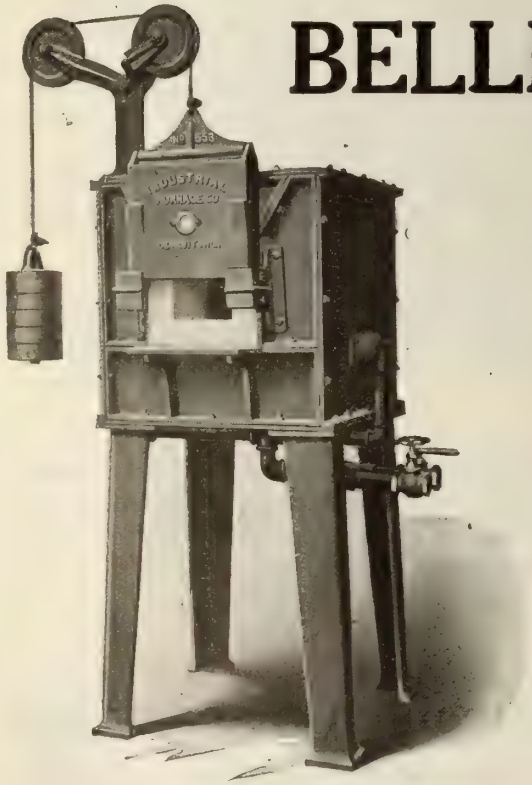
Worm-Geared
Belted or
Direct Drive

They keep costs down low by running smooth, safe and noiseless. Brake is self-adjusting. Gears are strongly made of phosphor bronze. Worms cut from solid steel forging. Construction is self-oiling and dust-proof. Capacity 1,000 lbs. to 10,000 lbs. A complete line of Electric, Hydraulic and Hand-Power Elevators.

Roelofson Elevator Works

GALT, ONTARIO

BELLEVUE FURNACES



Enable the Operator to Speedily Obtain an Intense, Uniform Heat.

A distinctive feature of Bellevue Furnaces is the accurate way they respond to the will of the operator. They speedily develop an intense heat and are always under accurate control. Bellevue Furnaces are simple and economical to operate. Combustion is perfect and no flames come in contact with material. For oil or gas in seventy-nine different styles or to your order.

Write for our highly illustrated catalog.

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2971 Bellevue Ave. - Detroit, Mich.

Representatives in Canada

CHAS. A. STRELINGER COMPANY, WINDSOR

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A HOIST THAT WON'T WORK

Have You One?

It may have been abused by overloading or careless handling.

It may have "worn out" after years of faithful service.

You will probably need it soon.

Ship it to us. Our repair department will quote for the necessary repairs, even if the block is not one of our own make.

If it is a Morris hoist the cost of repairs will be comparatively small—Morris hoists are so designed that the wearing parts may be replaced readily.

Of course we test all rebuilt hoists with our usual 50% overload test before shipment.

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Harris Heavy Pressure



is guaranteed by us as the highest quality metal for all round machinery work and

IMPERIAL GENUINE



for the largest Dynamo or Engines. Something exceptionally good for a heavy high speed job. We know, for we have been on thousands of jobs in the past thirty-five years. It costs a lot of money to keep telling you this. Verify it by ordering a box from our nearest works.

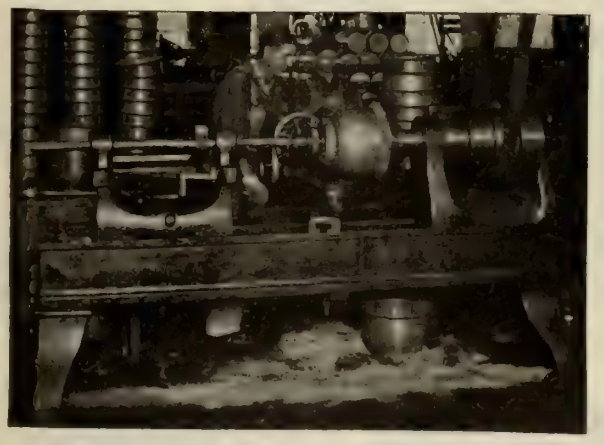
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SHEET METAL WORKING MACHINERY

BLISS

BLISS SPINNING LATHES



Bliss Spinning Lathe in production

These lathes, built in a number of sizes, are for spinning, burnishing, trimming and wiring the work produced in drawing presses. They are built in the most substantial and careful manner, with hammered steel spindles; the smaller sizes have bronze metal bushings in the head stock and the larger sizes have roller end thrust bearings and Timken roller bearings for spindles in the head stock. Compound slide rests are substantial. They are supplied either right or left handed, and for either inside or outside spinning. Iron cones are furnished. The hardened steel burnishing roll is provided with anti-friction bearings to prevent heating. By use of the tilting rest, all but the largest articles can be spun, trimmed and wired at one setting.

We build special lathes for individual requirements.

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"Specify Bliss Presses"
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No. 199

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Forgings
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Forged Shafting up to 30,000 lbs.
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Right heat treatment.
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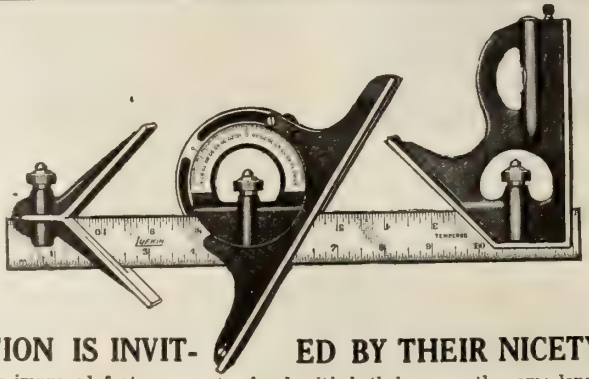
CARBON OR VANADIUM STEEL
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LUFKIN

COMBINATION SQUARES



LUFKIN

BEVEL PROTRACTORS
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YOUR CLOSE INSPECTION IS INVITED BY THEIR NICETY OF DESIGN AND FINISH

You will then see, among other improved features, center head with both legs exactly same length and ends formed, insuring accuracy on any circumference, large or small. Double protractor readily convertible into single protractor, serving perfectly for every sort of work.

THE LUFKIN RULE CO. OF CANADA. LTD. WINDSOR ONT.

Regrinding Possibilities Among Pleasure Cars Alone



A stalled car can do much to make the life of a motorist unhappy. Eighty per cent. of the car troubles are in the engine. Has yours been reground and fitted up for the summer's running?
Copyright Keystone View Co.

84%

of the pleasure car mfrs. grind their cylinder bores and use

HEALD

exclusively

A few of which are:

Apperson
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Cadillac
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Locomobile
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Mercer
Packard
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At this time one does not see the swarms of cars that crowded our roads during the Summer, but nevertheless most of them will again be under way before long. In the meantime many will be overhauled and to-day no overhauling job is complete unless the cylinders are reground and new pistons and rings installed. If you do general repair work, why not be equipped to handle this class of trade also? Let us send you full information and data on the possibilities in your territory.

If conditions do not warrant your putting in equipment get in close touch with some Heald regrinding shop. Learn all the advantages and send him your blocks. The commission, without any effort on your part, will be "velvet," to say nothing about having a satisfied customer.



Particular automobile owners are now insisting on Heald ground cylinders, as it is a sign of quality.

THE HEALD MACHINE COMPANY

51 New Bond Street, Worcester, Mass.

THERE is as much difference in the various makes of High Speed Steel as there is in men—

The practice and methods of manufacturers differ widely in every mill and anyone who is at all familiar with the manufacture of High Speed Steel thoroughly understands this

"Red Cut Superior"

The Nationally Known—First Quality

HIGH SPEED STEEL

is the best for all Machine Work

ARE YOUR TOOLS MADE OF "Red Cut"?

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Standard Gears

CUT GEARS



We are Gear Engineers

GEAR DATA FOR YOUR NOTE BOOK
CUT THIS OUT,—MORE COMING LATER.

Diameters for Spur Gear Blanks
From The Hamilton Gear and Machine Co., Toronto

For diametral pitches divide size given for 1 d.p. and proper number of teeth by the pitch used. For circular pitches multiply the figure for 1"c.p. by the circular pitch used.

T.	1 d.p.	1" c.p.	T.	1 d.p.	1" c.p.	T.	1 d.p.	1" c.p.	T.	1 d.p.	1" c.p.
12	14"	4.46"	35	37"	11.78"	58	60"	19.10"	81	83"	26.42"
13	15"	4.77"	36	38"	12.10"	59	61"	19.42"	82	84"	26.74"
14	16"	5.09"	37	39"	12.41"	60	62"	19.73"	83	85"	27.06"
15	17"	5.41"	38	40"	12.73"	61	63"	20.05"	84	86"	27.37"
16	18"	5.73"	39	41"	13.05"	62	64"	20.37"	85	87"	27.69"
17	19"	6.05"	40	42"	13.37"	63	65"	20.69"	86	88"	28.01"
18	20"	6.37"	41	43"	13.69"	64	66"	21.01"	87	89"	28.33"
19	21"	6.68"	42	44"	14.00"	65	67"	21.33"	88	90"	28.65"
20	22"	7.00"	43	45"	14.32"	66	68"	21.64"	89	91"	28.97"
21	23"	7.32"	44	46"	14.64"	67	69"	21.96"	90	92"	29.28"
22	24"	7.64"	45	47"	14.96"	68	70"	22.28"	91	93"	29.60"
23	25"	7.96"	46	48"	15.27"	69	71"	22.60"	92	94"	29.92"
24	26"	8.28"	47	49"	15.59"	70	72"	22.92"	93	95"	30.24"
25	27"	8.59"	48	50"	15.91"	71	73"	23.24"	94	96"	30.56"
26	28"	8.91"	49	51"	16.23"	72	74"	23.55"	95	97"	30.87"
27	29"	9.23"	50	52"	16.55"	73	75"	23.87"	96	98"	31.19"
28	30"	9.54"	51	53"	16.87"	74	76"	24.19"	97	99"	31.51"
29	31"	9.86"	52	54"	17.19"	75	77"	24.51"	98	100"	31.83"
30	32"	10.18"	53	55"	17.51"	76	78"	24.83"	99	101"	32.14"
31	33"	10.50"	54	56"	17.82"	77	79"	25.15"	100	102"	32.46"
32	34"	10.82"	55	57"	18.14"	78	80"	25.46"	105	107"	34.05"
33	35"	11.14"	56	58"	18.46"	79	81"	25.78"	110	112"	35.65"
34	36"	11.46"	57	59"	18.78"	80	82"	26.10"	120	122"	38.83"

Write us for Quotations

Hamilton Gear & Machine Co.

76 Van Horne St., TORONTO



KEEP UP PRODUCTION

Opinion is divided as to the value of Machine Efficiency Records, but one certain result is the weeding out of those machines which, being out of date, are unable to maintain production requirements.

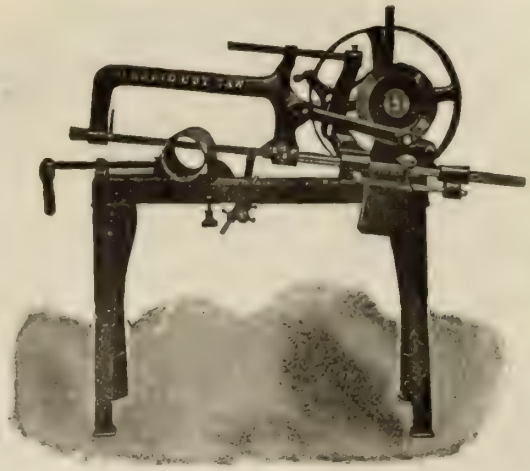
If you have any machines occupying valuable floor space whose "Production per Machine Hour" percentage is not what it should be, it will pay you to get in touch with us and let our experts advise you.

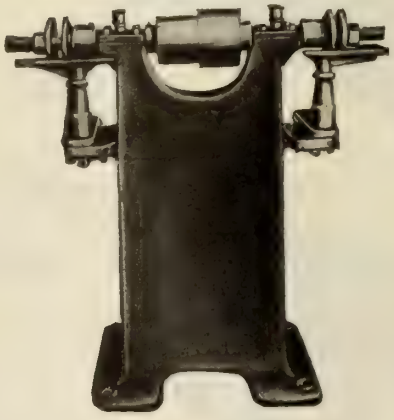
They are specialists in shop problems of all kinds and their services entail no obligation.

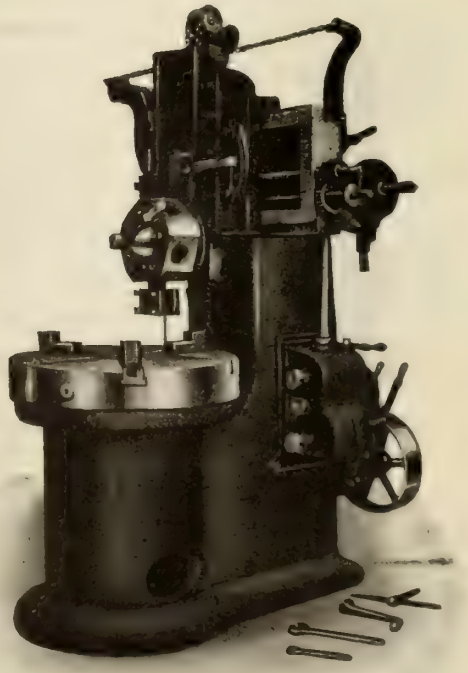
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Canada's Dependable Machinery and Supply House



This picture shows part of a "Little Giant" Screw Plate; notice the care with which it is put up in its handsome hardwood case; look at the compact and serviceable tap wrench.

YOUR SCREW PLATE SHOULD BE A "LITTLE GIANT"



Sectional View of "Little Giant" Die.

First:

Because **"Little Giant"** Dies can do more work for you than any other.

1. They have a wide range of adjustment. This is money to you if you have to work on both exact and oversize stock.
2. They are reversible in the collet, so you can cut close to a shoulder or other surface, or through the guide on straight work.
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4. They can be easily resharpened—this means **long** life.

Second:

When parts are lost or worn out they can be quickly replaced at practically every jobbing house in Canada.

Isn't this service worth something to you? Buy from your jobber—if he hasn't **"Little Giant"** Screw Plates in stock, write us.



GTD

Tap

GREENFIELD TAP AND DIE CORPORATION OF CANADA, LIMITED GALT, ONTARIO

United States Factory:

GREENFIELD TAP & DIE CORPORATION

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Handy Combination Protractor and Depth Gage

Here's a tool that every machinist, draftsman and shop foreman will find constant use for in laying out work.

With this Starrett No. 493 Protractor and Depth Gage any angle within 180° may be readily obtained by merely swinging the blade.

The scale is graduated by 32nds of an inch on one side and 64ths on the other, and, being easily set at any point in its length, permits the tool being used as a depth gage.

A new special Supplement to Starrett Catalog No. 22 "3" has been issued describing and illustrating this Starrett No. 493 Protractor and Depth Gage with other new Starrett Tools. Every mechanic should have copies of both catalog and supplement. Sent free on request.

THE L. S. STARRETT COMPANY

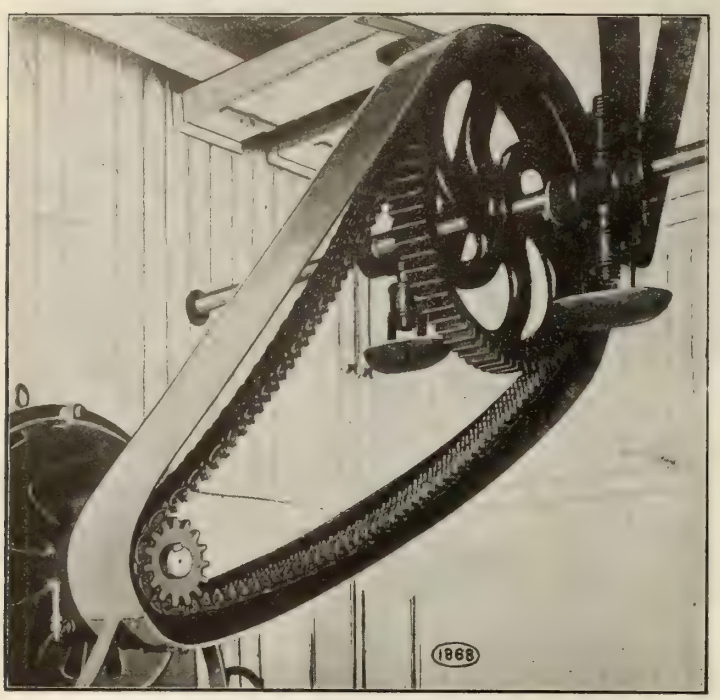
The World's Greatest Toolmakers
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Use Starrett Tools

MAXIMUM EFFICIENCY IN POWER TRANSMISSION ASSURED BY

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30 H.P. Renold Silent Chain operating Lineshaft

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We carry large Stocks of Silent and Roller Chains in Montreal and can make quickest possible deliveries.

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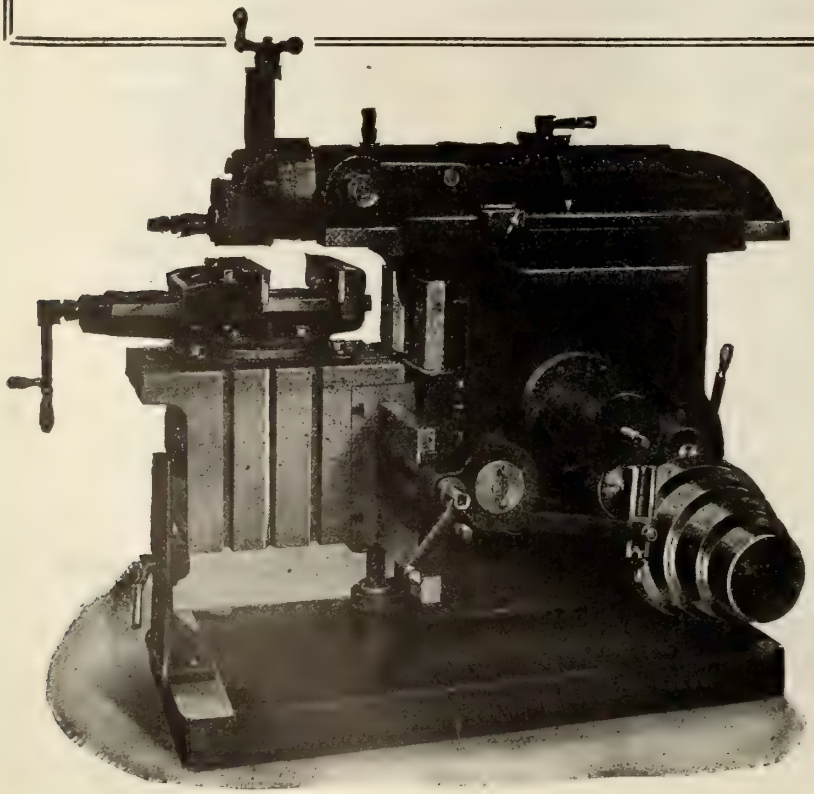
HEAD OFFICE
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TORONTO

McDougall Crank Shapers

16-20 and 24 inch

ARE-MAC-DEE IS A GUARANTEE



A Bigger Day's Work

is made possible with McDougall Crank Shapers than with any ordinary Shaper because the McDougall is built on lines especially for this purpose. It embodies the most approved features of the most practical shapers on the market and care has been taken to exclude all non-essential parts.

The column is massive in construction, well braced and reinforced internally. Exceptional strength is also seen in the ram, which is semi-circular in form and of box type. It can be set forward by crank conveniently arranged.

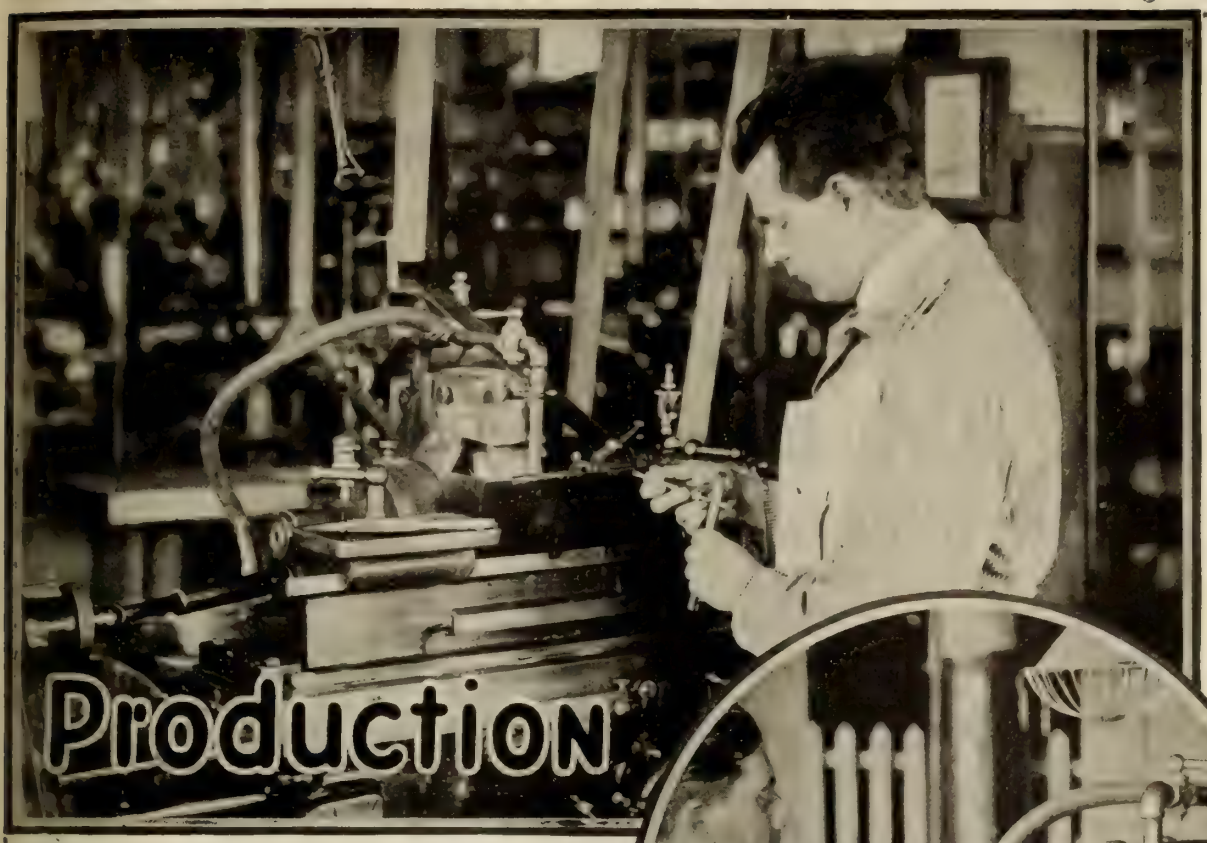
Slides are square, accurately fitted and with broad bearing surfaces.

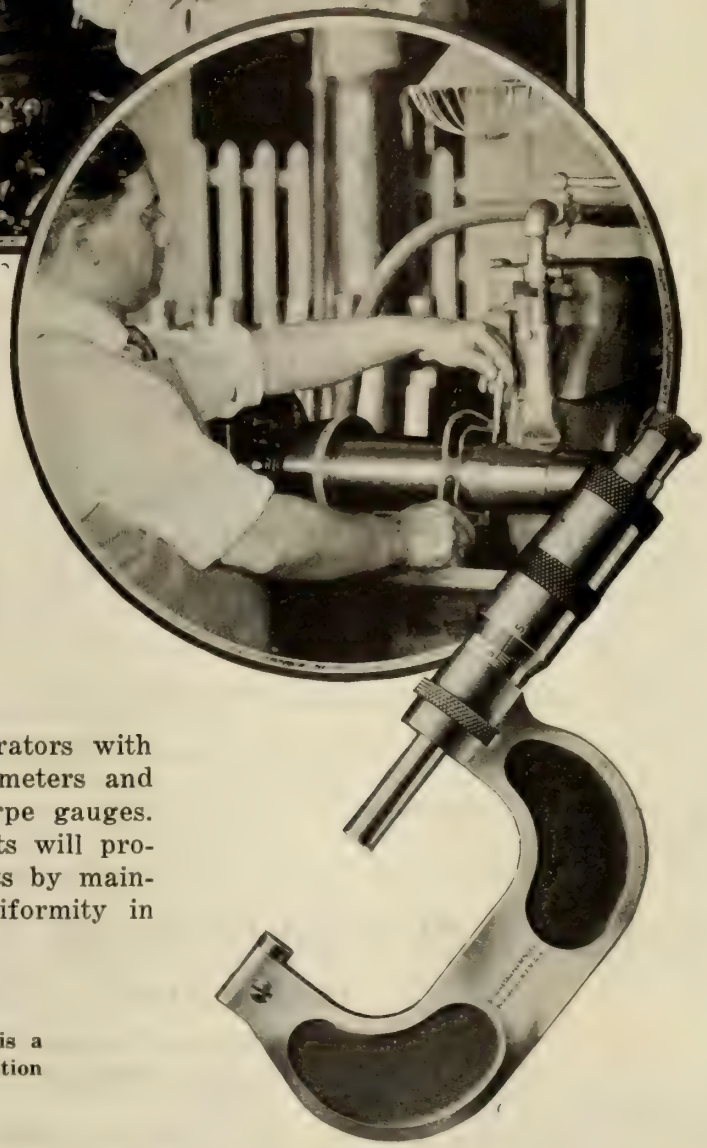
Have us explain the other salient points of this finely constructed machine. Full details on request.

The R. McDougall Company Limited

Galt, Ont., Can.

The Canadian Fairbanks-Morse Company, Limited
Sales Agents





—Accurate Production is Secured by Using Accurate Tools

Reliable precision tools are small but highly important parts of your grinding equipment.

Furnish your grinding machine operators with Brown & Sharpe heavy type micrometers and your inspectors with Brown & Sharpe gauges. These accurate measuring instruments will protect the good name of your products by maintaining unvarying precision and uniformity in your production work.

Send for our No. 28 Catalog. It is a reliable guide for the proper selection of precision tools.

Brown & Sharpe Mfg. Co.

PROVIDENCE, R.I., U.S.A.

Norton Alundum and Crystolon Grinding Wheels
FOR SPECIAL OPERATIONS

For the special job, the one where the corner of the grinding wheel must stand up, or where a face shape conforming to the shape of the work ground must be maintained, or where specially formed tools must be ground accurately, we may be able to suggest to you methods which will result in faster production, greater accuracy and better finish for your work.

A difference of one grain size or one grade of the wheel may give you surprising results. In addition, the artificial abrasives ***"Alundum"*** and ***"Crystolon"*** which we make ourselves in the large furnaces at Chippawa, are designed to offer the required properties for just such work as you have.

May we assist you in selecting the right grinding wheels for your shop?

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AND
MANUFACTURING NEWS

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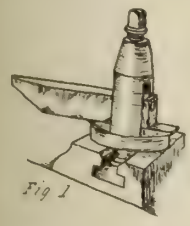
Keeping the Lathe in a Serviceable Condition

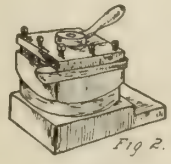
Lathe Still Holds Premier Position—Most Suitable Tool for Small Shop But Must be Kept in Accurate Alignment—Conditions That Develop Spring and Wind—Testing for Accuracy

By H. ALTON

THE progress of industry has given us a wide range of machine tool equipment, both in the improvement of standard designs and the development of special machinery for specific requirements, but the engine lathe still retains the premier position as the most suitable tool for the small shop carrying on a general jobbing business. The small shop that contains a grinding machine is very rare, many small shops are without millers, and many have no shapers or planers but where will you find a machine shop that has not got a lathe?

There are different methods that may be adopted in selecting a lathe. Weight is frequently a factor that influences the purchaser but unless the "weight" is "designed" into the tool, the addition


Fig 1


Fig 2.

metal may not enhance its serviceable qualities. Long wearing of parts, rigidity, appearance, adaptability, and many other qualities are features that require consideration, and not the least point of importance is that the tool should be the product of a manufacturer, whose reputation must be sustained by a high standard of workmanship in every machine placed on the market.

The engine lathe, almost automatically, drops into three classes, namely, the manufacturing lathe, the general utility lathe, and the tool room lathe. As a general rule the small shop wants the utility machine, owing to the wide range of work performed. The relative merits of the solid bed lathes, as opposed to those with fixed or adjustable gaps must be decided only when the conditions under which the tool is to work, are known. Frequently the two-spindle machine is a most serviceable tool.

One important point to consider in acquiring a lathe for the jobbing shop is the quick change features of gear and spindle drive. In the large shop, where tools are operating for long periods on one class of work, the quick change is of minor consideration, although even here the saving of time is advantageous. The small shop, however, is often required to make many changes every day and the conservation of time on each change means a great saving in the general total.

One of the weak points in lathe design, and one which is now passing, is the tool post shown in Fig. 1. For light speedy work a post of this nature is very serviceable, but falls down under heavy duty. A design that appears to meet modern requirements is that shown in Fig. 2. This type provides a greater grip for the tool and eliminates slip when taking heavy cuts.

Where quantities of similar pieces are frequently made in the job shop, and where a number of operations are made on each piece it is often advisable to use a removable turret that fits the shears of the lathe. A close study of turret lathe practice will enable the small shop owner to make more effective use of his engine lathes.

Rigidity of Parts

Absence of vibration is probably the most essential requirement in a machine tool, and nowhere is this more noticeable than in the tool holding portions. The effect of the overhang on a lathe tool on the allowable cutting pressure is shown in Fig. 3. Here we see that a pressure of only 100 pounds with a 16 in. overhang, the deflation is

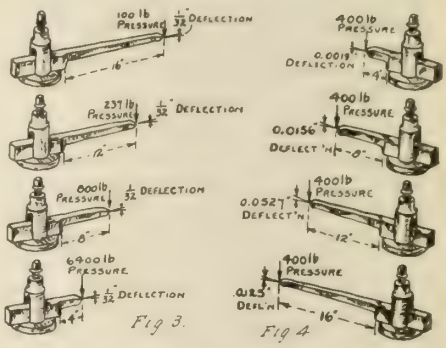


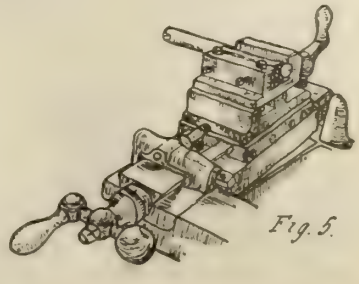
Fig. 1.—Suitable only for light work.
Fig. 2.—For heavy duty operations.
Fig. 3 and 4.—Showing effect of overhang of tool.

1-32 of an in. Note how rapidly the pressure increases as the overhang is reduced. Again in Fig. 4 note how the deflection of less than .002 in., with a 4 in. overhang and a 400 lb. tool pressure, mutiplies itself under this same tool pressure into a deflection of ⅛ in. to 16 in. Instead of having an assortment of different boring tools of various lengths, it is often cheaper and better to make a holder as shown in Fig. 5.

A good example of rigidity in tool support is shown in Fig. 7, an improvement over the old method shown in Fig. 6. The added holding facilities in the former case enables a much heavier cut to be taken without danger of deflection.

Equal Tool Pressure

Equalizing the tool pressure on work is one way of securing rigidity and ad-


Fig. 5.

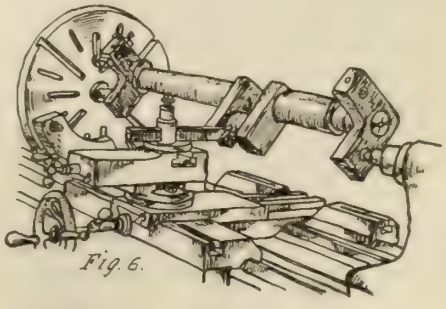
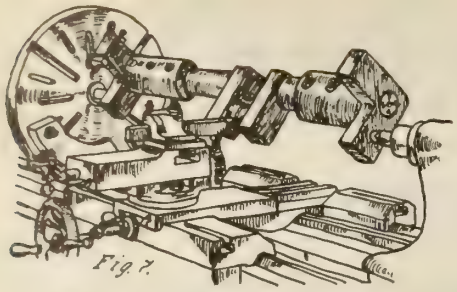

Fig. 6.

Fig. 5.—Effective type of boring tool. Fig. 6.—Inefficient method of turning crank shaft.



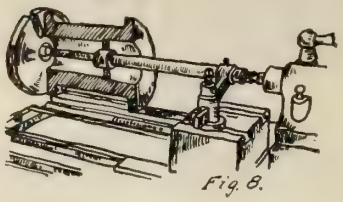


Fig. 7.—Rigid support for tool. Fig. 8.—Special boring bar for long cylinders.

ding to profits. Boring a hole with a cutter head in which the applied force is equalized between two or three evenly spaced cutters is frequently overlooked in the small shop. A simple boring bar is shown in Fig. 8. An arrangement of this kind will assure a true hole on lathes in which the shears are worn out of true, as the alignment depends only on the accuracy of the head and tail centres, and the face plate. Added rigidity is obtained owing to the outer end being supported on the live centre. A set of these bars is a good investment for the small shop.

Lathe Alignment

In order that a lathe may do its best work it is imperative that it be properly installed to maintain the alignment of the different elements. The conditions under which a new lathe is built and tested are, invariably, of an ideal character, and if these conditions are not the same when the tool is placed on the user's floor, the faults developed may be placed against the tool and not on the method of installation, which is nearly always to blame. A lathe is far more sensitive than many mechanics realize, and it would interest those of us who are not familiar with experimental testing practice, to see some of the practical demonstrations in connection with the flexibility of metals.

The writer had the privilege some time ago of observing some of these experiments in the works of Brown and Sharpe at Providence, R. I. The measuring machine used for the purpose is built on the most rigid lines. The frame is between 16 and 18 in. deep at the centre and of exceedingly strong section. The design was made with the idea in view of eliminating spring and distortion, to as great an extent as possible. One thing they do on this machine, is to take an accurately ground plug gauge, and adjust the measuring spindle until this is just held suspended between them. Then they ask you to place your hand under the bed of the machine and lift. As soon as you begin to pull up, the plug drops. The pressure exerted by your hand has been sufficient to spring the bed, and draw apart the measuring spindles.

They repeat this experiment in a somewhat different manner. They place the same plug between the centres, and you are asked to lay your hand on the top of the bed. The expansion of the metal caused by the heat of your hand is sufficient, in a moment or two, to cause the plug to fall. If a rugged machine, such as this is, built particularly for the purpose of withstanding deflection, is subject to such delicate stresses, what can we say about the ordinary machine tool bed? What happens in the long bed of the common engine lathe?

Some men are very particular when they purchase a lathe. When they require a lathe they consult all the catalogs, and then draw up a set of specifications calling for accuracy of one one-thousandth of an inch in 12 inches when boring and turning. They send out letters asking for quotations, requesting the weight of the machine, the size of the main bearings, length of carriage bearing on the shears, speed and feed ratios, and all such information. Then when a lathe that meets all these severe requirements has been purchased and it reaches the shop, in a good many instances it would be set up on a shaky foundation, often on a wooden floor. The bed would be carefully lined up and tested, the bed being made to set level by driving wedges under the legs until the desired setting was accomplished. In a month or two the floor would have taken another sag, and the lathe bed would accommodate itself to the new conditions. Next thing that happened would be a report from one of the men that the lathe would not turn true, or else that it was boring bellmouth holes. Then there would be trouble for the firm that sold the tool. Such men have difficulty in realizing that it takes common sense and judgment to maintain accurate alignment in a tool after it has been purchased, and no matter how carefully the tool has been built, if care is not taken, its accuracy will soon disappear.

The simplest way to test a lathe is to bore and turn with it, but the fact that such a test is unsatisfactory does not prove that the lathe itself is to blame. When you consider the ease with which a lathe bed may be sprung you will realize the truth of this fact. To repeat the experiment made on the measuring machine on a small scale, take any 16 in. or 18 in. lathe and put a bar between the centres and test dial indicator in the tool post. Bring the test indicator to register against the bar. Then put your hand on the under side of the bed and lift. Note what happens to the indicator reading. After this test one will not be so hasty in making complaints about a lathe not in turning or boring true. A little investigation as to where the trouble is, will suggest itself. The modern method of supplying most tools with concrete foundations, is about the best and only method of keeping machines so that accurate work will be turned out over a considerable period. If other foundations are used it is only fair to the machine and the manufacturer, to test a tool frequently to ascertain whether or not an uncertain setting has caused sag or deflection in the bed.

Wind in the Bed

A very important test is one that determines whether or not the lathe bed is free from wind and is level. The way to do this, is shown in Fig. 1. Accurate straight edges and a sensitive level are the appliances used. The bed is first tested for wind, as shown at A, repeating every two and a half or three feet, throughout the length of the bed. Then it is tested for level longitudinally, as shown at D. If a lathe is properly lined up with wedges and then grouted in on a substantial foundation of concrete, it will maintain its level position for a long while. On the other hand if it is placed on a wooden floor, and particularly an upper floor, the wedges must be frequently adjusted. In setting up a lathe that has legs of the cabinet type, always wedge up on the inside of each cabinet leg first, before driving the wedges on the outside edges.

Testing Centre Bearing

The alignment of the centre bearing must be true with the lathe spindle, if the lathe is to do accurate work, on its

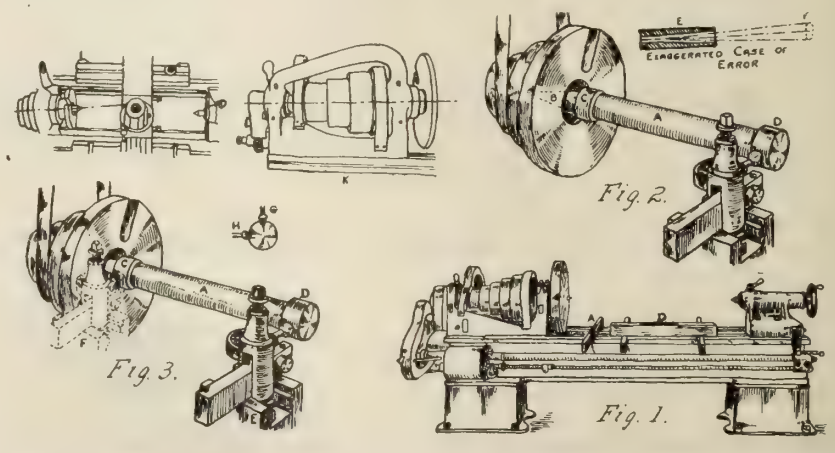


Fig. 1.—Testing for wind and sag in bed. Fig. 2 and 3—Testing alignment of spindle with lathe shears.

centres. This is tested as shown in Fig. 2. First make a test bar A, on an accurate lathe or grinder, this bar having a shank B to fit the head centre bearing. Collars C and D, which are from 12 to 15 inches apart, should be turned to the same diameter. Before putting this bar in the lathe that is to be inspected, it should be carefully tested itself on accurately ground centres with an indicator to see if it runs true at B, C, and D. If found true wipe out the centre bearing carefully and insert the test bar, leaving its outer end D unsupported. Turn the lathe over by hand and indicate the collar D which should run true. If it does not, it is evident that the centre bearing is not true with the lathe spindle, and the amount that it is out in the length of the test bar can be figured from the indicator reading.

Alignment of Spindle

Another important test is that for alignment of the spindle with the shears, both horizontally and vertically. This is shown in Fig. 3. To make this test, the same bar A is used. The indicator is set on the collar D in the horizontal plane, as shown. The carriage is then moved from E to F in order to get a reading on the collar C. There should be no difference in the readings on the two collars, which, of course, are exactly the same size. If the test is repeated in the vertical plane, as shown at G, it will show whether the centre line is true in this position. A scriber may be used instead of a gauge for both first and second lathe tests if no indicator is at hand, but these tools are so cheap and so generally useful that few shops can afford to be without them.

Alignment of Cross Slide

The alignment of the carriage cross slide is tested as is shown in Fig. 4. A very light cut is taken across the faceplate, and this is tested with an accurate straight-edge A, using tissue paper strips, as shown at B. At C and D are shown exaggerated cases of error. If the faceplate is at all convex the carriage cross shears must be scraped. If it is slightly concave there is no great harm done, as hollow work will bear on its outer edge slightly, which is much better than having the high spot in the centre so that the piece rocks.

The central position of the tail centre, and the alignment of the tail stock

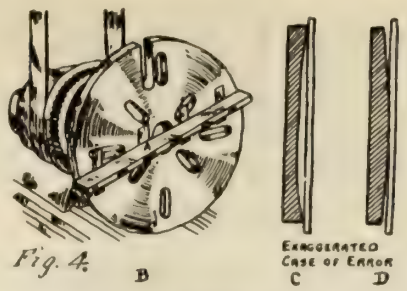


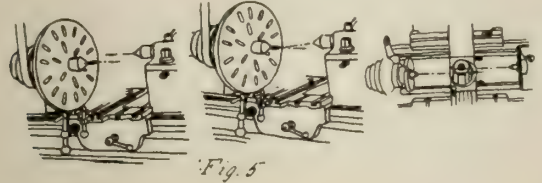
Fig. 4.—Testing alignment of carriage cross slide.

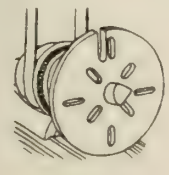
spindle, are checked up as shown in Fig. 5. An angle piece A is selected, which is known to be true. It is strapped to the face-plate, and to this is attached the test indicator B, placed to as to bear against the tail centre, after which the head is rotated by hand, and the gauge B is read on all four quarters. This test gives merely the central position of the tail-stock and does not tell how the tail spindle travels. To check up this point the indicator B is moved to the position shown at D, and the tail centre spindle is advanced to its extreme travel, and the test repeated at E. This will also show whether the head-spindle, although parallel with the shears, has worn low or not. All spindles will wear low in time, particularly if heavy chucking work is done. Lathe spindles are usually set from one to two one-thousandths high, by the manufacturers with this in view, and until they get from one to two one-thousandths low, it is not necessary to put shims under the head-stock or to adjust the bearing boxes.

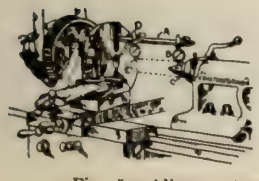
Testing the Centre Point

All of these other tests may prove satisfactory, and yet the lathe refuse to do accurate turning on centre work. In this case it is due, very likely, to the fact that the live centre is not truly ground. This is tested as is shown in Fig. 6. A bar is placed between centres, and a spot is turned as shown at A, as near as possible to the driving dog. The bar is then reversed and with the spot near the tail centre, it is indicated as shown at B. If this spot runs true, this shows that the head centre is ground accurately.

When it comes down to the last analysis the lathe is simply a machine which is used as a medium for making profits. The speed with which work can be turned out is a very good way to measure the earning capacity of the machine. Probably no one item contributes more to accuracy with high speed, than rigid fixtures. Thus when designing or building lathe tools and fixtures make them rigid. You will find it pays.







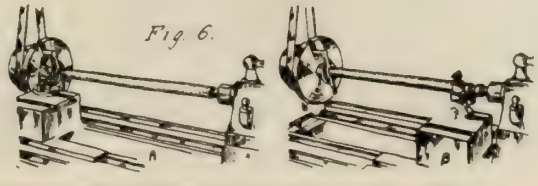


Fig. 5.—Alignment of centres. Fig. 6.—Testing for accuracy of live centre.

STILL IMPROVING THE LOCOMOTIVE

The locomotive, now about a hundred years old, was a British invention; and to-day engineers continue to introduce improvements in its design. Over forty years ago a device known as the "exhaust steam injector" was brought out. Its purpose is to use the power in the exhaust steam from the cylinders to force water into the boiler. The first injector of this kind was able to do its work against a pressure in the boiler of 70 lbs. per square inch. Later it was improved so as to feed at 120 lbs., and for higher pressures it was necessary to call in the aid of live steam from the boiler itself. Lately, however, a British firm invented a modification by means of which the injector can work against a pressure of 150 lbs. per square inch with one pound of exhaust pressure, thus effecting a great economy in live steam. This improvement is due to the use of an additional nozzle which brings the steam into more effective contact with the stream of water. In practice the amount of live steam required when this new device is fitted is nearly half what it was formerly and amounts to only 2½ per cent. of the total steam produced by the boiler.

BUNDLING WOOD BY MACHINERY

Cutting and bundling wood for lighting fires is a process which can be carried out on an economic basis only by very cheap labor or by very simple and efficient machinery. Cheap labor being a rare thing nowadays, there is an increased demand for machinery which will not only chop wood into the required lengths but also arrange the pieces in suitable bundles. A new machine for the latter process was recently constructed by a British firm. The cut wood is fed onto an inclined shoot which delivers them to a conveyor belt running at a considerable speed. It is thrown off the belt on to a slowly moving wheel with partitions into which the pieces fall. Any piece which does not happen to fall into a partition drops back again and is carried once more to the shoot. The partitions deliver into a trough with an opening at the bottom, through which the pieces fall into boxes. As each box is filled, the operator presses a foot plate which removes the full box and brings another into place for filling. The whole process is exceedingly rapid and the machine can be worked by one unskilled operator.

Mr. Morrison, who has been associated for some time with the Baines and David steel merchants, Toronto, is leaving his position to enter the accounting business.

Reducing Operating Costs by Careful Planning

Importance of Proper Routing Has Been Realized by This Plant —Good Lighting is Also a Feature—Jigs and Fixtures Have Reduced Costs and Increased Production

By J. H. MOORE

WHEN MANUFACTURING any product, it is very important that the plant manager arrange his departments in such a manner, that so far as possible, the part, or machine being made, passes through the factory with as little backing up in routing as possible. The importance of proper routing is unquestioned, for it may mean the difference between profit and loss. The wasted time in some plants, which refuse to give routing the consideration it deserves, is amazing. The average factory, however, is beginning to realize the necessity of planning the route of a product, just as one would plan a journey to cover as much ground as possible with the least effort, so that in many cases profits have increased since improvement in routing has taken place.

The logical place to begin planning is when the factory is being built, and the Brantford Computing Scales Co., Brantford, Ontario, had this though in mind when they laid out their present plant. From one end of the factory to the other, everything has been carefully considered, with the result that their product starts in the foundry at one end, and goes out the shipping door at the other. The plant occupies approximately 60,000 sq. ft., and they have about four acres for expansion when required. Two railway sidings are incorporated, with shunting privileges on another line. In this way shipping facilities are provided for.

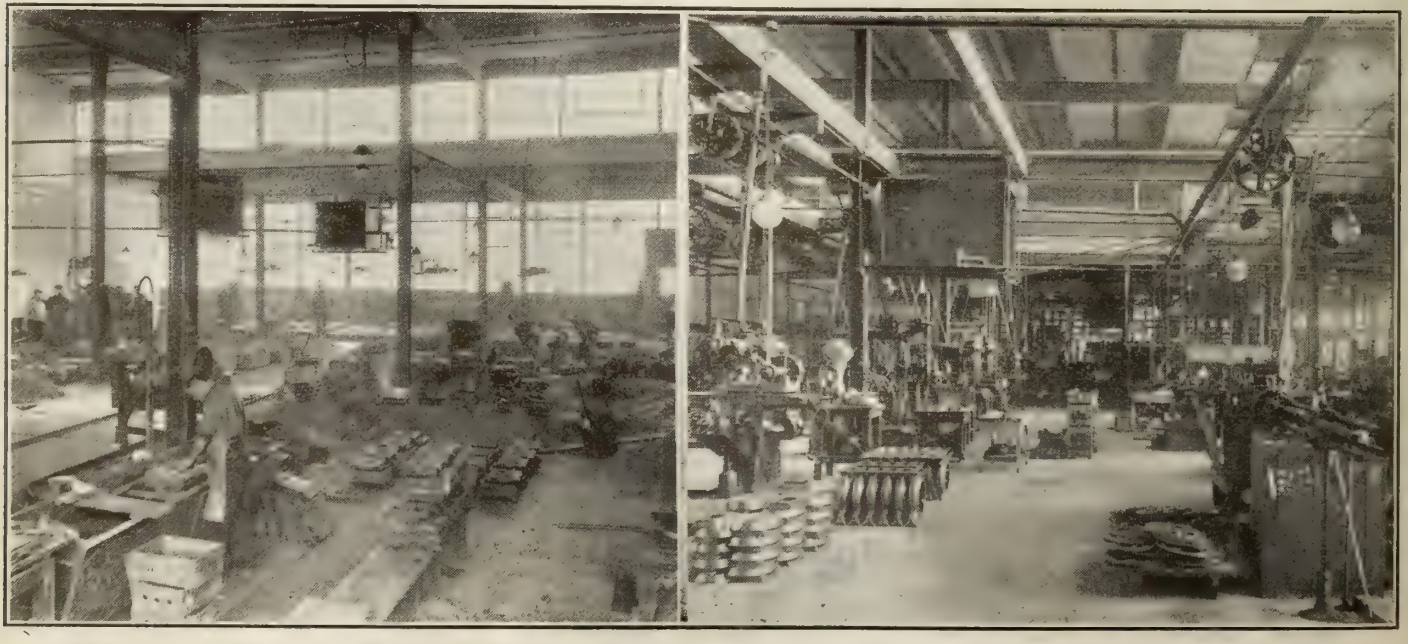
A feature of the entire plant is its good lighting. There are no dark shadows to contend with, the result being, workmen can turn out an accurate job, such as is required in scale work, without eye strain. Starting from the extreme end, we find the foundry separated from the rest of the factory by a fire wall. The photograph at Fig. 1, speaks for itself, because it shows clearly the light provided, and the neat arrangement of the foundry generally. Cast iron, brass, and aluminum castings are made, and they specialize in light casting work of all kinds, doing outside work as well as castings for their own product. The heaviest piece they make weighs about 80 pounds, and this is the base for their meat slicer. Twenty men are employed in the molding shop, and at present they pour three times a week. The cupola room, which is directly adjoining the foundry, is well laid out, and everything is carefully weighed before entering the cupola. This is very important, as owing to the light nature of castings made, the grade of iron poured must be absolutely correct.

No waste is tolerated throughout the entire plant, and nothing is sold to junk dealers. All scrap, cuttings, etc., go to the storage yard outside the plant, which is also adjacent to the cupola room. An oxy-acetylene outfit is used in the foundry as a means of reclaiming and building up small defects which may occur. The type of outside castings made covers quite a varied field, including, automobile jack castings, parts for washing machines, electric fixture castings, smoking stand parts, book rests, and all sorts of novelties.

Coming from the foundry we enter the mill room where castings are cleaned before going into stock. On leaving the mill room they must pass over a scale before getting to the raw material stock room, and in this way a careful check is kept on the tonnage of castings leaving the foundry. Should raw material, strip steel, or any other material purchased outside come to the factory, it is received at a door opposite the raw material stock room, and it also has to pass over the scale before entering the room, so that a close check on outside material is likewise kept.

Raw Stock Room

In the raw material stock room we find a carefully laid out department with well arranged bins, each having its own card to show the amount of parts in stock. Racks for bar stock, etc., are also provided, each section and size being plainly marked. A feature in this department is the blueprints used to show the parts going into a specified number of scales, or meat slicers, as the case may be. Usually, these are put through in lots of twenty-five, or one hundred, and the stock keeper can immediately tell from his blueprints, what parts he has to issue. A portion of one of these sheets is shown at Fig. 2. Later on, in the finished stock room, the store keeper in that room, checks up the number of parts received from a similar set of blueprints, so that they know exactly if anything has been spoiled between the two departments. In the list,



Figs. 1 and 3.—Foundry and machine shop of the Brantford Computing Scale Co.

a reasonable amount is allowed for wastage, as it is realized no factory can run 100 per cent. efficient. Should further stock be required, the foreman of the particular department needing the extra parts must make out a surplus stock order, and of course this shows him up, and he must account for the discrepancy.

Should any parts require grinding or polishing, before entering the raw material stock room, they go to the polishing room which is almost alongside the stock room. A splendid dust exhaust system is used in this department keeping atmosphere clear, and when castings are weigh'y, swinging cradles are used at t.e machines to support the work.

The Machine Shop

The machine shop, a small portion of which is shown at Fig. 3, is well arranged, wide aisles being the rule, rather than the exception. The machines are laid out on the floor to a predetermined plan, the parts passing from one machine to another with as little waste movement as possible.

Several of the operations are of extreme interest, and in a later article we will show some of the jigs used, but at present will confine this story to the description of the plant itself. Only high-class machine tools are used, as accuracy is essential in the making of their product.

Leading from the machine shop is the tool storage room, where all jigs, drills, cutters, etc., are stored. A double check system is used when issuing tools to the workmen, this holding them directly reponsible. Next to the tool storage, is the tool grinding room, and one man attends to all grinding. Every workman is not allowed to grind tools to his own liking, but an expert attends to this work entirely, this increasing the life and efficiency of the various tools.

Alongside of the latter room, and close to the machine shop, is the part inspection room. Here all parts must pass inspection before going any further, and incidentally, this is the second inspection, as all castings leaving the foundry are inspected before entering the raw material stock room.

Leaving this room, the parts proceed to the first paint room, when they are given a coat of anti-rust and a coat of filler, later being baked in an oven. After this they proceed to the finishing paint room, receiving various numbers of coats, depending upon the nature of finish desired. Air paint brushes are used, except where hand striping is done. An expert in this line makes some remarkable effects by hand, and handles the transfer work as well. A baking oven is also used in this department.

Where required, pieces leave the part inspection room and go to the electro-plating room, where the necessary finish is arranged for. Special holding racks are used in order to prevent the operator marring the finished surface.

After the parts leave either the paint room, or the electro-plating department, as the case may be, they pass into the finished stock room where they are arranged and carefully handled, as some of the castings have a very high glossed surface.

Assembly Room

We now come to the assembly room, this being arranged in two sections, one for scales, the other for slicers and cheese cutters. A foreman is in charge of each section, and gets his parts from the finished stock room which is very handy to both departments. Fig 4 shows a small portion of the scale assembly room, and the product is arranged on long tables as shown, gradually working up to a finished article. After the scale is properly balanced, a government inspector checks it up, seals the balance chamber, and puts his O. K. on the finished product.

A large variety of styles are made covering the grocery, meat, hardware, candy, and other trades, cylinder and dial types being generally used. Specially arranged dials compute the amount to be charged, depending upon the price per pound, as well as the weight. After the scales are inspected, they go to the shipping room, where they are packed, and here again the value of careful planning is noted, for the style of boxes best suited to the various types of scales, etc., has been carefully studied. Passing from the shipping room, they go direct to the cars, in this way having had a continuous journey from one end of the plant to the other.

The general offices, drafting room, etc., are situated at the extreme end of building away from the foundry, and here we also find that the various separate offices have been arranged with a view to efficiency.

Purposely, we have left out mention of the tool room until the present time, as it is outside of the regular manufacturing process. Directly next to the tool storage room, and tool grinding room, is the tool room where all jigs, fixtures, etc., are made. Cribs lead into both of the former mentioned departments, so that close communication with each other is always possible. The class of work being performed in the tool room is of a very high order as will be seen when we publish the later article dealing with the jigs used when making various parts of the scale and meat slicer.

The system of heating and ventilating the plant is worthy of notice. In both Fig. 1 and Fig. 3, sheet metal boxes can be seen suspended from the beams. These are units in heat system known as the Vento Unit, and briefly,

(Continued on Page 39)

BILL OF MATERIAL FOR 25 MEAT SLICERS

CASTINGS GREY IRON

No. Reqd	No of Part	Name of Part	Rough Weight		Deliver to	Mch No	Notes
25	10009	Base	18 lb. 25	0 oz.	Cleaning Bch.		
25	10501	Fly Wheel	7 lb. 25	8 oz.			N.P. & P.
75	11513	Collar	17 lb.	8 oz.	Bull Lathe	43	
25	11547	Cap for Housing	12 lb.	8 oz.		43	N.P. & P.

COLD ROLLED STEEL

No Reqd.	No of Part	Name of Part	Size	Length	Weight	Deliver to	Mch No.	Notes
25	11035-6	Pin for Holding Ck. Pin	1/8 Rd.	32 1/16 in.	2 oz.	Sml Foster	44	
100	11602	Screw Retaining Axle.	3/16 in.	53 in.	1 lb. 4 oz.	Acme	39	Pack. Hdn.
50	11624	Spindle for Grinder	3/8 in.	95 in.	3 lb.	"	39	

BRASS TUBE

25	11523	Oil Pipe	1/4 Rnd	159 3/8 in.	1 lb. 9 oz.	Sml Foster	44	

Fig. 2.—Showing the style of material list used in stock room. For convenience different parts of sheet are shown.



Fig. 4.—Section of the scale assembly room.

Successful Collection of Overdue Accounts

Making the Debtor Realize His Obligations—Handling the Slow Payer, the Careless Debtor and the Indifferent Type—Each Must be Dealt With in Different Manner—Sample Letters

By M. L. QUIGLEY

PROCURING prompt settlement of accounts is a problem which confronts practically every business house today. It does not make any difference what the nature of the business so long as credit is granted. It seems to be a natural consequence to have a number of slow acounts.

Nearly every business is carried on on a credit basis, and until such time as some means can be devised to put all business transactions on a strictly "cash with order basis," this condition of affairs will prevail. While it is impossible, under existing conditions, to to each individual, in order to get the accounts, we can, by judicious and systematic handling, prevent a great many losses.

Practically every business man realizes that to some degree, his success or failure depends on his credit standing, and whether or not he may get behind with his obligations. He realizes that this standing is his chief asset, and by reminding him courteously and firmly of this fact it will be the means of spurring him on to greater effort to adjust his accounts, and this line of appeal can be made with good effect on most any debtor.

All debtors, of course, are not slow or indifferent in their payments from the same cause, but if there is any sense of responsibility at all, a man will endeavor to preserve as far as possible, the credit standing he feels he should enjoy, and when he sees visions of losing this, it is wonderful the efforts he will put forth to retain it. Not including the debtor who pays promptly, and with whom there is never any trouble or delay, we might place the rest in four classes, slow, careless, indifferent and unscrupulous. There are many reasons which probably tend to make a debtor slow, and all slow debtors cannot be placed in the same category.

Methods of Handling Vary

Some people have a slow way of doing everything, and even payment of their accounts is undertaken in the same way. A debtor may be perfectly good in every way, but month after month, he is content to let his bills go past maturity, and be written to and dunned repeatedly before he makes settlement. These debtors cannot all be handled in the same way, so that to get the best results every case should be handled on its own merits. While an appeal to a certain motive in one man might get results, it would have no effect whatever, with another.

Through long handling of such accounts, you become accustomed to the nature and disposition of each debtor and are in a position to know what particular kind of appeal should be made to each individual, in order to get the best results.

The Careless Type

Particular attention should be paid to the careless debtor, because if he is permitted to continue in his own way of doing business he will, in all probability, go from bad to worse, but if influence can be brought to bear upon him in such a way as to make him sit down and realize his responsibility and put before him in a friendly way the results of his carelessness in handling his business, he will probably realize that you have, aside from the account altogether, a friendly interest in him, and will make an effort to justify the confidence which he believes you still have in him by making a determined effort to do better. Once this desire is aroused to do business in a business-like way, you have started him along the right way, and by reminding him regularly of his duty, it will only be a question of time until he will acquire the habit of paying promptly. This habit, like all habits, will be more pronounced as time goes on.

We are all human, and no matter how careless we are, we appreciate kindness or assistance, and there is a natural inborn desire to show appreciation for confidence which may be placed in us.

The Indifferent Type

Indifference is the reason for a great many debtors getting behind in their obligations, and a special appeal to this class of debtor to his sense of honesty will, as a rule, bring good results. Whether a man is sincere or honest at heart or not, he likes to leave the impression that he is, and by appealing to him, and assuming you have confidence in him, as a general rule his pride will assert itself and spur him on to action in order to justify himself with you. Persistent and strong appeals with an occasional telegram sent to this class

Dear Sir:—

We did not anticipate, when we wrote you a short time ago that it would again be necessary to remind you of your account which is still unpaid. We felt after the different appeals made to you that you would fully appreciate the importance of having this payment made and that it would have received attention before this.

While we are always anxious, and endeavor to oblige our customers in any way we can, sometimes at considerable inconvenience to ourselves, we feel, when a special appeal is made for payment as has been made in your case, that we ought to be shown the same consideration. You have, however, simply ignored the different appeals made to you although we would suppose if there was any just reason for the account being delayed this long, you would be most anxious to advise us of it, and not leave the impression by the indifference which you have shown, that payment was being purposely withheld.

If you looked at this in the proper light you would realise that there is more involved in this matter than simply payment of an account as if we are obliged to resort to some other method of collection, it will reflect greatly on the credit standing which you now enjoy and as the success of your business depends to a great extent upon the confidence of the people with whom you are doing business, we would naturally suppose that you would be very careful to prevent anything happening which would in any way jeopardize this confidence.

We trust you realise that the adjustment of this account means considerably more than simply the payment of dollars and cents and that you will put matters right by sending immediate settlement.

Yours truly,

Author is manager of collection department at The Ontario Wind Engine and Pump Co., Toronto.

Dear Sir:—

After the length of time we have already allowed on your past due account of $85.00, we naturally felt, when the draft recently made upon you was presented for payment, that it would have received consideration, but you have allowed it to be returned without any attention, in fact the bank advises that no response was made to the notice sent you.

To say the least, we think this is very unfair treatment when you consider the way you have been used in connection with this account as we have carried it at considerable inconvenience to ourselves and have not unduly pressed you up to the present time for payment. Common courtesy would demand at least a reply to our letters, or some reason for the draft being returned, but you have given neither although we would suppose that you would be most anxious to correct any false impressions which might be made owing to this draft being returned unpaid.

Please understand that this account cannot be carried for further time and it will be to your best interests to have remittance made immediately on receipt of this letter.

Yours truly,

of debtor will generally bring him to the sense of his responsibility, as once his affairs are made somewhat public, as they are having telegrams forwarded, he will be very desirous to prevent any false impressions being broadcast, and will, in all probability, attend to his obligations at once.

As a rule, ordinary collection letters to the unscrupulous debtor will be of little avail as such a man has become so hardened to this kind of thing. He has been through the mill so often that ordinary appeals have little or no effect. This class is naturally condemned and abused to a certain degree by all he has done business with, and receives as a rule, practically the same treatment from all he may be owing.

It sometimes happens, that if instead of threatening and appealing along the usual line, a special appeal is made, making it quite plain that you understand the position he is in and what others are doing in regards to collection of their accounts, it may have the effect of bringing results which you never expected, for being used to receiving scathing letters and threats, a different kind of appeal may strike the one good quality in him, and as this is only a chance anyway with the collection of an account of this nature, it does no harm to try the idea out.

The best way, however, once you find you have given this kind of man credit, is to call upon him immediately and get some reason or explanation for his not paying up. He cannot refuse to answer you or pay any attention to you the same as he would to a letter, and if there is any possibility of getting adjustment at all, your chances are much greater by actually getting in contact with him. Failing this, you still have recourse through the court.

In sending letters, or requesting payment of accounts, there is one fact that perhaps is forgotten or overlooked by the majority of letter writers, and it is this. That you are under no compliment in writing to this debtor for payment of his account, as the account itself is the result of credit given him, and credit in the first place, is really a favor conferred.

Business is a very serious affair and sincerity should stamp every action. Whether in selling goods or writing collection letters, there should be the same strain of sincerity throughout, and to my mind, letters should not be written in a jocular way, particularly to a debtor whom you have never met personally as it is possible that they will convey the opposite impression to what was intended.

The best example of business being done in a business-like way is perhaps shown in the manner in which obligations such as notes are taken care of in the banks. Every man who has a note falling due in the bank is most anxious to take care of it in some way, either by payment or renewal, and this desire is created simply through the system and policy of the bank in insisting on these obligations being taken care of at maturity. This can be created in the same way by making your debtors feel that you look upon settlement of their obligations on time as a serious matter, and by insisting on these being taken care of. If you are careless, your debtors will probably acquire the same habit.

When starting to use a new grinding wheel it should be run at full speed for a minute or two before applying the work, the operator standing clear during this brief period.

REDUCING OPERATING COSTS BY CAREFUL PLANNING

(Continued from Page 37)

here is how the system works. A fan draws in the air from the shop at the rear end of each unit, passes it over heated coils inside the box, and throws it out, over deflectors at the other end, in any desired positions, the result being an evenly heated or ventilated shop at all times. As far as we can learn, this was the first of its kind to be installed in Canada. The Ford Motor Co., Detroit, used it with good success, this fact prompting the firm whose plant is described, to adopt the system.

Referring to Fig. 3, it will be noted that an addition has been made by erecting a top floor over a certain portion of the plant. This new section will be used for light assembly work, and will be provided with a rest room, and all other conveniences. The experimental department will also be situated on this floor.

Outside the main building is the boiler room, heat treating department, and pattern storage. This is a separate unit, and a 115 h.p. boiler is used for heating purposes. In summer, a small auxiliary boiler is sufficient, as only the plating room requires steam at that time. The Dunham drip trap system is used.

In order to reduce the charges for water used in the plant, this firm decided to dig their own well, using the water secured for their plating room. The ground through which the well had to be dug was rather good gravel, so they hired a well digger on the understanding that he would charge so much for every foot he went down until he struck water. Another stipulation was that the firm owned the gravel brought from the hole. This being agreeable to all concerned, the well was made, and the gravel secured was used in the laying of the power house cement floor. When everything was totalled up, it was found that the saving effected in securing the gravel free, paid for the digging of the well.

This story shows how carefully every item is planned, and the thought placed on the well episode, is given in still greater proportion to the process of manufacture. Nothing is done without a good reason, and every department is arranged to be of as much help to the next one as possible. The operations are likewise planned, with the result that waste time is reduced to a minimum. A spirit of co-operation exists through the entire plant, and owing to the policy of the management, and the excellent working conditions provided, they have never experienced any labor trouble. The plant is running at normal, employs about 200, and hopes when conditions warrant, to still further branch out, building a separate foundry, enlarging the present machine shop, and making other important changes.

Increasing Output by Means of Turret Lathe

Actual Cutting Time Reduced by Use of Multiple Tools—Attachments That Aid Rigidity and Increase Production—Taper Turning and Threading

By J. H. RODGERS

FROM the standpoint of quantity production systematic machining of work is an essential factor. The material of which the piece is composed and the nature of the different detail operations will generally determine the class of tool best suited for the purpose. Due consideration, however, must be given to the volume of work, of a certain character, that can be performed on any one particular machine. Where sufficient work is available with-

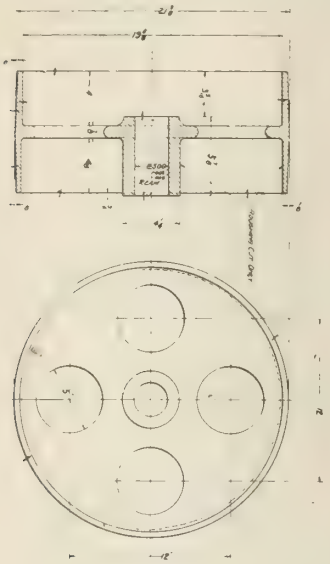


Fig. 4.—Showing dimensions of pulley in Fig. 3.

in the production range of automatic or semi-automatic machines, the installation of such equipment is often an economical investment.

Illustrations obtained through courtesy of International Machine Tool Co., Indianapolis, Ind.

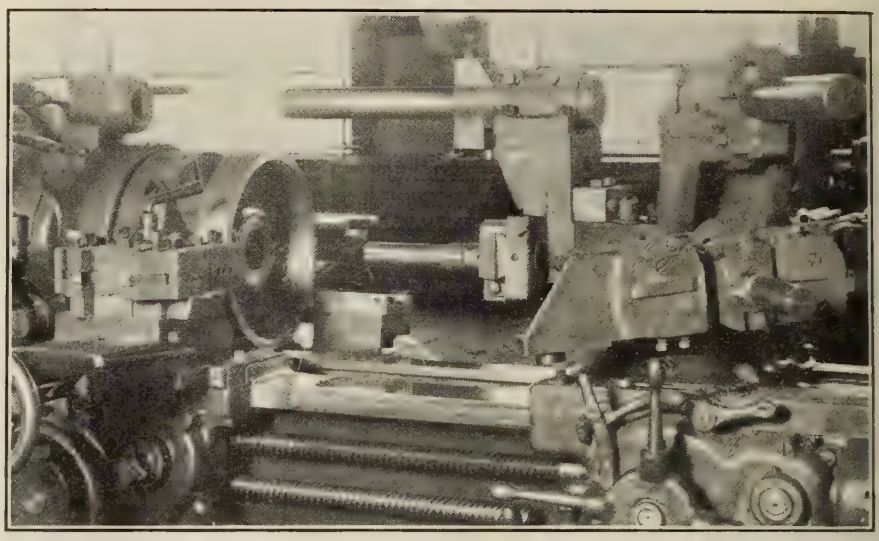


Fig. 2.—Machining cast iron fly wheel on turret lathe.

Manufacturing requirements to-day necessitate the use of heavy duty machinery, where the maximum amount of material must be removed in the minimum space of time. Not only is it a case of removing metal but likewise the conservation of unproductive time in the changing and setting of tools and cutters between the various operations. This latter phase of shop practice is one that has accelerated the development of the automatic type of machine tool.

Multiple Tooling

Turning has, until recent years, been more or less recognized as single tool machine work where no more than one tool was working at the same time. The demands for increased output resulted in machines of more rigid design, and subsequently the multiple tooling system. This last mentioned feature is one that is difficult to incorporate into the ordinary engine lathe, and in consequence the turret machine has, in many instances, replaced the former for production of duplicate parts.

One of the advantages of the turret lathe, where a number of similar parts are to be machined, is the fact that once the cutters are set for the various detail operations the work on all the pieces can be performed without the resetting of the different tools, thus saving valuable time and eliminating the necessity of gauging the work when each operation is commenced. The turret likewise provides an almost unlimited means

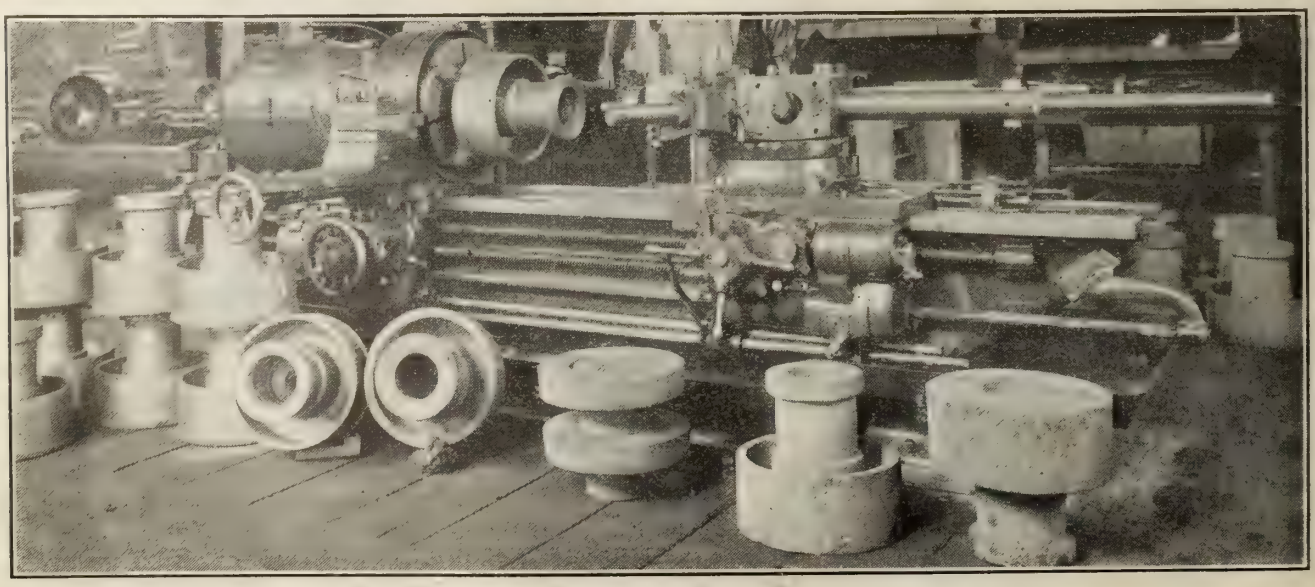


Fig. 1.—Machining a ball bearing centrifugal spindle pulley on heavy duty turret lathe.

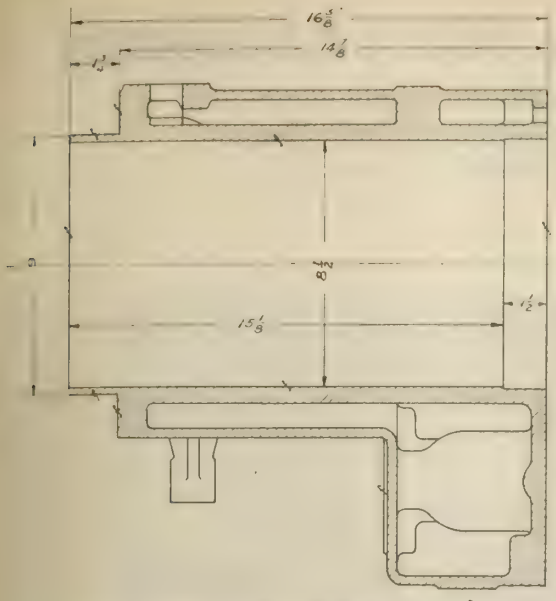


Fig. 8.—Details of large cylinder.

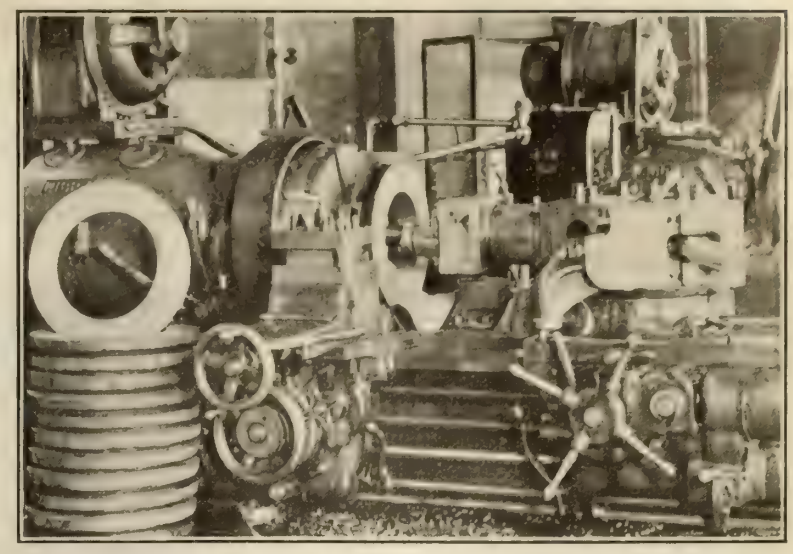


Fig. 5.—Facing, boring and taper threading large pipe flange.

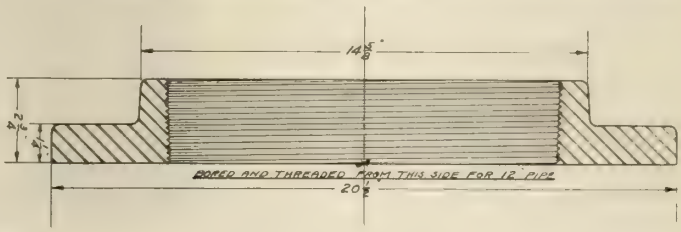


Fig. 6.—Details of pipe flange.

of using attachments for machining different surfaces at the one time. In addition to this, the tools in the forward carriage may be working on the piece simultaneously

Machining Special Pulley

The accompanying illustrations shows several pieces of work that have been handled to advantage on Libby lathes. Fig. 1 shows a heavy duty turret lathe

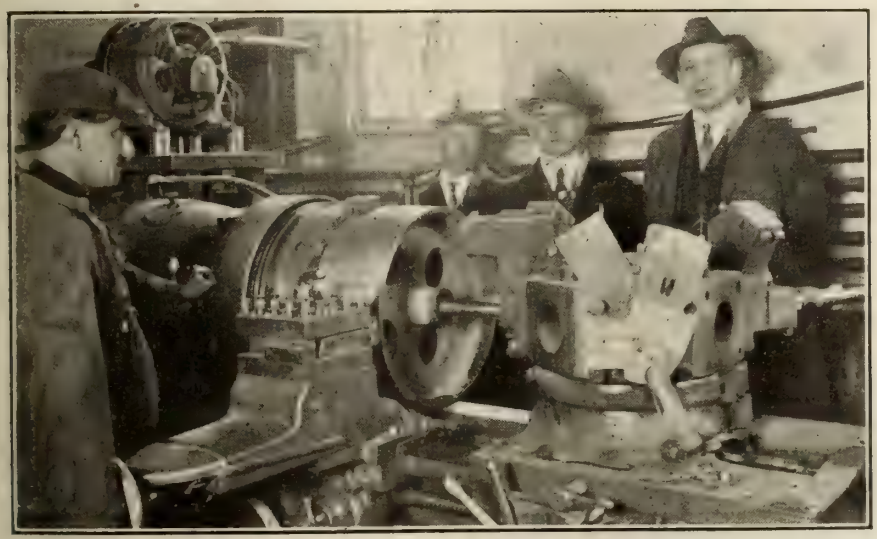


Fig. 3.—Turning, boring and facing large pulley.

machining a ball bearing centrifugal spindle pulley at the plant of the Cresson-Norris Co. of Philadelphia. The piece is 16½ in. dia. and has a hub 15¼ in. long. The boring bars are provided with long pilots which are supported in a bushing in the hollow spindle of the head stock. The space between the hub and the outer shell is machined by a tool secured to the small turret on the forward carriage. Recessing the bore is accomplished by means of boring bar fitted to a movable slide on one of the main turret faces. The collar of the hub is finished with a tool held in a special block that has a vertical adjustment, the work being supported by means of a pilot the full size of the bore. The weight of this piece, finished, is 309 lbs. It is machined all over, as shown, in 2 hrs. and 32 min., a saving of approximately 80 per cent over the previous method.

Automobile Fly Wheel

Fig. 2 shows an 18 in. automobile fly wheel being machined. The piece is turned on the outside diameter, faced on both edges, taper turned on inside for friction clutch, and bored and faced on the front side of hub in the average production time of 9 minutes each. Added rigidity is obtained by means of a special pilot bar that is elevated above the work and is supported, when tools are working, in a bearing located on the front housing of the head stock. The rim is faced and sized by tools in the forward turret.

Fig. 3 illustrates the machining of a 22 in. dia. cast iron pulley. The piece

(Continued on Page 47)

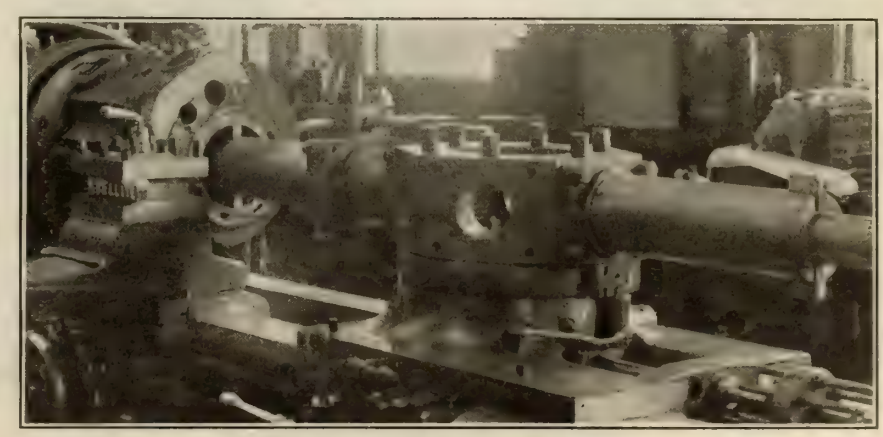


Fig. 7.—Machining large cylinder casting.

Intelligent Choice Made By School Students

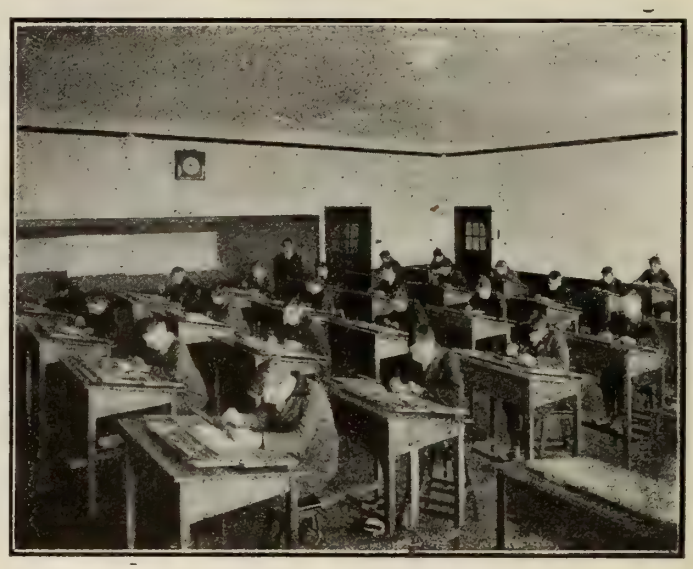
Steady Growth of Attendance—Additions to be Made to Original Building—Students May Specialize After Second Year—Evening Classes Well Attended

By H. B. BEAL
Principal London Technical and Art School

THE LONDON Technical and Art School is one of the pioneer institutions for vocational education in Ontario. From a very humble beginning in 1912 in an old and discarded public school building, it has steadily grown till to-day it is one of the best equipped technical school institutions in Canada. the spacious first unit, which when it was opened in 1918, it was freely predicted would never be filled. The London school board is at the present time receiving tenders for the first addition to the original building.

The readers of this article will be particularly interested in the facilities provided for the training of boys and young men. In addition t othe academic class rooms and science laboratories where mathematics and science as applied to the shop departments are emphasized, the school contains a well-equipped machine shop, woodworking and finishing room with complete power mill machinery and bench equipment for two full classes, an electric wiring room, automobile department, plumbing department and two draughting rooms.

In addition to matriculation courses leading to the engineering and applied science departments of the University there are full time general industrial and technical courses for boys. In these courses boys devote one half of their time during the first two years of their course to academic studies of high school grade, but correlated to the shop work of the school and the other half of school time is devoted to machine shop practice, woodworking, electrical work, draughting, materials and applied science. These two years provide a good general education and a variety of shop work which enables students to make an intelligent choice of a practical course in which to specialize during the third year. The final year, or two years if desired, may then be devoted to specialization in one practical department as a major subject with the draughting, mathematics and science related to it.



View of drafting room at London school

A considerable and increasing number of students who have left school and have been in industrial establishments long enough to find out that they require further training to fit them for success in the industrial world enter the technical school for special full time day courses. More than forty of such students are at present taking machine shop and woodworking training.

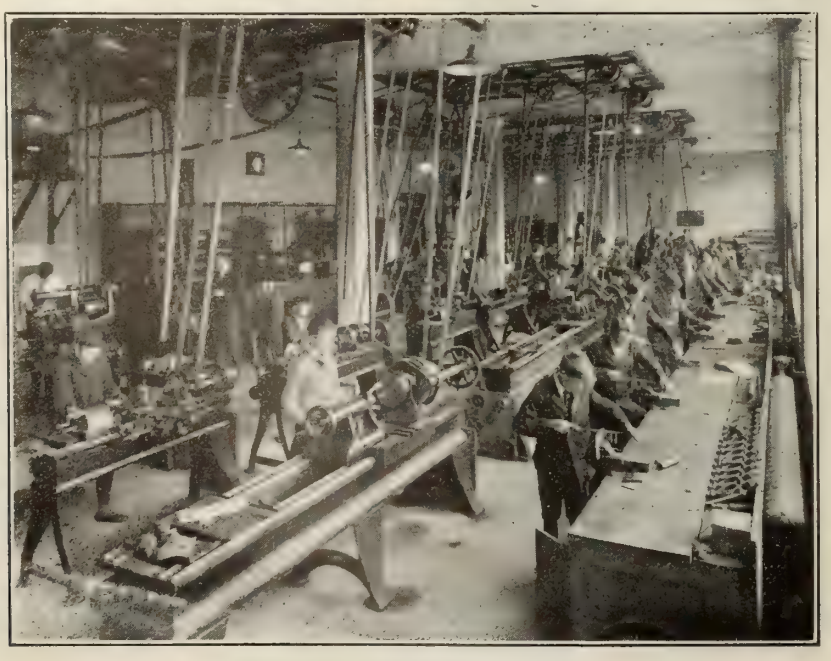
Evening classes attract many young men from the local industries. These classes cover a large variety of practical subjects including machine shop practice, welding, plumbing and steam fitting, cabinet making, carpentry, joinery and mill superintendence, roof framing and stair building, stationary engineering, electric wiring, wood carving, science of electricity, machine draughting, architectural draughting, sheet metal draughting, show card writing, art, industrial design, industrial chemistry and mathematics.

For the benefit of students in the automobile classes, the following equipment is available: 1 Hudson-four car; one McLaughlin-four car; one Cadillac-four car; one Oldsmobile-eight car; one Peerless-four car; one Ford car; one Curtiss aeroplane V-type eight cylinder engine; one rotary aeroplane eight cylinder engine; one Peerless eight cylinder engine, working model; one Fairbanks two cylinder 1½ h.p. stationary motor; descriptive charts with blue prints of engines and mechanisms; full equipment of tools.

Woodworking classes are furnished with the following:

1 Cowan 12-in. circular rip and cross-cut saw with hollow chisel mortise attachment; 1 24-in. Cowan thickness plan-

(Continued on Page 47)



Partial view of machine shop at London

Classes Organized According to Local Needs

Large Registration in Each Class—Courses of a Practical Character—Applicants Given an Intelligence Test—Women Interested in Automotive Instruction—Commercial Courses Well Attended

By G. E. EVANS
Principal Port Hope High School.

FOR a number of years evening courses in technical education have been conducted in Port Hope, the classes meeting in the high school two hours twice a week. Organized work so far include the following subjects:—Mechanical drawing, English, and arithmetic, automobile mechanics, bookkeeping, typewriting and stenography, home nursing and first aid, millinery and dressmaking. This selection of subjects was decided on after a survey of the local requirements and the industrial occupations available for adults in the town and vicinity. The initial registration and steady increase in attendance from the beginning has been very encouraging, and the fact that there has been a large number registered in each class since its inception has amply proven the wisdom of the choice of these subjects.

The class in mechanical drawing has proven attractive to the employees of several local factories where there are regular draughting departments. The aim of the course is to enable those taking it to read and interpret a blueprint. In the short time at the disposal of instructor and student it is, of course, impossible to take up an extended study of the principles and theories involved in this subject, but the instructor brings as much theory into his explanations as is feasible. The aim is that the course shall be practical and that beneficial results shall be achieved each night. Regular drawing instruments and boards are used, and some of the work done by the students in actual draughting is really excellent, to say nothing of the skill attained in reading and interpreting the blueprint.

In English and arithmetic there is an astonishingly large number who apparently have not got beyond the rudiments of the three R's. The demand seems to be for training in reading, writing, spelling, and in the simple arithmetical operations. That this demand for the more elementary phases of these subjects is not necessarily due to any mental deficiency or retardation on the part of the students has been clearly shown by the use of intelligence tests; and the results of educational tests, when applied in the subjects concerned at different times, afford evidence of steady improvement. The Ayres' spelling test, the Thorndyke or Hamilton writing scales, and various silent reading tests have been particularly valuable in the latter regard. These tests are so standardized, and scientifically constructed that improvement in the students can easily be gauged. Of course, the instruction has to be individual as we seldom find two in the same stage of development.

The class in automobile mechanics has been a very popular one, both men and women being interested. A complete chassis has been purchased for purposes of instruction. The engine and working parts of the car are taken apart and put together before the class, and the use of each part of the machinery is explained. Owing to the generosity of the instructor in loaning the school engines and parts from different makes of cars, also owing to the use of charts, the class has received instruction as to the operation, construction and repairing of several standard automobiles. The lecture method is used hardly at all in this class as the instruction is almost entirely in the form of actual experiment in the mechanism of the automobile. In addition to the chassis a full supply of mechanic's tools is on hand for the use of the class.

The classes in bookkeeping, typewriting and stenography, have proven attractive not only to typists and bookkeepers who wish to renew their knowledge and skill but also to novices in these subjects. The teacher, at the beginning of the term, made a study of the systems of bookkeeping and filing used in the mercantile and manufacturing establishments in Port Hope and built up her course on the basis of what she discovered. Actual office methods and procedure are reproduced as far as possible, thus keeping the course entirely up-to-date and efficient. In typewriting and stenography the training is given by actual practice. Next year we aim to have a course of lectures to be given at regular intervals to the students in commercial subjects by prominent business men, bankers and manufacturers in the town.



Port Hope Collegiate Institute.

In home nursing and first aid we have a graduate nurse of experience as teacher. For equipment we provide a hospital bed with spreads, first aid kit, and various sick room utensils. The essentials of sanitation, diagnosis and treatment of the sick are taught, and, where possible, practical demonstrations are given in illustration of the various things to be done in the sick room. Students are also trained what to do in cases of emergency as in fracture, hemorrhage, drowning or poisoning. This course has proved especially useful to mothers and housekeepers.

As for millinery and dressmaking, we find that these are very popular subjects, having an appeal to women in general because of the possibility of economy in the home sewing. Sewing machines, electric irons and ironing boards form the equipment for these classes. Students start by learning stitches and doing simple sewing. Then as skill develops, more advanced work is attempted until eventually, the finished article, be it hat or dress, is turned out. Owing to the fact that the apprenticeship system in dressmaking seems to be dying out here, those who wish to learn this subject naturally come to our school, where they can learn under practised and efficient dressmakers.

So successful has this evening school become that the school authorities are now talking of establishing a day technical school, and building a handsome addition to the high school to accommodate the students' day and evening classes. It is hoped that by establishing day courses in agriculture, metal working and wood working, automobile mechanics, home making and home economics, etc., many students would be attracted to this school from the surrounding country. Whether this plan is to be adopted remains to be seen, but mention of it is made to show how extensive a hold the evening technical school has obtained as an educational institution in Port Hope and how the idea of technical education has become firmly established here.

News From the Welding Field

Commercial Welding on High Pressure Boilers

Eliminate Guess Work—Weekly Test of Operator's Skill and Progress—Choice of Gas or Electric Process for Certain Classes of Work—Best Method of Applying Patches

By EDWARD H. HEIDEL

FOLLOWING THE welding of flue sheet patches, described by the author in the first part of this article which appeared in March 23 issue, he continues:

Top or bottom half of back flue sheet may be renewed, care to be taken to see that line of weld clears all braces and does not fall through arch tube holes. Cracked flue sheet bridges may be welded after the flues have been removed from that area by having the cracked bridges properly "V'd" out and welded. Allow the sheet to become cold after welding each bridge before starting another. Weld on both sides. Gas preferred.

Stoker Tubes

Where stoker tubes are to be applied, sheet is first marked off and cut on a 45-degree bevel with gas cutting torch. Tube then set in allowing ⅜" on each end to be belled out. Tubes are then tacked in four places and welded from the bottom up, on both inside and outside.

Conclusion of paper read before the February meeting of the American Welding Society, Chicago Section. First part appeared in March 23 issue.

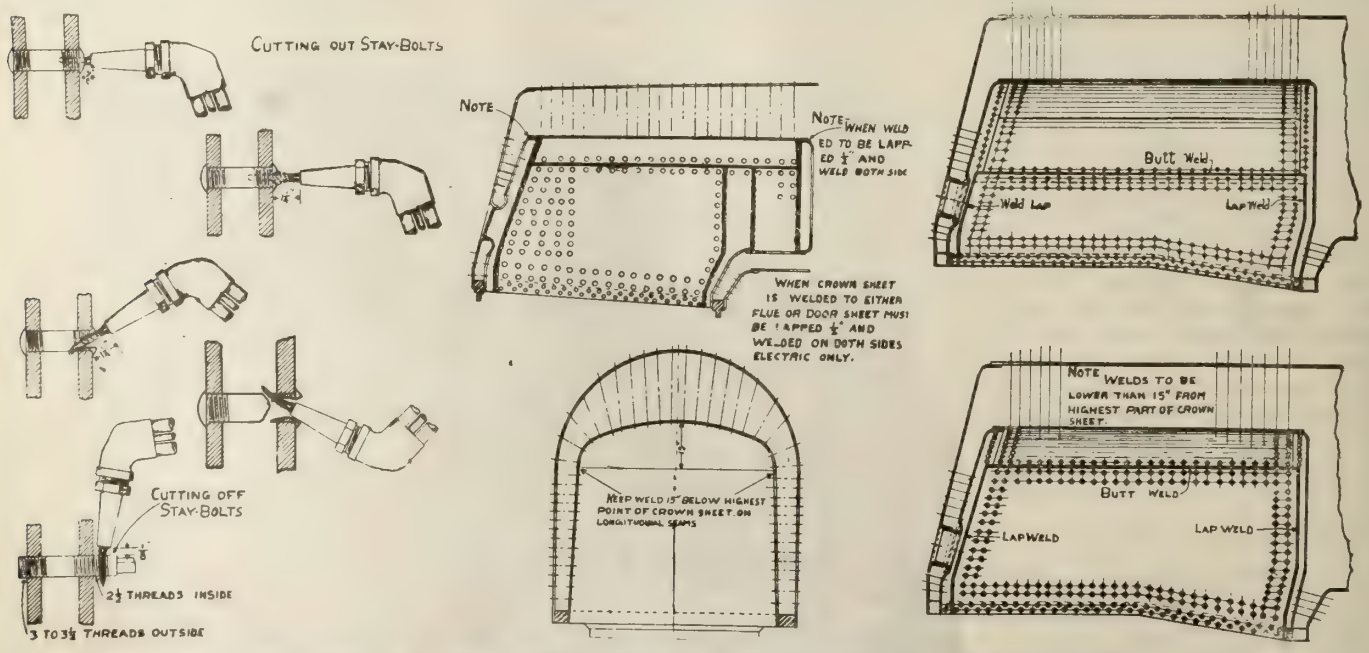
Application of crown sheets should be considered new construction and sheet so designed that line of weld will be lower than 15" below top of crown sheet. When crown sheet is welded to door or flue sheet it must be lapped ½" and welded on both fire and water side. Carefully fit all sides using standard gauge, tack every 12" when clamps should be removed and welding completed between tacks. Where possible reinforce from both sides.

Reinforcing Mud Ring Corners

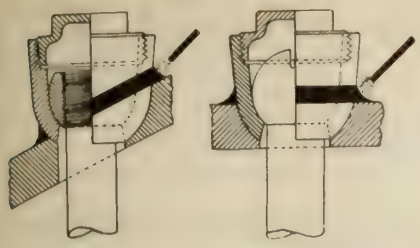
It is considered a good practice to reinforce mud-ring corners inside and out as engines go through shop for classified repairs. Before welding, sheet should be clipped clean and free from oil, dirt or other foreign substance. Corners should be caulked before welding commenced. Metal applied should extend at least 6" beyond corner of ring and up about 8" inside and outside according to conditions. Seams in the firebox can be reinforced in the same manner, first cleaning and caulking seam, then building reinforcement to height and width of sheet welded upon.

Patches may be applied to all sheets in the fire box with the exception of crown sheets. In applying patches to back flue sheet, line of weld must be lower than 15" from highest part of crown. Not more than two patches to be applied to any one sheet. When further repairs are necessary, entire new section to be applied, large enough to eliminate the two old patches. Crack in side or door sheet over three staybolts should not be welded, but a patch applied. Avoid vertical welds in side sheets except at flanges. Fit patch using standard gauge, tack every 12". Start welding at the bottom, working up on side half way, returning to the bottom, working up opposite side to center.

It is good practice to apply patches in side sheets with a circular or elliptical shape, with a DISH pressed in about ¾". Patch held in place with machine bolt through every fifth hole, staybolts butted against patch and bolts placed in center of patch with nuts on the side of welder, with which patch is to be straightened as welding progresses. Staybolts butted up against patch from



Left—Cutting stay bolts. Centre—Welded fire box, combination type. Right—(top) half side sheet weld; (bottom) full side sheet weld.



Electric welded flexible sleeve.

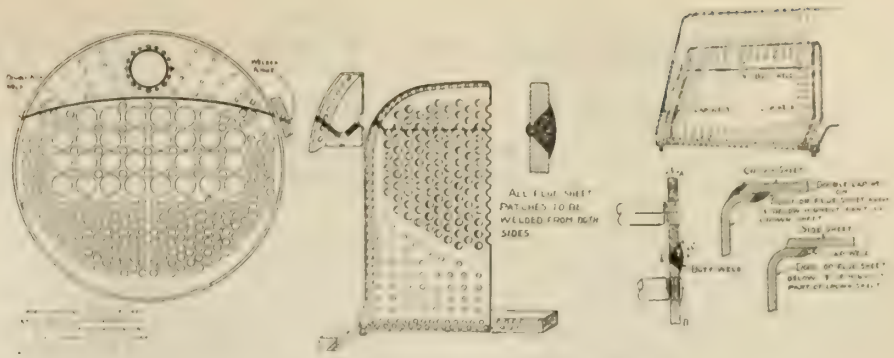
the outside must be turned back or loosened as soon as welding reaches that point in order to remove stresses when weld is contracting.

Half sheets are recommended instead of patches when making repairs. When repairing fire boxes, a number of small adjacent patches will not be applied, but the defective part of sheet should be cut out and repaired with one patch. This refers particularly to round house and running repair work.

Welding Flexible Sleeves

Holes are first cut or drilled in ou side sheet, the size depending on type of sleeve used, 1″, 1½″, 2″, 2⅜″. H les are then counterbored approximately 3/16″ wide at seat to insure proper alignment of sleeve with bolt. It is good practice to bolt motor in place when counterboring at a greater angle than 10 degrees. Do not use oil or lubricant of any kind as this will interfere with making a good weld. Before beginning welding of sleeve, sheet should be cleaned of scale, oil or foreign substances; sand blast preferable. Line up sleeve with bolt end with special tool made for this purpose, which a so holds sleeve to seat while welding.

In welding sleeve to sheet which c nsists of forming a light bond of metal or bead at point of angle as a seal, only sufficient metal to prevent leakage should be applied as the strength and security of the bolt does not depend upon the weld. Care should be taken at the beginning and ending of bead, which can be overcome by lapping weld so as to avoid pin hole.



Left—Front flue sheet. Centre—Flue sheet patch. Right—Welded fire box.

Broken Mud Ring

When the mud-ring is broken, sheet in firebox should be cut between first and second row of staybolts and wide enough to work torch or electrode. Should there be any question as to the depth of length of crack, ring can be heated up dark red and allowed to cool when crack will show up very distinctly.

WELDING INDUCTION MOTOR COPPER

By Fred E. Rogers

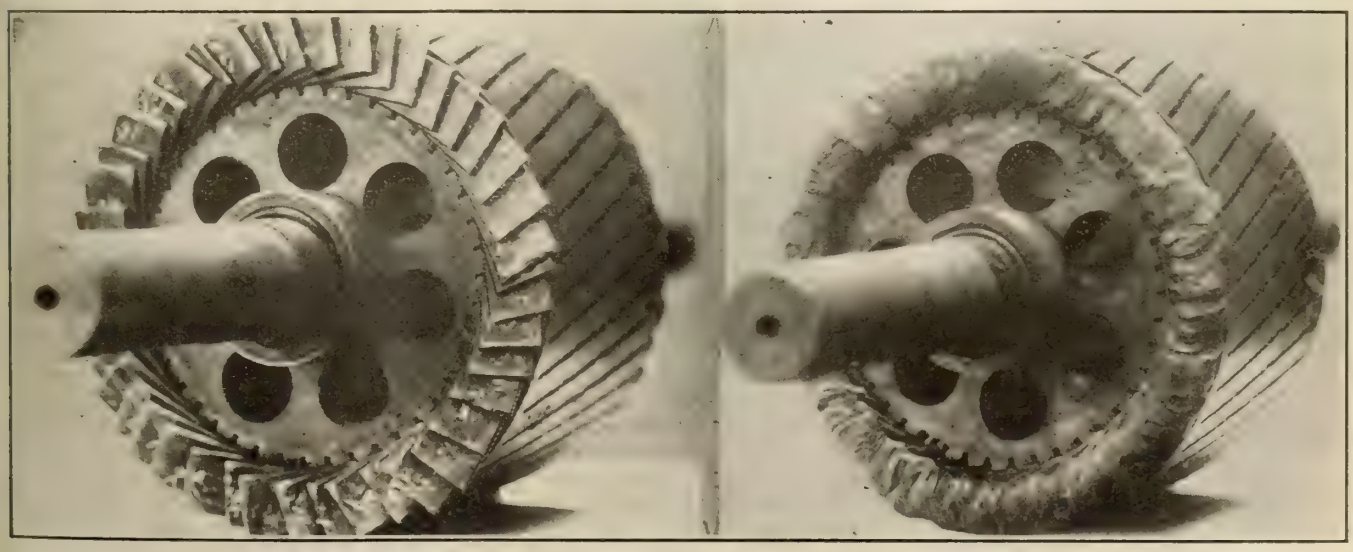
Oxy-acetylene welding has been applied with success to the "short-circuiting" copper strips or bars of induction motors, making a marked improvement in construction and efficiency of the rotor, and motor as a whole. The rotors, made up of sheet steel disc stampings mounted on a shaft, are "wound" with bare copper strips or ribbon wire set in slots punched in the periphery. The ends of these copper strips have heretofore been joined in a continuous ring at each end by soldering, generally. A more or less common practice is to mortise the strips into copper or brass end discs, and solder them to make a perfect electrical joint. The objection to soldering is the liability of the solder to fuse when the rotor becomes overheated and fly out, thus reducing the efficiency of contact.

The Eck Dynamo & Motor Co., Belleville, N. J., recognized the value of oxy-acetylene welding on this copper work. The copper strips inserted in the slots, are bent over at right angles, lapping one upon another, shutter fashion, as shown in Fig. 1. The overlapping ends are welded, using pure copper filling rod to reinforce and increase the thickness of the joints. The welded job shown in Fig. 2, has a ring of solid conducting copper fully 50 per cent thicker than the strips, and the conductivity is raised to over 100 per cent.

Comparative tests of soldered copper and welded copper show that the efficiency of the motor with welded bars is increased about 15 per cent for the same temperature rise of 50 degrees C. This means that a motor of a given rated horsepower with soldered connections may be rated at 15 per cent more when the rotor windings are welded.

The cost of welding is in measure offset by the elimination of the copper end discs which are no longer required, it being estimated that the saving in copper on some motor sizes balances the cost of the welding gases. The time of welding both ends of the rotor shown in the illustrations was about 24 minutes, or 12 minutes for each end. The welding was done with a No. 616 Manufacturers torch, using a No. 5 tip.

Author is engineer of the Davis-Bournonville Co.



Armature before and after welding.

Manufacturers Views On Adolescent Act

Technical or Night School Favored by Some—Good Advice Given to Boys on Entering Plant—Temporary Hardships May Result—Suggest Better Grade of Teachers

IS AN attempt being made to over-educate the youth of Canada? Will the new Adolescent School Act hamper the manufacturer, or should it have come into force long ago? These, and other thoughts regarding education came to our mind, and believing readers would be interested in the viewpoint of Canadian maufacturers, we made it a point to ask these men for their opinion on this very important matter.

Wm. Inglis, president of the John Inglis Co., Toronto, says that he has never heard tell of anyone getting too much education whether technical or otherwise, but he believes that there is a tendency for young men and girls to go to school until they are into manhood and womanhood, and then start out to learn a trade or a business when they are so matured that they require journeyman's pay to keep them.

Interest in Work Essential

"I do not think any one should start to work under sixteen years of age," he continues, "and if they have a good common school education and are interested in their work in such a way that they can go to the technical school or common school at nights for the betterment of the business they are interested in, I think they will probably learn more in this way than they would going to school until they are twenty.

"When we take boys on at our plant," concludes Mr. Inglis, "we try to impress upon them the necessity of such education, as we do not want to see them stick to the trade for the balance of their lives as they only become machines and not human beings, and as there is lots of room at the top in any business, I think if the boys and girls are taken hold of, well schooled and looked after, it is not only better for the manufacturer but better for themselves."

George A. True, president of the Northern Crane Works, Walkerville, is in favor of all the education that can be given. He believes children should be allowed to stay in school until 16, but as he remarks, all children are not alike.

Supply of Labor Limited

C. W. Sherman, president of the Dominion Foundries & Steel Co., says that they find it difficult, in fact almost impossible, to get any English speaking boy or man to do the rough work incident to their business. "We always have to resort to foreigners," says Mr. Sherman, "and it is getting so that our supply of labor is limited and expensive, particularly as there is quite a restriction on this class of people entering Canada.

"I left school when I was fifteen years of age," concludes Mr. Sherman, "and at that time I had sufficient education to carry on without much difficulty."

R. M. Hamilton, of the Canada Machinery Corporation says that the only youths they employ are apprentices, but that he sees no reason why boys of sixteen years of age with a previous experience in practical work, however superficial it may be, would not be better than boys who are younger, and who have had no shop work of any kind.

Will be Good Long Run

T. A. Russell, president of the Willys-Overland Co. does not believe we are over-educating the youth. "When an important change is made in any long established custom," says Mr. Russel, "you generally find that the conditions are worse before they are better. It may be that the change, just at the moment, by the enforcement of the Adolescent School Act, causes some dislocation and hardship without corresponding advantage. I cannot but feel, however, that manufacturers and society in general, must, in the long run, benefit materially by raising the standard of education of the greatest possible number of our citizens."

Another prominent manufacturer, who prefers that his name be omitted, says he agrees with the Adolescent Act, because he feels that to have the education of the youth of the country continued until they are 16 years of age will have a good effect.

"We don't employ youths under 16 in our business except in exceptional cases. It doesn't seem as if it would be wise to take boys from school earlier than that. The exceptional cases might be those who are found practically incompetent of a higher education and where it is necessary that they assist possibly a widowed mother in gaining a living. I would imagine that whatever may be found impracticable in the Act will be removed, and it certainly would pay everyone interested to give it their consideration."

"Judging from the results, I should conclude that the trouble is not one of over-education but of under-education," says another well known manufacturer.

"In my opinion," continues the gentleman, "the class of people obtained for the teaching staff is by no means as good as it might be, or should be. Such elementary subjects as arithmetic, spelling and the use of good English are improperly taught because the teachers are not sufficiently well acquainted with them. The remedy would appear to be to pay better wages and attract a better class of teacher. If this were done, there would be no need for young people continuing at school after the age of fourteen except for the study of technical subjects."

An entirely different viewpoint is expressed by another manufacturer who says, "I am thoroughly satisfied that an attempt is being made to over-educate the youth of the country by spreading their studies over too wide a range instead of concentrating on a fixed number of essentials, leaving the student as he develops into maturity to do his additional reading along these lines to which his mind is naturally attracted, or his talents specially adapted. Instead of that we have in Manitoba an attempt to compass a smattering of the whole range of human knowledge, with the inevitable and obvious result that the youths are not being grounded in any single line of studies. I attribute that in Winnipeg to the fact that there are very few men on the school board, or connected with the department of education, who have had anything but a public school education themselves, and they are attracted by the glamor of a lot of names of subjects of which they themselves know nothing but the names.

"As a graduate engineer myself," concludes this gentleman, who is president of a well known firm, "I have seen the same tendency in engineering. There does not seem to me to be any question but that improvement could be made in this matter."

Common Labor Required

"I believe," says John Leitch, managing director of the Collingwood Shipbuilding Co., "that every boy and girl should receive a good general education but that the majority do not require to be highly trained. Common labor is required everywhere, especially in a new country like Canada, and it stands to reason that the laboring class does not require to be instructed in highly technical matters. All our industries, however, require skilled men of good education and as far as I have seen, the youths of Canada at present are not over-burdened with education on technical subjects.

"In Great Britain and Germany a great amount of attention is and has been paid to the education of the apprentices. In many works the more brilliant are required to spend only a portion of their time in the shops and the remainder of the time in attending university or technical college, this during the day, not at night. Formerly, apprentices in Great Britain were encouraged to attend evening classes while they had to put in all of their time in the plant during the day. They think so much of technical education now that they have changed this system, to give the boys a chance to study during the day.

"Naturally a great number of the ap-

prentices are not studiously inclined and in each plant it is only a few of the brighter and more ambitious apprentices who attempt to qualify for the college courses, so that there is no fear of the plants being over-run with young men who have taken degrees. The matter really adjusts itself.

"Regarding the Adolescent Act, if children were compelled to stay at school until they are sixteen years of age, I do not think they could possibly be over-educated. The regulations might, of course, be a hardship to a great many people who require their children to work as soon as they possibly can, and latitude might be given to such people. Other things being equal, I certainly am of the opinion that children should remain until they are sixteen or over."

The remaining opinion is also from a prominent manufacturer, and here is what he says. "The Adolescent Act not only hampers manufacturers, but it hampers all in the community who pay taxes, or who have work to do.

"At the beginning, I would lay down the principle that every child ought to be educated up to that point where it ceases to absorb a reasonable proportion of the information offered, or where the probability of such information being useful in after life becomes relatively slight. This would not be a difficult system to operate, for, by a combination of competitive examinations and teachers' grading, only a certain proportion of those attending one grade would be permitted (also compelled) to pass on and attend the next grade. The present entrance examinations, also the matriculation, pass all above a certain quality. A similar culling out each year, based not on a certain pass percentage of marks, but on the individual's ability relative to all others of the same age in the province, would ensure to the capable child an education up to senior matriculation. Suppose for example that 25 per cent. were turned down each year after 14 years, or the entrance age. At each succeeding year there would be carried forward for further education 75 per cent., 56 per cent., 32 per cent., 24 per cent., and 18 per cent. of the original class.

"The cream of the youth of the country would be educated, and the mentally slow, the lazy, those unwilling to think, would be started to work with an educational equipment in proportion to their ability or inability to use it. There is a lot of low grade work to be done in this or any country, and there are a lot of people born every year with low grade brains. This is not a matter of argument, it is a positive fact. Our educational institutions should be so arranged that the low grade work of the next generation will, (so far as it cannot be done by machines) be done by the citizens of small mental calibre. Let the thinking be done by those capable of thinking. Look at the condition of some European countries where the thinking, such as it is, is done by the proletariat, while the intelligencia, if not killed, subsist on odd jobs.

"The question of whether a rather dull son of a rich man should be put out of school for his dullness is a mere detail of operation. Perhaps it would be better to have him out of the class and away from his mental superiors. His father has a right to buy him an education, certainly, but let it be in a private school or with a tutor. The Adolescent Act keeps all to one level," concludes this manufacturer, "it keeps the most stupid in school for two absolutely wasted years where they learn only to be dissatisfied, and it spends on them the money (taxes) which ought to have been spent on providing the poor but highly intelligent neighbor by his side with not two but four or five years of free education."

INTELLIGENT CHOICE MADE BY STUDENTS

(Continued from page 42)

er; 1 16-in. Cowan jointer; 1 36-in. Cowan band saw; 1 Cowan single head shaper; 1 Cowan chain mortiser; 1 Williams cut off saw; 6 wood turning lathes; 18-in. machine grinder; all machines are individually motor driven and suitably guarded. Full equipment of tools.

The machine shop is equipped with the following tools:—1 20-in. Draper lathe; 1 16-in. Greeves Kushman lathe; 1 14-in. Prentice engine lathe; 2 13-in. Willard lathes 6 in.; 1 13-in. Willard lathe 7 in.; 1 10-in. speed lathe; 1 Browne & Sharpe milling machine; 1 No. 1½ Cincinnati Milling Machine; 1 Cincinnati Universal Grinder; 1 Wilmartin & Norman New Drill Grinder; 1 16-in. Sibley Drill Press; 1 12-in. Ford Smith Hacksaw; 1 Ford Smith Emery Wheel Stand; 1 15 h.p. Lincoln Electric Motor; 1 38-in. Split Wood Pulley; 3 Anvils; 3 Forges, Buffalo Forge Co.; 1 7½ h.p. Induction Motor; 2 Welding Outfits; 1 No. 5 American Gas Furnace; 1 No. 16 American Gas Furnace; 1 No. 1 American Gas Blower; I Tool Room Enclosure; 3 6 in. Independent Jaw Chucks; 1 Westinghouse Tool Post Grinder; 5 South Bend 13-in. Lathes; 2 Hendey 16-in. Lathes; 1 Planer, Canadian Mach. Corp.; 1 Shaper, McKenzie 16-in.; 1 Drill Press 14-in. Table; 1 Grinder, Perfect 1-in. Spindle; 1 Motor 15 h.p.; Full Equipment of Tools.

INCREASED OUTPUT BY MEANS OF TURRET LATHE

(Continued from page 41)

is finished all over to the dimensions shown in Fig. 4 at the rate of eight a day. With the engine lathe it required approximately 4 hours for completing each pulley.

Large Pipe Flange

An interesting turret lathe job is shown in Fig. 5 and 6. It is a large cast iron pipe flange, faced, bored taper, and threaded to take 12 in. pipe. It will be noted that the pilot bar is held rigid in the turret while the tool holders for boring and threading are designed for horizontal movement at right angle to the lathe spindle, the travel being controlled by the taper attachment at the rear of the machine.

Motor Cylinder

A good example of the possible range of the turret lathe is shown in Fig 7. By means of special holding fixtures secured to the face plate of the machine the work can be placed in position on comparatively short time. The piece being machined in a Wolverine motor cylinder of cast iron, 8½ in. bore, and weighing when finished 228 lbs., the metal removed being about 48 lbs. The cylinder is bored, faced on both ends and recessed in a little over 40 minutes —one-third of the time formerly taken.

These are only a few examples showing the possibilities of the turret lathe as adapted to the machining of heavy equipment in reasonably large quantities.

The city council of Edmonton has authorized the expenditure of $150,000 for power plant extensions and improvements.



Physics room at London technical school.

Practical Ideas for Shop Executives

TAPER REAMER FOR DRILL PRESS

By V. Coffin

Where large numbers of holes are to be reamed for taper pins, a saving can be accomplished bo h in labor and reamer costs, by making a one flute reamer to be used in the drill press. This applies particularly to the smaller sizes, where the reamer is more apt to be broken by hand usage. We have a reamer in use at present that has reamed over 2,000, No. 2 taper pin holes, these assemblies being of cast iron and steel. After selecting a suitable piece of steel and machining out reamer blank, it is necessary to provide a fixture that will not allow the blank to be sprung while the quarter section or one flute is being milled out.

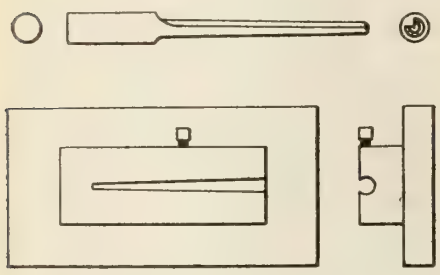


Fig. 1.—Taper reamer for drill press.

Tee shaped casting Fig. 1, is bored and reamed by standard taper pin reamer, and top of casting is cut away until part of reamer blank when inserted would be exposed. By inserting set screw at the side it would prevent the blank from rolling during milling.

After section is removed, reamer should be carefully hardened and ground to size, and after leaving usual land at cutting edge, reamer should be backed off for a quarter of the diameter to provide clearance. Too much will cause it to dig in. Reamer can be sharpened when dull by grinding on the flute. When using the reamer it is lifted and brushed frequently with oiled brush to clear cuttings from flute, and should be run at a moderate speed. Provided with rigid fixtures and careful handling it will increase production.

CLEANING SPECIAL TAPPED HOLES

By Donald A. Hampson

One of the meanest jobs that comes along is the bruised thread of a tapped hole when that thread is a special. It is to be expected that no one will have taps for such threads. If the damaged thread would only appear always in a convenient shaped piece, the task would not be so bad, but invariably it is in some piece that is so awkward to swing in the lathe that it would pay to scrap the piece if another were obtainable.

Sometimes the piece can be grasped in a vise and an inside thread tool, held in both hands, used like a scraper to clean out the thread. This is a slow, bumpy job but it is well worth trying. As long as the thread is reasonably fine—say, not coarser than 16—this method is good. The only bad feature about the thread tool method is the difficulty of getting the first complete thread scraped out—the starting of the thread—and this trouble may be avoided by making a special tool with the point turned the opposite way. Such a tool enables the machinist to scrape from the inside out, from a good portion of the thread into a bad, and is often the salvation of the job for the first thread is almost certain to be one of those bruised.

Another good method is the making of a tap. No, not an expensive tap or a long drawn out job. Take an ordinary piece of steel and cut on it a smooth thread of the same lead as the bruised thread and as nearly the full size as can be determined. After threading this piece, turn the end tapered like a taper tap and then file one flute in the end. This "tap screw" is to be run in the hole to straighten up the damaged threads, the idea being that it will catch the threads as the point enters and as the fit grows tighter the one flute will scrape its way in and the piece line itself up as the poor thread is corrected. And in a majority of cases, it does the work in good shape. If the part happens to be brass, the steel tap screw may be used as it is; if it is some ferrous metal, it will be necessary to case-harden the tap. By making the tap on the end of a bar, it is possible to repair threads deep down inside, where they could not be reached by other methods.

WEIGHTS OF METAL BARS

By W. F. Shraphorst

The accompanying chart provides a convenient method of determining the weights of solid or hollow metal bars of ordinary dimensions. By means of a straight edge placed across the chart as shown by the dotted lines, the weight may be easily found. The chart shows the result for a bar of mild steel 2 in. in dia. and 30 ft. long. The table herewith shows the weight of mild steel to be 487 lb. per cu. ft. By connecting the 2 in. column A with the 30 in. column D, and working back from the intersection on line B over the 487 in column E, the point where the straightedge cuts the column G will be the desired weight; in this case 320 lbs. By calculation the weight is found to be 318 lbs.

The weights of common metals mostly used in industry are as follows:

Aluminum .. .. lbs. per cu. ft.	165
Brass	534
Copper	556
Wrought iron	485
Lead	710
Nickel	537
Mild Steel	487

The chart may be used vice-versa if desired. If it is required to know the length of bar that will weigh a certain number of pounds the reverse process would be necessary.

For hollow bars the same method would be followed, calculating the inner and outer diameters and deducting the former from the latter.

SUB-PRESS NOTCHING DIE

By A. J. Q.

The die shown in the accompanying sketch illustrates a tool designed for notching angles in sheet metal. The angles in this particular case being 30, 45, 60, 90 and 135 degrees. The tool is of the sub-press type, and does not

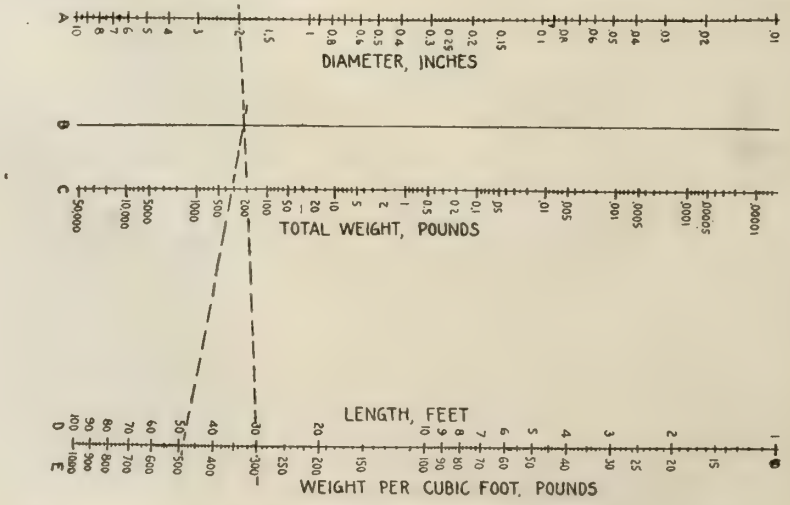
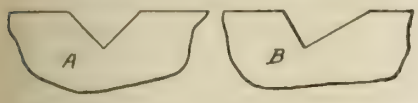


Chart for finding weights of metal bars

require to be fixed in press or other machine. The die may be revolved to any desired position, an index pin being provided for this purpose. This permits the notch desired to be brought to the front of the machine. The index plunger (7) is pulled out to allow the die block to revolve. On the side of the shoe are two adjustable stops or gauges that are set to give the notch required. By regulating the position of these stops the centre line of the notch may be altered to suit varying conditions, as shown at A and B.

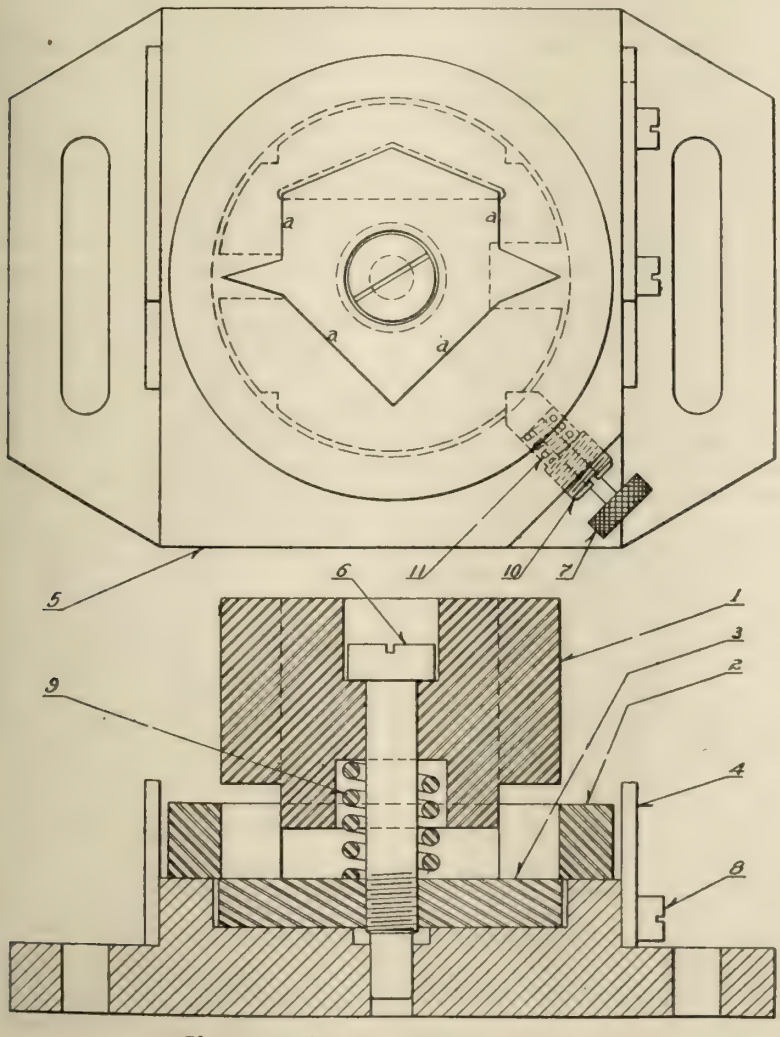


The construction of the tool is shown by the drawing. The punch is made in one solid piece and, in this instance, has five different angles. The punch is piloted into the die, fitting closely at the four faces (a). This not only guides it vertically but eliminates shearing of the cutting faces. The punch and die are held together by the bolt (6), and spring (9) is strong enough to strip the stock. Ample space is provided between the punch and the die for the insertion of the stock. The end of the clamping bolts forms the bearing on which the punch, die and index plate revolve. The locking pin and gauges are carried on the die shoe. The die need not be fastened down unless desired.

With certain modifications the same die may be adapted to punching holes of different diameters, stamping or stencilling letters, etc. The die here described has been used successfully for some time.

EMPLOYEES AS SALESMEN

A plan recently adopted in a local shop manufacturing a domestic machine, has done much toward creating more business for the company, the employees directly gaining increased employment. It was proposed that the employees should have the privilege of receiving a salesman's commission for every order brought in. This naturally caused some enthusiasm among the more ambitious of the men, who with their inside knowledge of the machine, had the advantage over the average salesman, in that they can intelligently talk machinery and inspire confidence in the prospective buyer who generally lacks this knowledge. Believing results can be obtained in this way toward increasing business, the employee utilizing his spare time in hunting up prospects, will take a much greater interest in the product manufactured. This proves a valuable asset to any firm, as an interested employee means increased efficiency, costs being lowered through less wastage of material. A satisfied staff of workers employing the personal interest cannot be bought by money alone, and when this co-operation is attained it will go far toward building up future business of any company.



Plan and sectional view of sub-press notching die.

PROVING MULTIPLICATION

In performing long problems of multiplication errors frequently occur. This is particularly true when the work is hurriedly done in checking up dimensions in the shop or drawing office. The proof here given has been used by the writer for many years and, although not a new method by any means, may be of interest to other readers. The method is generally known as "casting out the nines." Take for example the problem here shown.

3·6942	3+6+9+4+2 = 24
46·375	2+4 = 6
184710	4+6+3+7+5 = 25
258594	2+5 = 7
110826	7×6 = 42
221652	4+2 = 6
147768	
171·3185250	1+7+1+3+1+8+5+2+5+0 = 33 3+3 = 6

Like many other rules the work is easier than the explanation. The sum of the digits in the multiplicand is found to be 24. The sum of 2 and 4 is 6. This is the factor for the first row of figures. For the second row (multiplier) the factor is found to be 7. The product of these two factors is 42, the sum of which is 6. The digits in the product are dealt with in the same manner, the result being 6. This shows that the work is correct. If the results differ it indicates that an error has been made. By confining the work to each line the error can easily be located. There is one way in which this rule may be defeated and that is by making two errors, one of which compensates the other. This, however, will rarely occur.

LUBRICATING WORK ON MILLER

By J. H. R.

For lubricating milled work, oil, pure or soluble, or soapy water is generally used, but this does not apply to cast iron or brass. Where milling is not a regular operation, a cooling lubricant can be dispensed with, but in most cases it is to be preferred. It should be liberally used because it does more than merely lubricate the work. Plentiful oil makes easier the formation of a smooth surface, and helps to free the teeth from chips and cuttings. Milling cutters, and especially those of high-speed steel, are expensive tools, both to purchase and to maintain in a state of efficiency. It is important, therefore, that they should only be used for work which are designed to do. Where carbon steel milling cutters are used, care should be taken to see that the correct temper is given for the work the tools have to do.

Conditions Have Improved in Many Quarters

Reports From Various Cities Are Very Encouraging—Sugar Industry and Textile Trades Are Busy—Automotive Trade Shows Increased Activity and Iron Working Industries Are Picking Up —Several Promising Industrial Prospects

"THE FORT William Paper Co., are making additions to their plant," says W. Webster, secretary, Fort William board of trade, "A sluice is being constructed from Lake Superior in front of the plant site to the grinding mill, for the purpose of facilitating the movement of pulp wood from the booms in the lake to the grinders. A sluice-way 2,600 ft. long is projected out into the lake, considerably elevated at the outer end, water is pumped from the lake into the sluiceway and the pulp wood floated to the grinding mill. This will effect quite a saving in handling time."

"Industrial conditions," says R. E. Armstrong, secretary of the Saint John board of trade, "along some lines, are showing an improvement in this section, but basic industries, such as lumber, lime and fish, are still in a semi-comatose state. There is a feeling, however, that with the opening of Spring there will be a revival in all of these lines.

"There is little building construction going on as yet, outside of the erection of schools and necessary public buildings of this character. Many of our people are anticipating the construction of new residences during the approaching summer. One of the busiest concerns at the present time is the Atlantic Sugar Refineries. This industry has been doing quite a large export business, shipping in the vicinity of about 3,000 tons per month of refined sugar to the United Kingdom, France, Italy and other overseas points. Spice-making is showing improvement, at the spice mills of G. E. Barbour Co. and the Canada Spice and Specialty Mills.

"The brush industry is bristling up a little and will soon be back to normal. Cotton manufacturing is also showing an improvement. The nail manufacturing business, which is one of our chief industries, is not very active as yet, but with a revival in building conditions in Canada and throughout the world, this branch of industry will soon depart from its quiescent state.

"There is likely to be an improvement in brick manufacturing shortly. The Lee brick-yard, which is one of the most promising in this section, has lately passed into the hands of an energetic company.

"Metal industries are beginning to recover slowly. The McAvity plant, which was busy on shell-making during the war, has entered upon the manufacture of iron piping for water distribution. The city is planning some street-paving and water extension for the coming summer.

"The winter port has had quite a busy season. While general cargo shipments have not reached the total of last year, a very decided improvement has taken place in the export of grain, the shipments to date amounting to 221,318 tons, as against 134,902 tons last winter. Potato shipments to Cuba have been larger than for several years. This winter has also witnessed the return of live stock exporting. Three cargoes of cattle have gone forward this winter, being the first shipments since 1912 from here. It is expected that Courtenay Bay development work will be resumed within the next month or two. General business is on the upward move with still brighter prospects ahead."

J. H. Brosseau, secretary-treasurer of the Sherbrooke, Que., board of trade, says, "Our industries at the present time are looking better, particularly our textile industries, such as silk, wool, and cotton. Our jewelry manufacturing firms are finding business rather quiet but at this season of the year it is generally expected. The same may be said of our mining machinery, which is no doubt due to the strike of the coal mining region of Cape Breton, also on account of the dulness of the copper market, thereby causing very little activity in the copper mining region of British Columbia, but as confidence is improving, we expect in the near future a change for the better, as the copper and coal situation must improve when general business begins to feel the activity of all its branches."

J. A. McGibbon, secretary of the Oshawa board if trade, says that business conditions generally are improving. He continues, "A marked improvement is noted in the General Motors, and the factory is now working overtime and new hands seem to be taken on each day and the staff materially added to. In consequence, other factories are also increasing their output, this applies more especially to Pedlar People, Ltd.

"During the past month, the factory of the Thornton Rubber Co., was destroyed by fire and there are rumors that Col. Phillips, a son-in-law of R. S. McLaughlin, is going to operate a wood-working plant there. The Spring and Axle Co. are now in operation, and Mr. F. C. McCulloch has purchased the old Parks foundry and has booked large orders for brass works and intends to commence operations at once.

"There is a good deal of business construction being done in the line of stores, etc., and the lack of houses, has made the local council decide to construct from 10 to 20 new houses under the supervision of the Oshawa Housing Commission. There are rumours that the Fletspar Glass Works will commence operations in the very near future. As a whole the industrial situation is a good deal brighter than at the first of the year."

"Industrial conditions in this City are slowly but surely improving," says H. Westoby, secretary of Guelph chamber of commerce. "The Crowe Iron Works, which until recently were on short time, are now running full time, and several other of the iron industries are either on full time or running four days per week, and all tell me that within a few months they will again be running six days per week. The White Sewing Machine Co. which has recently been extremely slack, has just taken on a new line, the manufacturing of school desks and furniture. They are increasing their number of employees from 60 to 200 immediately, and have announced that by the middle of this summer they will be employing 500 men. The textile and rubber industries are running night and day, and the industrial outlook as a whole is brighter at the present time than it has been for 12 months past. The City of Guelph has arranged a very elaborate program of street paving and other work for the current year, and with the improved industrial outlook, there should be work for every man before many weeks have passed."

George I. Warren, managing secretary of the Victoria, B. C. chamber of commerce, states that the Beech-Aitken Co., who put up canned fruits, etc., have located in Victoria.

Chas. A. Cooke, secretary-manager of the Regina board of trade, says that they have every prospect of a busy building year, largely residential, with several commercial structures, though, he adds, a great deal depends on the outcome of negotiations at present proceeding between employers and employees in the construction trades.

F. Maclure Sclanders, commissioner of the Border chamber of commerce, says that industrial conditions throughout the border communities have been much better and brighter than they had any logical reason to expect, when the magnitude and duration of the recent war is remembered. He mentions that conditions have steadily improved since the start of the year, and that they have no reason to complain. He adds, "We have good reason to be hopeful and encouraged, and we have weathered the storm very satisfactorily indeed. True, we are not nearly so busy as we could be, save in a few instances, but we are not worrying. The worst is over; the best is still to be.

"As to new industries—these are coming in steadily and quietly: — two quite recently. In all, we now have 238 operating industries here. People further East do not realize just what is

(Continued on Page 66)

New Things in Shop Equipment

CHAMFER GRINDING FIXTURE

A fixture for holding die chasers while grinding the chamfer has been developed. With this attachment it is possible to obtain the exact angle and length of chamfer on the complete set of chasers. The supporting portion is adjustable and graduations provide accurate setting for any desired length of chamfer, either on the milled or tapped style of chaser. Guiding key and stop, which may be locked, governs the position of the chaser in respect to the grinding wheel. All sizes of chasers may be ground on the one fixture. The Device being placed on the market by the Geometric Tool Co. of New Haven, Conn.

OFFSET DRILLING ATTACHMENT

An offset attachment for drilling, milling, countersinking or counterboring port holes in such equipment as pneumatic tools, etc., from the interior of the cylinder has recently been developed. The arm is made especially rigid for heavy duty work. The offset arm and transmission members are made of vasco-vanadium tool steel, heat treated by the Bellis process, and accurately ground and lapped after hardening. All parts are closely fitted to obtain extreme rigidity of cross section. The attachment is made to fit any standard type of drill press. A full assortment of drills and counterbores are supplied with the device. It is made by the Harris Engineering Co., of Bridgeport, Conn.

PORTABLE ELECTRIC DRILL AND GRINDER

A portable electric drill having two speeds has been recently placed on the market. The two speeds permit the tool to be used in a dual capacity, namely that of drilling and of grinding. It has a drilling capacity of from ⅛ to ⅝ in. in steel, and is supplied with a 6 by ¾ in. wheel for grinding purposes. The slow speed is used for drilling and the faster for grinding. The motor is of ½ h.p. and is capable of operating on either direct or alternating current, of the same voltage. A quick make-and-break switch in the handle controls the motor. The machine weighs about 18 pounds. It is manufactured by the Wodack Electric Tool Corporation of Chicago, Ill.

TUBULAR FRAME DRAWING TABLE

A line of drawing tables, in which the frames are tubular, has recently been developed and placed on the market. The design gives all the rigidity of other types of construction and is very much lighter. The table can be raised till it is forty-four inches from the floor when in a horizontal plane. A hand-wheel operating an elevating screw is employed to do the lifting. The table can be clamped when the proper height has been obtained. It also can be tilted from the horizontal to almost a vertical position. Large corks are inserted in the feet of the stand to prevent floors from being marred, and also to eliminate the tendency to slip around. A combination drawer and tray can be attached to either the left or right hand side of the frame, and can be clamped at any convenient height on the standard. The drawing table is manufactured by Hoffman Drawing Stand Co., of Rochester, N. Y.

MACHINE TIME CALCULATOR

A calculator that has been designed for use in computing time required for operations performed on machine tools, whether these tools be of the revolving or the reciprocating design, has been placed on the market. It consists of cylinder enclosed in an aluminum case, with a slide rule of special design attached to an extension of the base. When used in connection with revolving work or tools, on such machines as lathes, boring mills, drilling or milling machines, the cylinder has tables giving the number of r. p. m. made by work or tools of diameters from ¼ in. to 10 ft., at all ordinary cutting speeds. In connection with planers, shapers, slotters, or other machines having reciprocating tools or work, the procedure of calculating the time is quite simple. The instrument was designed to be used by rate setters, estimators, and others whose duties require a study of machine operation time. The instrument is about sixteen inches long and weighs about three pounds. It is manufactured by the Simplex Calculator Co., of York, Pa.

NEW CIRCULAR MILLING ATTACHMENT

One of the latest offerings in accessories for machine tools is a table that can be fitted to a standard high-speed vertical milling machine for circular milling operations. The attachment is mounted on the regular table of the machine and driven from a telescopic shaft which furnishes the longitudinal table power feed. This means that on the standard milling machine for which the fixture has been designed, thirty-three feeds are available. The circular feed is finally driven through two gears that can be transposed, which doubles up the number of feeds just mentioned. It is possible to operate both the longitudinal and circular feeds simultaneously, which is an advantage on some classes of work. Some of the measurements of the fixture are; diameter of working surface, 10-½ in. maximum height from nose of machine spindle to table, 9 in. ratio of table revolutions to turning of handle, 40 to 1; weight of fixture is 110 pounds. The fixture is manufactured by the Taylor and Fenn Co., of Hartford, Conn. The fixture is designed to be attached to the vertical milling machine manufactured by this firm.

PIPE THREADING MACHINE

A 12 in. threading and cutting machine that can be equipped for threading oil well casing and hydraulic pipe has been placed on the market. The normal range is from 4 in. to 12 in., but may be adapted to cut pipe 2½ in. in dia. The range is accomplished by means of two die heads, each head having only the one set of chasers. The die head or carriage may be moved either by hand or power, one operating lever controlling the traverse in either direction. Automatic safety stops are provided for the carriage travel. The reaming tool is quickly set to position and locked with a lever. The reamer is fed to the pipe by rotating the cutting off feed hand wheel in a counter clock-wise direction.

The machine has a single pulley drive. The variations of speeds, eight in number, are obtained in the speed box, located under the main spindle, by shifting levers on the side of the gear box. The machine is started and stopped through a friction clutch by either one of two levers located at the extreme ends of the head stock. This enables the operator to start or stop the machine when threading or when fitting up flanges. A lever is located midway between the starting and stopping levers for reversing the machine. The chucks for gripping the pipe have three jaws. These jaws are geared and have universal adjustment. They are also self-centering to the pipe. The rear chuck is equipped with flange grips for fitting up flanges.

Is made by the Landis Machine Co., Waynesboro, Pa.

HYDRAULIC MARKING MACHINE ATTACHMENT

Attachments have recently been manufactured for a marking machine which will enable markings to be done in a circle, on the flat sides of cutters, rings, and other similar parts. The object to be marked is placed on a fixture mounted on the table of the marking machine. The top of this fixture is free to revolve on ball bearings. Adjustments can be made to mark to any radius, in order that all markings may conform to the space provided for same on the work. A plain roll die is used and it is held in one position and revolved about its axis by means of a rack

fastened to the side of the machine. As the work is brought in contact with the revolving die, the top plate of the fixture is revolved. A plug set in the centre of the revolving plate, fitting the bore of the work, keeps the latter in the proper position. At the end of the marking stroke the die is returned to its starting position by the return stroke of the slide. The hydraulic operation of the table results in satisfactory marking, regardless of variations in the thickness of the work. The attachment is manufactured by the Martin Machine Co., Inc., of Turner's Falls, Mass.

HAND-OPERATED VALVE FACER

There has recently appeared on the market a hand-operated bench machine for accurately and quickly refacing valves of internal combustion engines. It is being marketed under the trade name of "Peerless valve lathe." The hollow spindle of the lathe is mounted in a single long bearing, the body of which is cast integral with the base. In this spindle is located the chucking mechanism, which consists of two collars having each a three-point internal cam which actuates three pins. When the front jaws grip the valve stem they are locked tight with a nut. The rear jaws are used in the spindle and valve drive. A gear turns the lathe spindle, and, as it turns, the tendency of the jaws actuated by the internal cams, is to bite harder on the valve stem. Thus no locking device is needed here. The spindle of the lathe is bell mouthed in order to accommodate the fillet between valve and stem which is sometimes excessive. Provision is made for locking the spindle when tightening the front jaws. These jaws are tightened by means of a spanner fitting in slots in the collar containing the internal three-point cam. A special automatic feed is provided for the tool. The uniform rate of feed is said to produce a finish that reduces grinding in to the minimum. The machine is manufactured by Steiner Bros, of Lima, O.

HEAT-TREATING FURNACES AND OIL-PUMPING SYSTEM

A double-chamber, semi-muffle heat-treating furnace has lately been placed on the market. Both chambers of this furnace are individually controlled. Thus different operations can be carried on simultaneously. The furnace is underfired, combustion taking place under the floor and the products of combustion pass up along both walls to the arch and then down on the work. The furnaces may be equipped to use either gas or oil or a combination of both. The furnace is not only built with a cast iron casing, but also with a sheet steel casing. In connection with these furnaces, and other types manufactured by the same firm, is an oil pumping system. This system delivers oil at a uniform pressure and free from foreign matter. The foreign matter is removed from the oil by strainers. Spring-load relief valves prevent injury to the system in case the discharge should become clogged. The valves also furnish variations in the operating pressures. A pressure dome dampens the pulsations in the pump, at the same time serves as a settling chamber in which the water and sediment settle before the oil is delivered to the burners. Gauges provide easy pressure readings of the oil. The pumping system is made with a capacity delivering 82 gal. of oil per hour. The furnaces are known as the Stewart furnace and are manufactured by the Chicago Flexible Shaft Co., of Chicago, Ill.

INSIDE MICROMETER CALIPERS

There has recently been placed on the market a set of inside micrometer calipers having five rods, which permits of measurements being made from 3 in. to 8 in. in increments of 0.001 of an inch. It is well adapted for use in determining the internal diameters of cylinders and rings, as well as taking linear measurements, testing the parallelism of surfaces, comparing gauges, etc. The barrel, spindle and thimble are similar in construction and diameter to those employed on outside micrometers. One feature of this new micrometer is the provision of a detachable handle, which may be instantly set to permit of easy reading of the graduations, whether the work is right or left hand. The extra rods make for quick changes to suit the work to be measured. The rods are changed by simply unscrewing one rod on the threaded stem of the barrel, and then screwing the proper rod in place. Each rod is ground square at the hardened end, so as to seat in the proper relation at the barrel shoulder. The point of measurement is fitted with a hardened tool-steel anvil, which is adjustable to lengthen the rod and to compensate for anvil wear. The faces of the anvils are ground to a small radius. Additional lengths of rods can be supplied to special order. The micrometers are being manufactured by the Reed Small Tool Works of Worcester, Mass.

LATHE ATTACHMENT FOR CYLINDER GRINDING

A Lathe attachment, that has been designed for use in small garages, where it is desired to obtain a cylinder-grinding equipment at a reasonably small cost, has recently made its appearance on the market. The device can be attached to any lathe of 14 inch swing or over. The driving motor is mounted in frame of the fixture underneath the grinding spindle. This frame is attached to the ways of the lathe close to the head stock. The motor, that is usually supplied with the outfit, is rated at ½ h. p., and can be driven from any lamp socket. With this attachment is also supplied an angle plate, mounted on the lathe carriage, and to which the cylinder block to be ground is attached. The motor drives the grinding spindle by means of a belt. A chain and sprocket drive is led to the head-stock spindle of the lathe, and by this means the carriage feed mechanism is actuated. This carriage feed is used to feed the cylinder block when grinding. This arrangement permits of all the different lathe feeds being available. The grinding spindle is driven at 5,600 r. p. m. The eccentric throw of the wheel from the dead center is adjustable by a hand screw graduated to 0.0005 in. The angle plate holder will accommodate the largest size six cylinder block, having an inside length of 33 in. Cross movements of the holder are obtained through a screw, and the holder may be raised or lowered by means of two vertical screws. The total weight of the attachment is about 500 pounds. The apparatus is manufactured by the Liberty Tool Co., of Irvington, N. J., and is marketed under the trade name of "Elteco."

HYDRAULIC PRESS

A new 250-ton hydraulic press that has been designed primarily for pressing solid rubber truck tires on or off wheels has recently been placed on the market. The press can, of course, be adapted for many other uses. The frame and top platen are steel castings. The ram area is sufficient to produce the required tonnage with an initial pressure of 2,000 lbs. per sq. in. The pump is of the three plunger type. One plunger is larger than the other two and is designed to handle the low pressure liquid quickly and when the pressure rises over 200 lbs. per sq. in. it is automatically cut out. The larger plunger is 2 in. in dia. and is used to cut out the large plunger. When this plunger is cut the two smaller plungers continue in operation and deliver the higher pressure required for the maximum tonnage. The press is controlled by operating a globe valve located in the by-pass piping, taken out of the main pressure pipe. When the valve is open, the oil or water used as a medium of pressure, is returned to the supply tank instead of being delivered to the cylinder of the machine to apply pressure to the ram.

The tank is of the enclosed type and when desired a compressed air line can be connected to the top of the tank to furnish means of forcing oil or water quickly into the cylinder to move the ram up to the point where high pressure is desired. In cases where air pressure is used for this purpose the pump furnished is equipped with all high pressure plungers. A safety valve protects the press from a careless operator. The bottom platen is 42 in. in diameter and the maximum distance between the top and bottom platen is 37 in. The ram has a stroke of 33 in. The press is manufactured by the West Tire Setter Co., of Rochester, N.Y.

Extreme care should be exercised in the storage of grinding wheels. They should be stored in dry places and be supported on edge in racks. Straight-sided shellac and rubber-bonded wheels of ¼ in. or less in thickness should be laid flat on a straight surface to prevent warpage.

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The Passing of a Great Man

SIR JOHN EATON is dead. In all parts of Canada people are still talking about the passing out of this great man, broad of vision and open-hearted, who mixed good deeds with his daily work. His ability as a merchant and manufacturer is unquestioned, but it is the man rather than his business that people are talking about.

Although he only spent a brief period on this earth, his life was a very useful one. He made thousands of other lives brighter and happier, and not only has the world of trade and commerce lost a keen leader, but humble homes have lost a true friend.

As a just and generous employer he was without an equal. His personal knowledge of his employees was amazing, as the following story shows. During the war he discovered in his own quiet fashion that the wife of one of his enlisted employees was contemplating digging up her garden the following day. Bright and early the next morning two men knocked at her door and mentioned in a casual manner that Sir John had sent them up to dig the garden and plant seed for her. A simple story, yes, but it shows the great heart behind the man in the background.

A thousand similar stories could be told for he was always helping someone. Were we allowed to coin a phrase we might say, "He lived—and thousands benefited through his short stay on earth." Would that there were more of his type. Men who could rise to greatest heights, yet always be in a position to stoop and help the less fortunate.

Figures Show An Increase

COMPARED WITH 32,184 tons in January, a total of 33,572 long tons of iron was made in Canada during February, according to official figures from the Dominion Bureau of Statistics. This shows a slight improvement, and the latest total was made up from 25,400 tons of basic iron, and 8,172 tons of foundry iron. Although an increase is shown over the former month we still have a long way to travel before reaching the 1921 average, as the January, 1922, output was the smallest on record for some years back. In fact, February figures, are second lowest, the average monthly tonnage during 1921 being 50,000 tons.

The same can be said regarding Canadian steel production, because although the output of steel ingots and castings in Canada was 9,000 tons higher in February than in the preceding month, it is still lower than the average monthly tonnage during 1921. In February the total tonnage was 42,388 long tons, comprising 40,939 tons of ingots, and 1,449 tons of steel castings. The average monthly output last year was 56,000 tons, or 13,612 tons more than February 1922 production.

Electric steel castings produced during February totalled 772 tons as compared with 856 tons in January, but in the former month practically all castings made were for direct sale.

In spite of these figures showing below the average production of last year, it is a good sign to see this increase over the former month. The steel market in the States is strengthening every week, and prices are now firm in many lines. Canada is bound to feel the effect of this within a short time, so that we can look forward to noting a still further improvement in the tonnage figures for March and April.

That Extra Two Years

ON ANOTHER page of the issue will be found an article on the new Adolescent School Act, this comprising the opinions of several prominent Canadian business men. Although a few disagree with the movement, to keep the youth of Canada in school until the age of 16 has been reached, the consensus of opinion seems to be that the extra two years' study will help, rather than hinder.

It seems to us that a great deal depends upon the nature of the subjects taken up during the critical period, 14 to 16. If the authorities in charge of the various educational institutions are wise, they will see to it that the students receive as much practical education as possible. That is, something which will be of real value to them, after they leave school to earn their living. The average boy cannot afford a college education, and his parents are perhaps anxiously awaiting the time when he can leave school and help earn some money to keep affairs at the home in smooth running order. All men cannot be plant owners or managers, likewise all boys leaving school cannot have the same capability or inclination.

Our suggestion would be this: Let the principals of the various schools study each boy, cultivate his acquaintance, get to know his inclinations; then if he is suited for this work, whether it would be the principal's own choice or not, let him help all he can towards granting the boy his wish. Make his two years additional schooling count for something, so that when the various educational factories, as one might term them, let loose their army of 16 year old business enthusiasts, manufacturers all over the country will feel the extra two years' schooling has been worth while.

Prepare For The Future

BUSINESS may be quiet but that is no reason why manufacturers should not be preparing for better times. When fishermen are not engaged in the catch they are mending their nets and their example might well be followed out by every plant owner during the present lull. This is the time to get together and exchange ideas so that when home and export trade returns we will be able to handle it efficiently.

Several Canadian manufacturers are adopting this building up policy. They are to be especially complimented for their aggressiveness, for when business opens up there is no reason why Canada should not be well to the fore.

A REMARKABLE increase in customs revenue for Toronto is noted in the report for March. The customs and excise revenue will amount to at least $4,500,000 as compared with $3,697,635 for March, 1921. This means at least a total gain of $803,000. The gain over February will amount to over $1,000,000 this being one of the largest on record.

Industrial Activity Showing Upward Trend

Mills Report Good Demand for Structural Steel—Canadian Dealers Secure Machine Tool Orders—Improvements Looked for in Many Lines—Look for Heavy Building Year

MACHINE TOOL ORDERS INDICATE ACTIVITY

A CANADIAN machine tool dealer secured a $30,000 order in American territory a few days ago, in spite of competition from dealers in the States. Some of the tools ordered are not made in Canada, but the Canadian firm receives credit and commission on the business.

Several other good orders in machine tools have been closed, one being for about $10,000 worth of plant equipment. While the tool market is far from booming, conditions are on the upgrade. Enquiries are better, and several good prospects are being nursed along.

Small tools and supplies are selling at a fair rate but the market is spotty, several dealers having off weeks while others report an increase in sales. From the nature of the orders received however, it is plain to see that the stock of the tools in manufacturing plants must be very low, as immediate delivery is the usual cry.

Scrap metals are not moving very rapidly, nor are non-ferrous metals. This applies to all Canadian markets.

Iron and steel is in slightly better demand, but this condition is expected as the season advances. March business shows an improvement of about 10 per cent. over the former month.

Building construction is active, residence building being featured. Montreal predicts a splendid building year. Activity at the different Canadian water fronts is very marked and considerable repair work is proceeding.

The Algoma Steel Corporation is operating at about 60 per cent. capacity, but rail mills in the East are shut down.

Mills report an increased demand for structural steel. Pig iron is in slightly better demand, but nothing like normal.

No one seems to be worrying about the coal strike. Manufacturers are well supplied with coal, and in many cases, stocks are good for three months. One large user, requiring at least a car load every day, reports that he is well supplied, and can run night and day for 90 days. The opinion exists that not only will the miners' wages be reduced, but freight rates as well, thus causing a good sized drop in the price of coal to the consumer.

In the United States, the production of steel has increased considerably during the past two weeks. The present rate of steel ingot production is around 32,000,000 tons a year, compared with 17,000,000 at the end of December. Whether the present rate can be held is another question, as some of the material at present being purchased is going into stock.

The price of bars and shapes in the States is now 1.50c. This brings the level back to where it stood a few months ago. Three or four weeks ago these products could be purchased for 1.35c. Prices all along the line are stiffening, and shading has been practically eliminated.

Plates are quiet, and there is an enormous excess of productive capacity. Several mills stay closed as they do not find it worth while to accumulate enough orders to justify starting. Nails are in heavy demand and the price is firm, $2.40. Hoops and hot rolled strips have advanced $2 a ton during the week and are now 1.90c. Bands are stiffer, and cold rolled strip remains at 3.50c, a price set at the start of the year.

Coal is not much in demand, everybody having stocked up in anticipation of the present strike. Coke has weakened during the past ten days, but pig iron shows a little added stiffness.

Toronto

April 5th.

A CANADIAN firm closed an order in the United States the other day for approximately $30,000 worth of machine tools. This shows conclusively how eagerly business is being followed up at the present time. Some of these machines will be made in the States, but nevertheless the Canadian firm receives the commission. The same company has secured a $10,000 order for plant equipment in Canada, so that they are naturally well pleased with themselves.

From the above information, one must not run away with the idea that the machine tool market has improved overnight. Such is not the case. Conditions are gradually but steadily improving, but the market is still spotty. The two orders previously mentioned are bright spots, but next week it is doubtful, in fact, very improbable, that as much business will be closed by the firm we refer to. Several other dealers report a good week in machine tools. In fact, it seems to have been a rather profitable one for the majority of merchants in this line. What next week will show is another matter. Second hand tools are moving fairly well.

Iron and Steel.—The iron and steel business closed during the last seven days is better. Every week sees a slightly increased demand, which however is but natural, for spring is now with us and building and general construction work is automatically picking up. There is nothing featuring, and prices remain the same. Price shading is practically gone, and several dealers talk about a possible advance at the middle of this month to balance the increase in the States recently on iron and steel bars and shapes. Should this occur, it means bars and shapes would go up to 2.90 the price existing about the beginning of February. Present quotations, however, remain as follows:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron. — A slight increase in the demand for pig iron is making itself felt. Several foundries report better business, and of course, when this occurs, it means that they will have to order pig, their stocks being so low. The iron and steel market, as well as the pig iron field, are finding this condition true, viz., that users have allowed their stocks to reach the point where immediate delivery is requested. It is safe to say that an increase of at least 10 to 15 per cent. has been made in the demand for pig iron, when comparing March business with February. The price remains firm, $27.15 for No. 1 silicon, 2.25 per cent. to 2.75 per cent.

Non-Ferrous Metals. — Very little change can be reported in this section. The demand is still light, and while a spasmodic spurt occurs for a day or so, it soon settles into the rut again. Prices remain the same, and local quotations are as follows:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	26 00

Small Tools.—This market is becoming very spotty. For example, last week a certain dealer had the best week in six months' time. During the past seven days, the same dealer has not closed enough business to pay expenses. On the other hand, several merchants who reported poor business the previous week are feeling much better when considering the orders closed during the past few days. It would seem as if dealers in this line are getting their good and bad periods, but when the number of sales is totalled up, the volume of business closed during March has improved at least 10 per cent. over February.

Steel Pipe.—The demand for this commodity has increased slightly during the week. Prices are firm, and the companies making this type of pipe are now specifying time deliveries, as they have quite a number of orders on hand. Prices for pipe will be noted on quotation pages.

Miscellaneous.—Waste and wipers continue in good demand. Oils and

greases are selling at a good rate, the automotive trade being partly responsible for the increase. Prices are steady and there is no change recorded. Following are present quotations:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal.	1 35
Linseed oil, raw, single bbls.	1 00

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bls.	1 00

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

Scrap Metals.—Some lines show added activity, but to find a feature is impossible. Buyers are purchasing cautiously, and the margin of profit to dealers is very low. This is a purchasers' market and they are making the most of it. Following are existing prices:

Copper, light per 10 0lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition 6...	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	11 00
Cast boring	5 00

Montreal

April 5th.

AFTER analyzing the reports from various sources regarding the iron and steel business, it is evident that the gradual improvement which has been more or less in evidence for the last few weeks, is still being maintained. There have been no rapid strides in any particular direction, but the general tone is more encouraging. Locally, the activity along the harbor front is daily increasing.

A good amount of machine repair work has been handed out to the various shops, and on the vessels in port, also the floating and land equipment, considerable work is in progress. Building construction is very active, living up to the promises made during the winter. It is predicted that in Montreal and vicinity there will be more building this season than there has been in any season since the boom year of 1913.

Iron and Steel.—The demand for steel is not as heavy as producers would like. The amount of business offering is an improvement, however, over last week, and there is no doubt that the railways will be in the market for steel rails at an early date, and while the looked-for March business did not materialize, it is stated on good authority, that the railways are now making up the figures and that orders will be placed before Easter.

The rail mills in the east are shut down, while the Algoma Steel Corporation is operating at about sixty per cent. of its capacity. Jobbers and the mills report that the demand for structural steel is increasing at a satisfactory rate. No very large orders have been received, but a considerable number of small and medium sized ones. Merchant bars are still moving in a fairly satisfactory manner. Sheets and plates are in good demand, and prices are still firm.

The latest view of the coal strike is that as long as transportation is not affected the supply of steel will be sufficient for all demands. For some months past local mills have been sending their sales representatives to call on the consumer direct. Jobbers have objected to this, especially as price cutting was much in evidence. In fact, many small orders were closed as low as $2.40 base, and in some instances $2.25 base. The base price quoted was $2.75, so it can be seen how keen the competition became. There is every reason to believe that jobbers and the mills are now getting together and will maintain quotations. Prevailing prices quoted are:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—Very little has happened in the pig iron market during the week. No changes in quotations have been made. Local dealers have been keeping their eyes on Buffalo, as this market has a definite influence on local quotations. It has been ascertained that Buffalo furnaces have taken a good deal of business in New Engand territory, and this material will be delivered via the new Barge Canal. Most of these orders are for eighteen dollar iron, and as it is well known that every ton of such iron represents a loss, it is stated that quotations will immediately be revised upward. If such is the case it will ease up the situation locally for iron is at present being quoted at $29.80 for No. 1 iron.

Machine Tools and Supplies. — Although contract plants have been more active lately than since last autumn, they find that their present machine tool equipment is sufficient to take care of all requirements. For that reason they cannot be interested in new machine tools. Railway shops and the large plants operating machine shops are not interested in anything in a big way in machine tools, the result being that sales are not much in evidence. Occasionally single tools are sold, and salesmen are very aggressive, price shading being often in evidence. Inquiries are fairly numerous, but it is difficult to turn inquiries into business. The supply end still continues to be good, and a gradual increase from week to week has been noticed. An off week is reported occasionally, but the general feeling is one of improvement. Prices on supplies are steady, the only flurry being an occasional further discount from list.

Non-Ferrous Metals.—No changes in local quotations on non-ferrous metals are reported, and business appears to be merely dragging along. The market has been featureless for some time past, and it was thought that the large order received by the Northern Electric Co., about ten days ago, would have thrown them into the market for metals, but dealers have been disappointed in this connection. In the list of local quotations it will be noted that prices are as low as they were last summer at the lowest period of the depression. Local quotations are:

Lake Copper	16 75
Electric Copper	16 50
Castings, Copper	16 25
Tin	34 00
Spelter	7 00
Lead	6 50
Antimony	6 50
Aluminum	23 00

Scrap Metals.—Scrap metals show a slightly better demand, but local conditions are still weak. There appears to be ample material to supply all the light demands. Quotations locally are as follows:

Copper, light per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	18 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	3 00

Pittsburg

April 5th.

PRODUCTION of steel has undergone a noticeable increase in the past week or two, after having been practically stationary for two or three weeks. The rate of steel ingot production at present may be estimated at 31,000,000 to 32,000,000 tons a year, against 29,000,000 tons at the end of February, say 17,000,000 tons at the end of December,

and 23,000,000 tons in October and November

Except for the inconsequential exception that a few pipe mills are stocking pipe to a limited extent, all the production of steel is based on actual shipping orders, so that production is a correct and prompt reflection of the orders received by mills. The only question as to the entire soundness of the steel situation is in connection with the possibility that buyers have lately been stocking to such an extent that in future they will not require as heavy shipments as they are receiving at the present time.

Iron and Steel Production. — That there has been some stocking is beyond doubt. Many of the orders have shown that buyers were rounding out stocks, while there is independent confirmation of the point in that anyone can observe that steel is not being actually consumed at the rate at which it is being produced and shipped. The present rate of production is in excess of the average rate in 1912 and 1913, the two best tonnage years before the war, with about 30,000,000 tons of ingots made in each year, yet it is plain that there is not the same degree of general industrial activity now as in those years. There is more dwelling house construction and more production of automobiles, but there is not nearly as much production of factories, bridges and skyscrapers, and not nearly as much railroad steel is being taken.

The situation would be clearer were it not for the coal strike that began April 1. The stocking of buyers would be attributed to their having allowed stocks to go down to an unreasonably low level and to their knowing that they would have need of more steel in spring. Presumably buyers know what they need and what they do not need. They would not buy for fear of demand outrunning productive capacity, for the production of steel in the past three months has been just one-half of steel-making capacity, so that the buyers have had a 100 per cent. margin of safety. They could have doubled their orders and merely filled the mills.

The coal strike, however, makes a difference. Buyers may have feared that it would interfere with production and shipments, and they may have ordered extra steel before April 1 against the possibility that the coal strike would prevent their getting desired deliveries after the strike had been going a few weeks. If that has been the case there is a possibility of orders beginning to fall off shortly. Thus far there is no evidence, in the actual market, of anything of this sort.

Prices Stiffening.—Mills have been very keen to secure higher prices when at all possible, much keener to stiffen prices than they were in the first place to try to keep them from going down. The market in bars and shapes has gradually worked upward until now it is fairly quotable at 1.50c, against 1.40c a week ago, and 1.35c three or four weeks ago. The 1.50c price is not absolutely maintained on all business, but concessions have obtained only in the case of particularly desirable orders. Some mills have passed up orders rather than shade 1.50c. Again, some small orders have been going at 1.55c and 1.60c, particularly when the specifications were undesirable. To illustrate, a carload of bars in two sizes would probably go at 1.50c and a carload in a dozen sizes at 1.60c.

It is a question where plates should be quoted. They are not active and there is an enormous excess of productive capacity, but the price has some stiffness because some mills simply stay closed, not finding it worth while to try to accumulate enough business to justify starting, while some producers who make bars and shapes also hold plates at the same price as bars and shapes whether they get plate orders or not.

Nails are very firm at $2.40 and the market is in strong position, with a decidedly heavy demand. Mills would probably succeed if they tried to advance to $2.50 but they are disposed to let well enough alone.

Heavy Sheet Bookings.—Placing of actual orders for sheets, and contracting for second quarter delivery has been heavy in the past week or two, since mills began announcing that their prices would be advanced $3 a ton April 1, or close to that date. If the threat of an advance was made, as is asserted in some quarters, because certain mills were running out of orders the move has been quite successful, and by the time the business is all summed up it will probably be found that buyers generally are well covered to July 1, at prices lately ruling, 2.25c for blue annealed, 3.00c for black, 4.00c for galvanized and 4.35c for automobile sheets. The covering in blue annealed has not been as extensive as in black and galvanized, since it has been quite uncertain whether blue annealed would really go up, and there has also been some conservatism on the part of the automobile trade. The American Sheet and Tin Plate Co., issued no notice to the trade that it would advance its prices, but its customers evidently assumed that it would make an advance if the independents did, for they have been buying quite freely.

Hoops and hot rolled strips have advanced $2 a ton in the past week, being now quite steady at 1.90c, the prise at which cut hoops have been for several weeks past. Bands are stiffer. Cold rolled strip remains at 3.50c, where it has been since January 1, and is unlikely to change in sympathy with the advance in hot rolled strips.

Never in the case of the numerous "suspensions" the bituminous coal mining industry has had was a suspension so widely expected or so long in advance, as the one that began April 1, and naturally buyers stocked up accordingly, being so anxious to be forehanded that they ceased being very active buyers about the first week in March, since when the coal market has been dull with prices declining. On the day the strike began, non-union producers marked their prices back to where they had stood before the March decline began, but there has not been enough trading to show where the market stands, there being hardly more than asking prices. Evidently the steel producers are satisfied that they will get along all right. With assistance from the non-union fields, even allowing for considerable labor trouble at non-union mines, the steel mills are probably assured of a supply much longer ahead than they have orders for steel.

Connellsville coke has weakened slightly in the past ten days, but is still as high as early in February after prices had recovered from the low level obtaining in the fore part of January, when spot furnace was $2.75 to $3.00, against $3.25 to $3.50 at present. As demand for coal began to decrease about March 1, Connellsville operators began blowing in more coke ovens, and from time to time it appeared there would be a surplus of coke, but each time demand seems to have increased enough to prevent any serious slack developing. Foundry coke remains at $4.25 to $4.75, depending on brand, with a slightly better selection of brands at $4.25 and $4.50.

Pig iron is even firmer than a week or two ago at $19.50 for Bessemer, $18 for basic and $19 for foundry, f.o.b. valley furnaces.

LOWER CUSTOMS RATE ON AUSTRALIAN IMPORTS

A report from the Canadian Trade Commissioner's office in Melbourne, Australia, shows a list of materials and articles which may be imported into Australia at reduced rates of duty if used in the manufacture of specified goods, or for specified purposes. Among those mentioned are certain sizes of iron and steel sheets; drill chucks and four-jaw independent chucks; machines for the manufacture of wheels for children's tricycles and accessory equipment; wood and metal patterns for use in the manufacture of alternating current electric motors, (this line is limited to one set of patterns for each motor frame size for any one importer or manufacturing firm); tractors, caterpillar and cable plowing types. Other appliances include irons for planes, shears, winding pulleys, etc. The above specified minor articles, machine tools and parts, and tools of trade, are now admitted (for the purpose specified) free of duty if from the United Kingdom and at the rate of 10 per cent. ad valorem if from any other country.

MANY NEW VESSELS USE DIESEL DRIVE

The efficiency of the Diesel engine is rapidly proving its superiority in marine practice, so much so that large ocean transport companies are adopting this type of power in many of the new vessels under construction, and likewise fitting out existing vessels with the Diesel engine when conversion is decided on.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 2 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 00
Castings, copper	16 25	17 00
Tin	34 00	34 50
Spelter	7 00	7 25
Lead	6 50	6 75
Antimony	6 50	6 75
Aluminum	23 00	26 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.80
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 00	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 50	3 50
Medium brass	4 50	4 50
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00

	Per Ton	Gross
Boiler plate	$9 00	$9 00
Heavy melting steel	9 00	10 00
Axles (wrought iron)	17 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	18 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	18 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... Net

Solder, strictly	$0 24½
Solder, guaranteed	0 26
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	2 75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	55
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	55
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	25 to 35 off
Can. high speed cutters, net to less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. p'ates all bright	8 25	...
Galvanized sheets, No. 28		5 55
Queen's Head, 28 B.W.G.	7 00	....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 35
Linseed oil, raw, single bbls.	1 00

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored.13

Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Plans have been prepared for the new Eastwood School, Edmonton, Alta., estimated cost $465,000.

Erection of a factory costing $30,000 is contemplated by the Crystalline Milling Co., 120 Bay St., Toronto.

The Canadian Wire Bond Boxes Ltd., 17 Mill St., Montreal, Que., is in the market for a 40 h. p. electric motor.

The Manitoba Rolling Co., Winnipeg, is in the market for a 36 in. lifting magnet for handling scrap; also 100,000 lbs.

Erection of addition to factory, three storeys, is contemplated by the Durant Motors of Canada, Ltd., at Leaside, Ont.

A. H. McPhail, architect, is preparing plans for a newspaper plant to cost $200,000 for the Border Cities Star, 104 Sandwich St., Windsor, Ont.

The proposed technical and vocational school for St. Thomas, Ont., now has the unanimous backing of the financial committee of the city council.

The Provincial Government plans construction of a dam on the Chaudiere River near St. Georges, Que., to develop 2,000 h. p., cost to be about $800,000.

A permit has been issued for the erection of a new Windsor and Walkerville technical school on Giles Blvd. and Elsmore Ave., Windsor, Ont., to cost $689,000.

A large addition to cost about $150,000 will be added to the University of Ottawa building, this year. Plans have been completed and work will likely start within a month.

Erection of a protestant orphan children's home costing between $200,000 and $250,000 is projected by the directors of the St. John Protestant Orphans' home, St. Johns, N. B.

Contracts for three large pressure filter tanks required for the Howard Smith Paper Mills Ltd., is awarded to Walsh Plate and Structural Works of Drummondville, Que.

The numerous brick plants at Milton, Ont., are said to be engaging large numbers of new men and have adopted a ten-hour day in anticipation of a busy season in construction work.

The St. Lawrence Balling Co., 23 St. Francois Xavier St., Montreal, is in the market for three electric motors, one ton and a half h.p., one three and a half h. p. and one two h. p.

The Board of Education, Guelph, Ont., will soon receive bids for a three storey collegiate including a vacuum steam with mechanical ventilation systems. Cost to be about $320,000.

Erection of a factory at the cost of $80,000 is contemplated by the Western Clock Co., 383 George St., South Peterboro, Ont. John H. Vernor of the same address is the party interested.

The city of Sault Ste. Marie, Ont., is having plans prepared for the installation of two gasoline engines for direct connection to present pumps in the pumping station. Cost to be about $20,000.

The Standard Steel Construction Co., of Welland, Ont., have secured the contract for all the construction steel work of the new warehouse building for the Canadian Ramapo Iron Wroks at Stamford, Ont.

A by-law will be introduced at the next meeting of the city council of Toronto, providing for the arranging of $109,000 for the erection and equipment of a technical school on Greenwood Avenue.

The Board of Education of Carleton Place, Ont., is asking the town council to submit a by-law for $110,000 in order to erect a new high school building and convert former premises into a public school.

A deputation from the County Council of Chatham, Ont., recently appeared before the Minister of Public Works, Ottawa, to ask for a $10,000 grant towards the construction of a bridge over the river at Prairie Siding.

The Toronto Transportation Commission will build a machine shop in Hillcrest Park at an estimated cost of $100,000. Equipment has not been purchased. It is also receiving bids for 8,000 tons of steel rails.

The Hamilton plant of the Canadian Libby-Owen Sheet Glass Co., Hamilton, commenced operation early this year. It is now producing at full capacity, and orders on hand warrant such operations being maintained for the balance of the year. This plant is operated continuously day and night.

Sir Adam Beck, Mayor Maguire of the city of Toronto, and the local Hydro commission met recently to discuss this year's program of capital expenditures by city Hydro system, which calls for $2,500,000. The chief subject of consideration was the new Hydro head office building at the corner of Front and Yonge St.

The plant of Walthausen Hat Corp. at Brockville, Ont., has been working at full capacity for the last twelve months, and the company has been unable to accept all export business offered. An officer of the company states that a 100 per cent. addition to plant is desirable when money conditions are easier.

Orders for ten marine boilers were received recently by the Engineering and Machine Works of Canada, St. Catharines, Ont., and the boiler department will be kept busy during the spring weeks, with both night and day shifts employed. Eight of the boilers are for delivery at Three Rivers, Que., and two are for Collingwood, Ont.

At a large meeting held recently at Renfrew, Ont., it was unanimously decided to proceed at once with the building of the new collegiate institute. Each of the members on the board of education addressed the meeting briefly, and also several of the large taxpayers voiced their approval. It was proposed to have the old collegiate building taken down before May 1st, 1922.

At a recent meeting the board of education of Oshawa, Ont., decided to spend $220,000 during the coming summer on the schools of Oshawa. The board decided that instead of spending $200,000 on the erection of one sixteen roomed school on the site now occupied by the Tennis Street school, they would build a twelve-roomed school on this site and an eight-roomed school in the south-east section of the city.

Last fall, piling was placed for the foundation of an addition to the north-western elevator, situated on the upper reach of the Kaministiquia river at Fort William. Work on the superstructure is now under way and will be carried on continuously until completion; this will be in time to participate in the handling of the 1922 crop. The additional storage space beng provided is 2,500,000 bushels. Construction is of reinforced concrete. The cost will be approximately $500,000. Barnett and McQueen are the contractors.

About as good a method as any of ascertaining how business is picking up, is to watch the volume of freight and general merchandise passing through the railroad yards. From official figures received, we find that freight business has increased about 15 per cent. since the start of the year, while smaller packages have increased in volume about 18 per cent. This shows conclusively that improvement is occurring, and the variety of products handled is exceptionally large. The percentages given are not confined to a few localities, but are an average of over 30 principal points throughout Canada.

The Canadian General Electric Co., has closed a good order from the west. Speaking to Canadian Machinery about this matter, Mr. Ashwoth, of the Toronto office, said that the order has been secured from the Manitoba Power Co., and includes the following equipment: Two, 21,000 k.v.a. water wheel driven vertical generators, and six, 7,000 k.v.a., 11,000 to 60,000 volts core pipe transformers. These are to be erected at the

Manitoba Power Co. plant at Great Falls which is adjacent to the present power plant of the Winnipeg Electric Railway Co., at Vac Bu Vonnet. Eventually the capacity will consist of 6 of these machines, in other words, three times the equipment now being provided.

Highway Crossings Ltd., manufacturers of steel crossings for use at railway intersections, have decided to locate their Canadian plant in Welland, Ont. A site for the factory has been secured in the Maple Leaf Park. The company's product is designed to take the place of wooden planks at highway crossings. A test is being made at the present time for the Canadian National Railways to show the advantages claimed for the steel crossings.

The Textile Industries in Canada showed a continued improvement during the month of February, according to reports received by the department of labor. Employment in the cotton mills in various towns reported a minor increase in activity, while the hosiery and knitted goods factories registered the same staffs as during the preceding months. In Quebec the situation is considerably more favorable than it was in January, improvements being reported in practically all branches of the industry.

For some years past the corporation by the name of Lachine Rapids Power Co., has been gathering data and preparing to finance a plant for the erection of a gigantic dam below the rapids to Heron Island in the St. Lawrence River, but the outbreak of the war prevented the action. It is rumored that efforts to put the scheme on its feet, through re-organization and strengthening of the concern, are to be made shortly. It is said that the work itself would cost in the neighborhood of $175,000,000.

The effort of the Canadian Department of Trade and Commerce to secure the establishment of branch plants of British firms for this country will be directed in London, England, by Trade Commissioner L. D. Wilgress. The department is desirous that boards of trade, chambers of commerce and industrial commissioners throughout the dominion shall communicate with Mr. Wilgress, giving him publications, statistics and other specific information regarding industrial openings in their own localities. An important part of the data placed in the commissioner's hands will relate to transportation facilities, raw material, labor, power cost, taxation, etc. Mr. Wilgress will get in touch with British manufacturers with a view to interesting them in the location of branch plants, and his work will be all the more effective if he receives the co-operation of organizations that have the same end in view.

Preparations are now under way at the Ontario Reformatory for the opening of a cannery which will be the largest in operation at any government institution in Ontario. It is expected that between 40,000 and 60,000 gallons of canned goods will be turned out this year. A large amount of new machinery for the canning factory has arrived and the balance is expected very shortly, and as soon as the coming season opens the inmates will have the new industry in full operation. Small canning plants are now being operated at the government institutions in London, Whitby and Hamilton.

C. A. Stirling, assistant manager of the Robbins & Myers Co. of Canada, Brantford, Ont., tells Canadian Machinery that they are finding a better feeling throughout the country. Enquiries are coming in faster, developing into orders in many cases.

Plans for hurrying up a start on the construction of the new east-end technical school, Toronto, were under discussion at a meeting held recently. It was announced that some final re-adjustment of the financial arrangement between the city and the province had still to be made, and that the matter would be voted upon at the meeting of the city council within the next few days. As soon as this last obstacle has been overcome the advisory committee of the school board plans to call a special meeting to give final approval to plans and to arrange for the speedy calling of tenders.

In connection with the passing of the bills of the Montreal Service Corporation and Canadian Light and Power Co., by the Quebec legislature, the statement is made at Montreal, Que., that the completed merger of these power interests will result in a capitalization of approximately $100,000,000. With the powers now granted, the development of the Ottawa at Carillon will be proceeded with as soon as weather conditions will permit, a considerable portion of preliminary work having been already accomplished. It is further claimed that the consolidation will finally result in the production of upwards of 300,000 h.p. much of which has already been contracted for. To carry out the work to completion the total of $40,000,000 will be required, it is claimed, all of which will be expended during the next two years. The financial plans are well advanced.

The Enterprise Foundry Co., Sackville, N. B., have completed a new steel shop for making bodies for steel and gas ranges, and the wing for japanning. A number of sheet metal working machines have been installed in the addition and those in the main plant have been moved in. By these improvements the output of this department will be considerably increased. As the plant covers so much ground that power can be no longer advantageously transmitted by shafting, part of it is being electrified. Another new development is the installation of a large air compressor which can be used for sand blasting and other foundry work.

A new industry has been secured for Oshawa, Ontario. It has been announced from reliable authority, that W. E. Phillips, Limited, a recently organized company, has secured an option of the plant of the Thornton Rubber Co., in this city which a few weeks ago was destroyed by fire. It is understood that as soon as the necessary transfer papers are filed the new organization will commence re-building the plant and equipping it with new machinery for the manufacture of wood-work, moulding, mirrors, picture frames, etc. It is the intention of the company to have the plant in shape for active operation by May 1st. At first 50 men will be employed but ultimately it is expected the plant will require some 150 to 200 men.

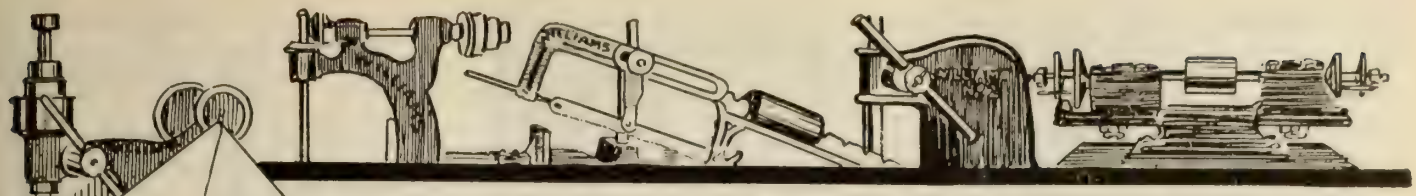
A report from Saskatoon, Sask., states that as a result of the introduction of a one-man car on the Saskatoon street railway system a deficit of $8,996 as compared with a deficit of $58,884 for 1920 is shown by the year 1921, a reduction of approximately $50,000. It certainly speaks well for the new cars.

Here is what Mr. S. L. Squire, chairman of the executive committee, Canadian Good Roads Association, has to say on the automotive question in Canada. Twenty years ago there were less than 300 cars in Canada or one car for each 1,360 miles of road; we now have one car for every mile of improved road. It is clear that for motor use, the road is 1,300 times as important as it was 20 years ago.

Timber as well as water power to ensure an unlimited supply of newsprint paper exists in Newfoundland, according to Wm. S. Coaker, Minister of Marine in Newfoundland, who is at present in New York city. Mr. Coaker stated that in addition to the paper pulp mills the capacity of 400 tons a day which was being promoted by British interests, there was sufficient wood and water power in the Humber River area to permit the establishment of mills to turn out another 600 tons a day.

The pulp and paper industry is lightly regarded as one of the most important of Canadian manufacturing industries, this being strikingly demonstrated by the figures for its operation during 1920, just issued by the Dominion Bureau of Statistics. The total capital invested is given at $347,553,358, of which $221,472,538 is in pulp and paper mills, $103,659,445, in pulp mills and $22,421,352 in exclusively paper mills. This, it may be added, was considerably increased during the early months of 1921. The total number of all mills is returned at 100, Quebec leading with 46, Ontario next with 37. Quebec has the largest number of pulp mills, 18; Ontario comes second with 7.

An increase in manufacturing space from 2,000 sq. ft. to 50,000 sq. ft. is the record of development of the Brantford Computing Scales, Ltd., of Brantford, Ont. This new plant, already completed and fully equipped is said to be the largest and finest of its kind in the British Empire, and is capable of handling a turnover of approximately $2,000,000 a year. Until two years ago, the company did its business exclusively in Canada but latterly repeat orders have been received on shipments made to Great Britain, the United States, Australia and New Zealand.



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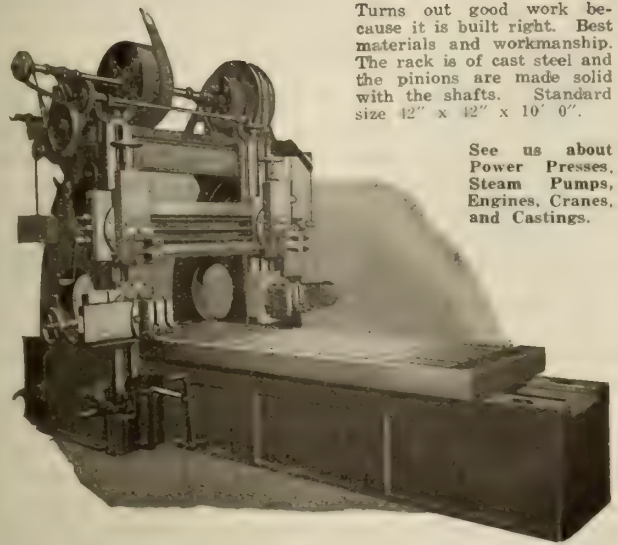
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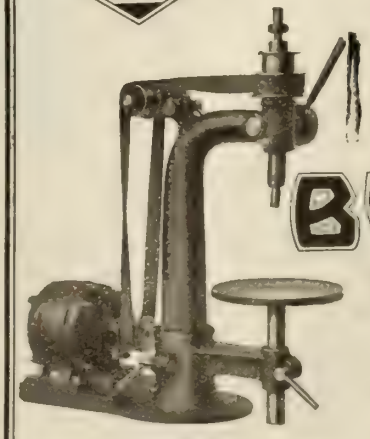
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Canadian Dealers:—H. W. Petrie, Ltd., National Machinery & Supply Co., A. R. Williams Machinery and Supply Co., Canadian Fairbanks-Morse Co., Williams & Wilson, Garlock-Walker Machinery Co., Yeates Machinery Co., Cope & Sons.

The ratepayers of Mount Elgin, Dereham Township, have decided to go ahead with the construction of a continuation school, at an estimated cost of $15,000.

Fire of unknown origin broke out on March 20 in the sawmill of the Kastner Lumber Co., Wiarton, Ont., destroying the mill, with a loss of between $5,000 and $6,000.

The Paris Knitting Co., Burford, Ont., has secured an old factory building and plan to install equipment for the manufacture of socks and stockings; estimated cost $30,000.

The production of brooms and brushes in Canada during 1920 was valued at $4,680,985, compared with $4,284,915 in 1919. In 1920 there were 55 plants engaged in making these products with a capital investment of $3,780,252. Exports to the United States decreased from 1919, but the value of goods sent to the United Kingdom and the British possessions increased.

The starch and glucose industry of Canada produced goods to the value of $8,379,185 during 1920, according to a report issued by the Dominion Bureau of Statistics. Comparing these figures with the total for 1919 shows an increase of over $500,000. The capital investment for 1920 was $6,112,124. Three Ontario plants represented practically the whole Canadian industry since only 10 people were employed in the two plants located in Quebec and Prince Edward Island.

For some time reports have been in circulation that the Canadian Locomotive works, Kingston, Ont., which have been closed since May last, are to reopen in April, but at the office of the works nothing definite is known. It is known that orders have been offered to the company, but that it would not pay to reopen the plant unless enough work was secured to keep the place busy for a year at least. As the locomotive works is Kingston's biggest industry, employing between 700 and 800 men, news of a large locomotive order is eagerly awaited.

The following are some very interesting figures showing the standing of the individual provinces for the Dominion of Canada with regards to automobile ownership.

Province	Cars	Population	Persone p.c.
British Columbia	90,600	31,000	16
Saskatchewan	45,010	62,958	12
Alberta	81,995	38,750	15
Manitoba	15,008	40,430	15
Ontario	2,929,054	206,900	14
Quebec	2,349,067	59,707	39
P. E. Island	88,538	13,051	50
New Brunswick	88,092	13,584	28
Nova Scotia	24,579	14,250	36

In all, this is a total of 569,000 motor vehicles which shows an average for the Dominion of one car for each 18 persons, or one car to every three families.

Commenting on the proposed development of the St. Lawrence deep water project, Col. Gear of the Montreal Shipping Federation, stated that if the scheme were carried out, it would result in incalculable damage to Canadian shipping and likewise delay in navigation through holding back the flow of the ice each spring. He instanced the cost as another objection, and intimated that the power development would benefit the United States more than Canada. He urged that the government study the report of the Shipping Federation, made to the International Waterways Commission.

MANY LINES GIVE PROMISE OF IMPROVEMENT

Discussing the building and general business outlook in the United States, the National Bank of Commerce says that the present activity in building operations is an outstanding feature. The building industry is second in importance only to agriculture, and in the more active building sections of the country that are systematically reported, comprising about half the states, considerably more than two billion dollars in contracts were awarded last year.

High freight rates due to labor conditions and high wages to labor are the controlling factors in building costs. They maintain construction prices at levels that interfere with the full and well-rounded development of building operations. They also serve to inject an element of fixed inflation into this, the greatest construction movement in the nation's history.

The lack of well-balanced development is made manifest by an analysis of contracts let and permits issued to date. Residence construction leads. Public buildings, roads, bridges, and other types of building for public purposes are next in importance, stimulated somewhat by desire to relieve unemployment. Business and industrial construction, which must be done on a basis of cost that will permit a present and continuing return on the investment, has not expanded correspondingly.

Despite the handicap of high costs, home building activity is being maintained for the present because the housing necessity compels it, even on the basis of uneconomical investments. Public building and construction are also being done on a high cost basis which will be reflected in high tax rates for years to come. Public building, like residence building, cannot continue indefinitely under these conditions.

Labor itself is the chief sufferer in the situation. Resistance by important classes of labor to wage declines in a period of declining prices disorganizes the entire productive organization of the country and contributes to unemployment in other lines. The maintenance of building operations on high wage levels delays general wage readjustment. It means exorbitant rents and prohibitive costs for homes for workmen. It is a general deterrent to a return to normal industrial, commercial and financial activity.

On the whole labor costs in the building field are not greatly reduced from their maximum. Transportation is a very large part of the laid-down cost of building materials and the adjustment of railroad rates is deferred by the refusal of railway labor to recognize that the period of war wages is over. In other words, high building costs are being maintained directly and indirectly by labor costs. It is there that the fundamental correction must be made.

Improvement in business with increased stability in underlying conditions characterized the period from February 16 to March 15. Prices of the major commodities have shown only normal fluctuations. Many lines of industry give evidence of increased activity and there appears to have been some decrease in industrial unemployment. Retail trade over the counter is reported as unsatisfactory, but mail order houses generally show an increase in business, attributable to the improved purchasing power and mental attitude of the farmer, due to the rise in agricultural prices.

Wholesale trade is generally reported to be better, although a considerable degree of caution wisely prevails. The rate of iron and steel production has increased, but the volume of forward orders still remains restricted. Immediate demand for boots and shoes is less active and other sections of the hide and leather trade continue to lag. The cotton textile situation is handicapped by strikes in the New England cotton mills. Wool manufacture is operating at a fair rate, although the demand for woolen and worsted fabrics has been disappointing. There has been a marked increase of activity in the manufacture of automobiles, tires and accessories. Car loadings have increased materially during recent weeks. Exports are at a low level, but this is normally the season of a light export movement. Business failures have declined in number since the beginning of the year. The past month has shown improvement in fundamental conditions, and consequently in business sentiment, as has been the case each month since midsummer of 1921.

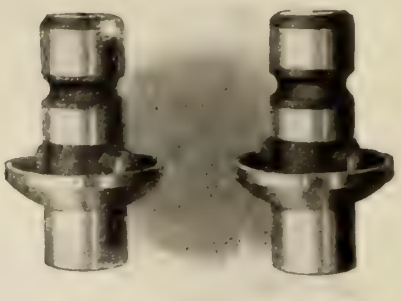
HANDSOME VOLUME

Hendey 1870-1920 is the unassuming title of an excellently arranged book issued by the Hendey Machine Co., Torrington, Conn., and which covers in a brief, yet thorough manner the founding and activities of their company. The edition of this book is limited to friends at home and abroad, and anyone reading it cannot help but feel that considerable thought has been given in its preparation.

Starting with a story of the founder, Henry John Hendey, the forming of the partnership is described, the first and second shops occupied being illustrated. Then comes a description of the forming of the stock company, followed by other exceedingly interesting chapters. The latter portion of book shows the photographs of the various presidents, and all officials are listed on another page. Several remarkably clear photographs of the present plant interior are shown throughout the book.

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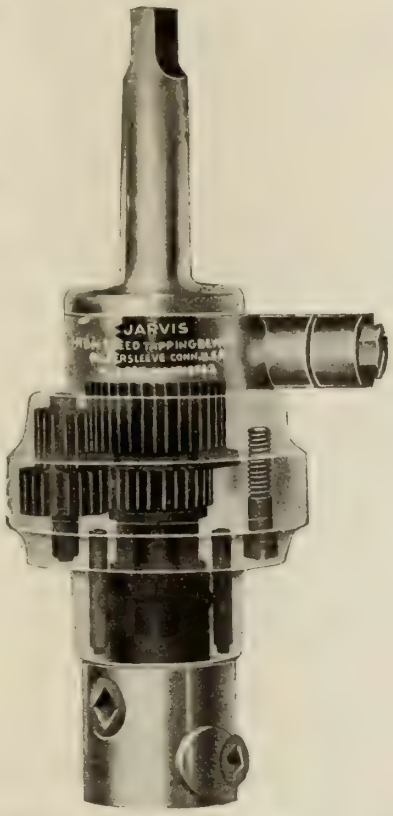
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Jarvis Tappers and Quick Change Chucks

And collets are developed to such a degree of perfection that the Geometric Tool Company recommends and furnishes them as a fitting adjunct to their line of threading tools.

Where one hole is drilled, reamed, counterbored, tapped and a stud set, or any two of these operations are done with one spindle, the Jarvis Quick Change Chucks pay for themselves in a very short time. Changes are made without stopping the Drilling Machine or Lathe.

There is no burring from constant use to interfere with the easy entrance or operation of the Collet.

Jarvis Quick Change Chucks and Collets consist of a chuck or locking member and a sufficient assortment of collets for any job.

Any standard Drill Chuck can be fitted to the Morse Taper Collets.

Combination Tapping Device and Quick Change Chuck

In place of the regular chuck, the Tapping Device is equipped with a Quick Change Chuck, forming a Combination Tapping Device and Quick Change Chuck. This is the combination much in demand.

The Booklet tells the Complete Story. *Write Now.*

The Geometric Tool Company

New Haven, Connecticut, U. S. A.

Canadian Agents

Williams & Wilson, Ltd., Montreal. The A. R. Williams Machinery Co.,Ltd., Toronto, St. John, N. B.; Halifax, N. S.; Vancouver, B. C.

ACCIDENT REDUCTION FREELY DISCUSSED AT CONVENTION

THE JOINT Safety Convention under the auspices of the Canadian Manufacturers' Association Board, Department of Labor, Ontario Safety League, Ontario Pulp and Paper Makers' Safety Association, Electrical Employers' Associatioff, Lumbermen's Safety Association and Industrial Accident Prevention Associations, got off to a good start on April 4th at the King Edward Hotel, Toronto. Several papers were presented of importance, and at a later date Canadian Machinery will treat these in more detail.

The first paper was given by Mr. S. Price, chairman of the Workmen's Compensation Board and he dwelt in detail upon Ontario's Accident Prevention Policy. He gave some interesting figures which showed the work his board was doing, and brougt out some very vital facts.

The next paper was presented by Miss Muriel Mackay, chairman of the subcommittee on Industrial Nursing of the public health section, Canadian National Association of Trained Nurses. In a very able manner she brought out the importance and necessity of nurses in industrial plants.

The third paper by Dr. C. L. Starr, professor of surgery, University of Toronto, was entitled "Surgical Treatment of Accident Cases," and Dr. Starr proved conclusively that only the highest quality surgeons should be engaged in this work. He pointed out that a surgeon engaged in industrial accident treatment should endeavor, whenever possible, to save a member of the body, but on the other hand, where he felt that the recovery of the member was extremely doubtful, he should insist on an operation, remove the member, and get the worker back as soon as possible. He also mentioned that although a workman might not perhaps be able to perform his usual task, he could start on lighter work until his injured member was functioning properly.

The last paper by S. J. Dickson, chief constable for Toronto, was on the subject of "Traffic Accidents," and he brought out in a very able manner the causes of the numerous accidents occuring in any large city. He emphasized the importance of checking up the capability of the driver of any automotive vehicle, and suggested that some law be enforced which would necessitate every driver going through an examination.

Leslie Hall, of the Williams Tool Corp., Brantford, Ont., and Erie, Pa., was a visitor in the office of F. F. Barber Machinery Co., Toronto, and stated that on his recent trip, lasting four weeks, through the States, that conditions in the machine tool business were showing exceptional activity all along the line.

PLANTS ARE WELL SUPPLIED WITH COAL

ALTHOUGH the coal miners are now on strike, there is no need for worry so far as Toronto manufacturing plants are concerned. Canadian Machinery got in touch with a large number of factories, covering a wide range of activities, and with very few exceptions, they are stocked up with coal for about three months or more and are paying little attention to the strike. Some firms are prepared to keep going until July 1st, without difficultiy, these being large users who consume about 15,000 tons a year.

The consensus of opinion is that there will be no difficulty in securing coal, even if the miners decide to stay out for some considerable time, for the government will no doubt have stepped into the breech before three months have passed.

The only real danger would be with the railwaymen. If they went on strike it would tie up traffic, but as the men on the railroads are well satisfied, there is little likelihood of this occurring. As one large coal dealer put it, "The day of sympathetic strikes is about over, and if consumers will just sit tight, refuse to worry and not rush into a panic buying movement, the complete matter will soon be settled."

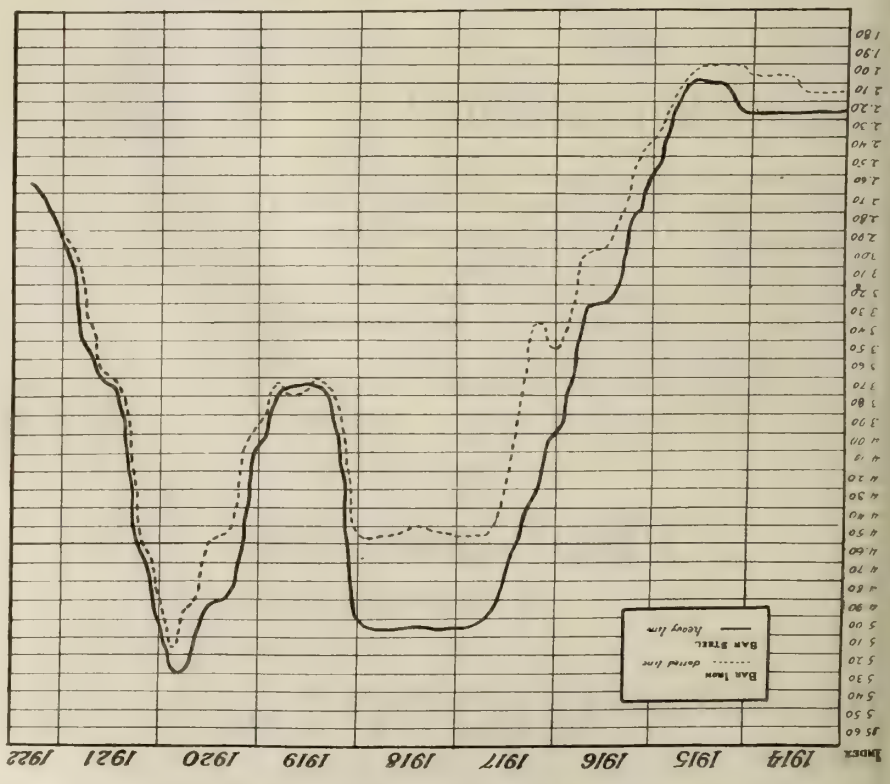
CONDITIONS HAVE IMPROVED IN MANY QUARTERS

(Continued from Page 50)

going on at the Border Cities. To believe what has happened here within the past few years, our Eastern friends would require to see for themselves —and even then, they are wonderful almost beyond belief. Miles upon miles of absolutely new streets, lined with fine homes, have come into existence within the lifetime of a little child not nearly old enough for kindergarten. No development that I ever witnessed in Saskatoon, or other Western city, during the boom of 1910-12, eclipses what I have witnessed right here at this most southern extremity of Canada. It will not be very long until one of Canada's great cities will be located right here. At the present time we are the third largest industrial producer in Ontario, and the recent census gives us a population increase of over 138 per cent.,— the greatest in the Dominion.

"As to the future,—it is bright. We are now working upon no fewer than eighty-two very promising industrial prospects, quite a number of which have already decided to come in when conditions revert to the more nearly normal.

THE TREND of iron and steel trade prices during the last nine years makes a very interesting study. The chart on this page, which is reproduced from Hardware and Metal, shows the comparative base prices on bar iron and steel year by year. The continued line represents the price fluctuations in Canada on bar steel, while the dotted lines indicates the rise and fall of primary base prices on bar iron, on the domestic markets. The index covers the actual prices, and thus the varying changes can be more clearly followed. The existing base price of $2.70, compares very favorably with the level of $2.25 in effect in January 1914. When freight rates, distributing and production costs, and various other elements are taken into consideration, it is readily recognized that the liquidation in steel prices is most thoroughly advanced.



Showing variation in iron and steel bars over a nine year period.

ATKINS METAL CUTTING SAWS

Business Looking Up?

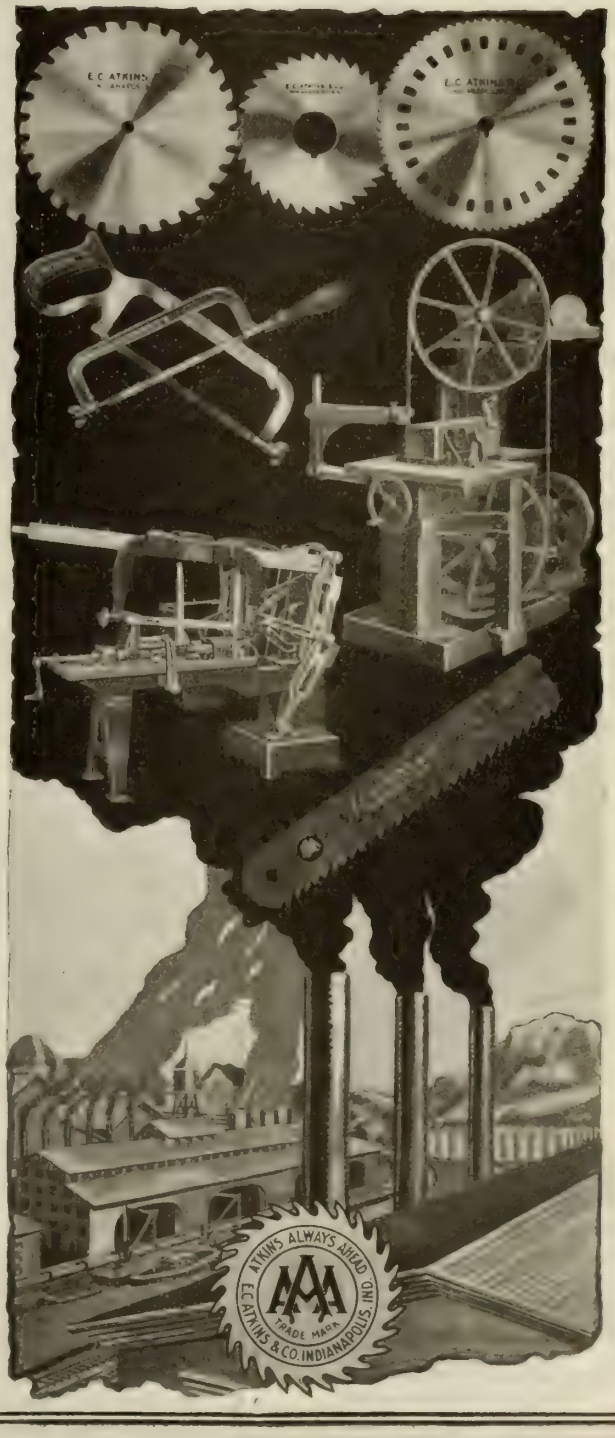
Building contracts are increasing; metal stocks are being depleted; factories are resuming; metal saws and machines must be ordered.

ARE YOU READY?

Put your plant in shape for a long run of good business. Write to the nearest point below for a catalog which will tell you why

Atkins Metal Cutting Saws and Machines are the BEST.

"A Better Saw for Every Use"



E. C. ATKINS & CO.

Est. 1857 **"The Sterling Quality Saw People"**

Home Office and Factory, Indianapolis, Indiana

Canadian Factory; HAMILTON, Ontario

Branch, carrying complete stock: VANCOUVER, B. C.

Canadian trade is again on the upgrade. Recent improvements in Canadian exchange and in the volume of employment are reflected in increased trade in February, as compared with the previous month. Total trade for February 1922, is $101,298,782, an increase of $2,724,791 over January.

"Maple Leaf"
BRAND
Stitched Cotton Duck Belting

"Maple Leaf" brand costs less than leather, rubber and balata; has a positive grip on the pulley and is true running.



Have us send you samples and see just why "Maple Leaf" sets the standard in economy, strength and durability.

Dominion Belting Co. Ltd.
Hamilton, Canada
Quebec Branch: 51 Duluth Bldg., Montreal



No. 4 Press
10 to 12
tons

Write for complete information on Atlas Arbor Presses. All sizes for all purposes.

ATLAS PRESS CO.
330 N. Park St.
Kalamazoo, Mich., U.S.A.
Canadian Representatives:
Chas. A. Strelinger — Windsor, Ont.

SHOW CONFIDENCE IN THEIR REPRESENTATIVES

W. H. C. Mussen, of Mussens Ltd., has fulfilled an obligation he committed himself to in March 1915, viz., to pay off the liabilities which existed when the firm was placed in voluntary liquidation seven years ago. At that time, as at present, this firm was engaged in the sale of railway, mining and contractors, and municipal supplies, and in common with such enterprises, sharply experienced the business depression which affected Canadian contractors during that period of the war. Faced by the further difficulty of profitably disposing of the heavy stock on hand, Mr. Mussen, president of the firm, decided that it was then advisable to apply for the appointment of a liquidator. It was announced at the time that the liabilities of the firm totalled $300,000, while the assets comprising merchandise on hand, realty holdings, open accounts, and bills receivable, amounted to $550,000, or approximately $250,000 in excess of the liabilities. As the stock carried was not of a character to be readily placed on the market, particularly during a period of depression with no construction work in sight, the action taken was regarded as offering the greatest possible protection to the creditors.

At the time Mr. Mussen declared the liquidation proceedings were not being sought with a view of reorganizing the business, and he was not in favor of such a proposal unless it would be one under which the creditors would each receive a hundred cents on the dollar.

At the time of the liquidation, John J. Robson was appointed liquidator, which position he has maintained ever since. With the completion of his services as liquidator Mr. Robson will enter the services of the firm as auditor.

During the seven year period since 1915 they have received the support of the manufacturing firms represented by them at the time of liquidation, with one or two exceptions. With these exceptions, the firm continue to represent the firms who were their creditors. During the period several other firms requested the firm to represent them, showing the confidence in which they were regarded.

BRITAIN SECURES CONTRACTS IN RIVAL COMPETITION

"The present outlook in the engineering world still leaves much to be desired," said F. W. Field, H. M. trade commissioner at Toronto, to Canadian Machinery during an interview. "There are, however, certain features which give rise to hope for the future," he continued. It is known, for instance, that in certain recent important contracts in South America, a big Continental combine was obliged to surrender its deposit and cancel its obligations on terms, because it could not meet the tender price it quoted in the first place. There is a tendency for prices to rise in those countries where the exchange is depressed, and this is obviously making it very difficult for firm prices to be quoted.

Germany in particular is making commercial enemies by quoting low prices and then increasing them without stating reasons. As there is now less margin in many cases between Continental and British prices, customers in increasing numbers are coming to the United Kingdom for quotations.

Another feature which gives ground for hope is the way in which British firms are securing large contracts in competition with their rivals. A recent case was the order for grain-handling plant for South Africa, and just previously a big order for electric rolling stock in South America was secured. In each case the size of the order is stated to constitute a record for the country.

The locomotive builders are engaged on work for authorities, including the Crown Agents for the Colonies, the India Office, or the various Dominion High Commissioners. Wagon builders are in a favorable position and have a fair number of foreign orders. The contract secured by one firm for the supply of 1,000 tank wagons to Russia has eased the situation.

Considerable reductions in the price of metal have made it possible for manufacturers of rails, fishplates, fishbolts, nuts, dogspikes, steel sleepers, and signal equipment to complete overseas, and many of them report good orders recently secured. The increasing inability of Germany to secure raw materials from outside sources has obliged the manufacturers of that country to cancel many orders undertaken, and in the new invitation to tender the British supplier feels fairly confident, American, French, and Belgian prices having increased.

Most openings announced bring a ready response from the United Kingdom and an increasing readiness to face even the financial difficulties. The steady appointment of foreign agents, especially in South America, is an eloquent indication of the desire to do more foreign business.

Firms specializing in docks, harbors, bridges, and railway layout are in a good position. The home authorities have been steadily in the market for repair and extension work, and, as the number of contractors is not too great, the work, even when spread out, has assisted materially to keep them going.

The foreign market also has furnished work for them. The Yellow River Bridge in China, harbor construction and extensions at Candia (Crete), a sanitation contract in Salonica, canal making and bridge building in Belgium, etc., have all come the way of the British contractor, and for others they are confident of securing at least part of the work.

"This information is absolutely correct," concluded Mr. Field, "as it is based on news furnished me by the head office at London, in the department of overseas trade."



With a DUMORE High Speed GRINDER, jigs, dies, gages, bushings, etc., which have become warped during tempering, can be brought down to limits as close as .0001 in. This is but one of many ways in which DUMORE grinders serve thousands of mechanics daily.

Can 5,775 Be Wrong?

A SHORT time ago practically unknown—to-day, indispensable in the shops of 5,775 of the country's leading metal working industries! Such is the remarkable sales record of DUMORE High Speed GRINDERS.

What greater tribute to the efficiency of these grinders could possibly be given? Surely the judgment of over five thousand of America's foremost leaders of industry can be relied on!

You, too, can unhesitatingly choose a DUMORE as the *one* grinder for *all* your intricate grinding work. Their extensive use by many varied industries suggests their adaptability—their *continued* use in these various lines of work prove the efficient and satisfactory service they render.

DUMORE grinders are durably built in six useful styles and sizes. Combining perfect running balance with correct cutting speed, these compact, high-speed grinders work with a total lack of end play and absence of vibration. Speed and accuracy are assured on the most delicate jobs—increased output and decreased production costs are a certainty with one or more of these DUMORE grinders in the tool room.

Their many advantages and conveniences—the economy afforded by their superior performance—result in re-orders from eminent industrial experts everywhere.

Let DUMORE grinders eliminate the need of costly tearing down of original "set ups" in your shop. Let us show you, as we have thousands of others, how a DUMORE can convert wasted moments into productive hours. Ask your dealer or write us direct for information that will aid you solve your grinding problems.

WISCONSIN ELECTRIC COMPANY

2944 Sixteenth Street Racine, Wisconsin

DUMORE HIGH SPEED GRINDERS

Classified Opportunities

Two cents a word, including "Canadian Machinery' box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads.,or ads. set in border, are at the card rates.

PATENTS

The old established firm. Patents everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.

FETHERSTONHAUGH & CO.

EFFICIENCY ENGINEERING

PRODUCTION COSTS REDUCED BY STANdardized methods. Machines—tools designed. Experiments supervised. Ideas developed. Time studies for piece work schedules. All interested address H. L. Roberts, M. E., 27 Hilton Ave., Toronto. C15 M.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

AGENCIES WANTED

IF YOU ARE LOOKING FOR A HIGH-GRADE firm to handle through the hardware jobbers and consuming trade throughout the Dominion, write us. It will be worth your while to investigate the special features of our marketing proposition. We know what co-operation means. Write to Box 860T., Canadian Machinery.

BUSINESS CHANCES

WANTED—BY AN ESTABLISHED CONCERN. Twelve to fifteen thousand dollars for a period of from one to three years, to take care of business expansion. This concern will stand the fullest investigation. 8% is offered with ample security to principals only, with an opportunity of becoming permanent associates with the partners, if mutually satisfied. Box 767, Canadian Machinery. (ctfm)

REGO WELDING and CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

SITUATIONS WANTED

MECHANICAL ENGINEER IS OPEN TO consider partnership or interest with manufacturer with a view to producing new high grade lines of engineering equipment. Must have good reputation and manufacturing facilities. Box 808, Canadian Machinery. (C.16M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience, 10 years general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery, (c23m)

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium and heavy work, green and dry sand. Bench, floor and machine molding, melt by analysis, and thoroughly competent on cupola practice. Good reference. Box 804. Canadian Machinery. (C11M.)

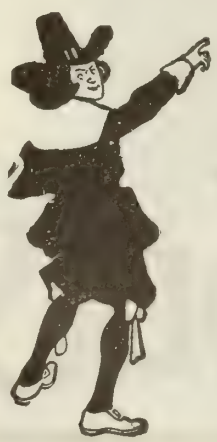
FOR SALE

ONE J. & J. TAYLOR SAFE, INSIDE DIMENsions 15 inches deep, 2 feet 6 inches wide, three feet 11½ inches high and fitted with a ouilt in compartment. Price $250.00.

ONE J. & J. TAYLOR SAFE, 18 INCHES deep, two feet 9 inches wide, four feet five inches high, fitted with a steel compartment. Both safes are in good condition and can be bought at a price that will save considerable money to the purchaser. Price $200.00. Box 806L Canadian Machinery.

STRUCTURAL STEEL BUILDING, SUITABLE for factory or warehouse. For sale at bargain price. Write us for particulars. Standard Steel Construction Co., Ltd., Welland, Ont.

FOR SALE:—ARCWELL ELECTRIC WELDing outfit, Heald Internal Grinder, 10 Pyrometers, Portable Crane, 5 Elevating Trucks, 1 four spindle drill, Sandblast outfit, several tool grinders, Warner Swazey screw machine 300 feet Matthews' Gravity Conveyor, 3 Tool Furnaces. This equipment almost new will sell cheap. Box 802L.



Put it There!

No, we're not shaking hands, but we would like to offer advice.

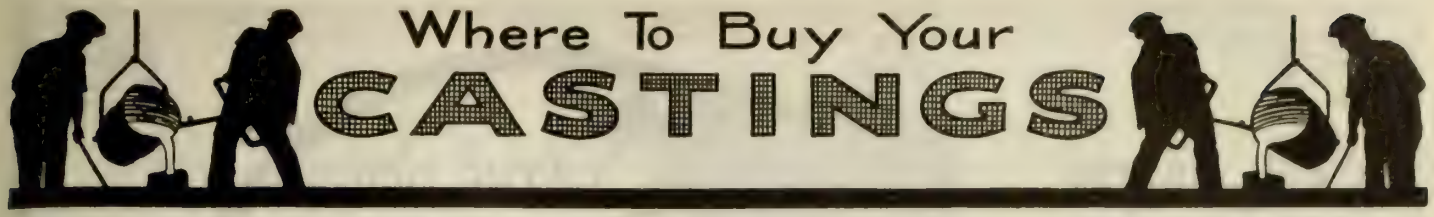
These columns have sold hundreds of dollars worth of equipment. A large number of men have been paid many times over by using these columns.

The easiest, quickest and cheapest way to dispose of, or buy new and used equipment.

Two cents per word. Minimum for one insertion $1.00. Box numbers can be had for 10 cents extra. Replies are forwarded immediately, and without additional cost.

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Everything comes to him who waits, but he who does not advertise waits longest.



The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

John T. Hepburn, Limited
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618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

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Malleable.

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LIMITED
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Steel Castings all sizes.

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Steel Castings up to 5,000 lbs.

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Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
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Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

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1—26″ x 12′ Pond Lathe, S.B.G., C.R., P.C.F.
1—24″ x 12′ New Haven Lathe, D.B.G., S-Q.C.G., C.R.
1—24″ x 12′ Can. Mach. Lathe, S.B.G., C.R., P.C.F.
1—21″ x 10′ London Lathe, S.B.G., C.R., P.C.F.
4—20″ x 8′ C.M.C. Lathes, D.B.G., S-Q.C.G., C.R.
1—18″ x 8′ C.M.C. Lathes, D.B.G., Q.C.G., C.R.
1—21″ x 10′ Butler Lathe, D.B.G., Q.C.G., C.R.
1—16″ x 6′ McDougall Lathe, S.B.G., S-Q.C.G., C.R.
1—18″ x 8′ C.M.C. Lathes, D.B.G., Q.C.G., C.R.

Shapers

1—24″ Rockford Shaper.
1—12″ Port Hope Shaper.
1—16″ Hendey Friction Geared Shaper.

Drills

1—No. D-1 H.D. Colburn Drill.
2—No 24 H.D. Foote Burt Drills.
1—28″ Barnes Drill, B.G., P.F.
1—22″ Barnes Drill, B.G., P.F.
16″—Back-geared Drill, lever feed only.

Miscellaneous

2—2″ x 26″ Pratt & Whitney Turrets.
1—No. 2 Gardner Disc Grinder.
1—3″ Acme Bolt Cutter.
1—No. 54 Perkins Sprue Cur.
1—No. 320 Brown-Boggs Press.
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Union Triplex Hydraulic Pump, 1¼″ x 4″.

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Stock shipments
Sizes 3-16″ O.D. to 4″ O.D.
Seamless Welded Brazed

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If you use Steel Tubing it will pay you to write for our list of material for

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Purchase now for future requirements and gain the benefit of our
GREAT SACRIFICE HIT

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What Interest Does Your Tool Investment Pay?

Armstrong Tool Holders pay you high interest on your investment in them by saving time, grinding wheels and high speed steel. Armstrong Lathe Dogs, Clamps, Ratchet Drills and Wrenches repay you with proven reliability and quality. In terms of real service Armstrong Tools pay the highest interest. Specify Armstrong.

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"The Tool Holder People"

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PARKER VISES



They grip like a Grizzly.

A Real Swivel Base *Not* a Clamping Device

The patented swivel is adjustable to any point on the base and is held securely by an expansion ring. This provides a swivel base with all the strength of a solid back jaw.

Other Good Points

Semi-steel castings, removable jaws pinned from the top, solid steel strengthening bar in the slide, improved saddle and solid under portion, set screw and spring in handle, extra strong screw and nut.

Send for Folder No. 12.



One of the "70"

The Charles Parker Co.

Master Vise Makers

Meriden, Conn., U.S.A.

Don't Keep It--Sell It!

If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
an engine
a compressor

or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

CANADIAN MACHINERY

Classified Advertising Section

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KAELIN ELECTRIC STEAM GENERATORS

Their Field

Any mill or factory developing its own power which has surplus electric energy during the whole or any considerable part of the day.

Any mill or factory operating on bought power purchased on a "flat rate" basis, but which is not using all the power allotted to it.

Capacities

These Electric Steam Generators are built in sizes from 600 to 25,000 K.W., corresponding approximately to 60 to 2,500 Boiler horsepower.

They can be operated by alternating current only, and are built for voltages varying from 550 to 12,000.

Advantages

Their first cost including installation is low compared with any type of coal or oil-fired boiler plant.

They are safe, clean, easily regulated, require but little attendance and take up very small floor space.

They can be operated in parallel with existing boilers or can be installed close to their work.

Information and prices promptly submitted on receipt of particulars as to your conditions.

Telephone: MELROSE 700 **Dominion Engineering Works Limited.** Cable Address: "Domworks Montreal"

MONTREAL, CANADA.

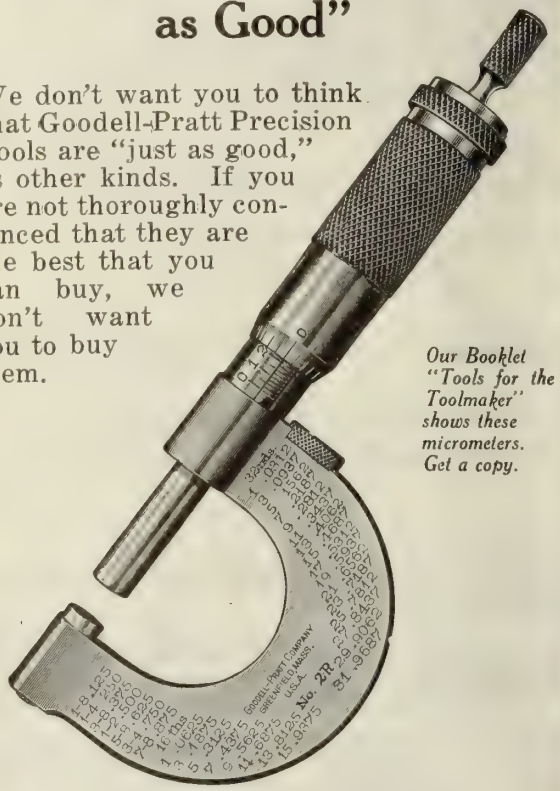
R. F. MATHER, Western Representative, London Bldg., Vancouver, B.C.

GOODELL-PRATT

1500 GOOD TOOLS

Don't think that Goodell-Pratt Tools are "Just as Good"

We don't want you to think that Goodell-Pratt Precision Tools are "just as good," as other kinds. If you are not thoroughly convinced that they are the best that you can buy, we don't want you to buy them.



Our Booklet "Tools for the Toolmaker" shows these micrometers. Get a copy.

We are sure that you can readily convince yourself that Goodell-Pratt Tools are better by making tests for accuracy, in comparison with tools of other makes. Take micrometers for instance: Before you buy a micrometer check it every .010 inch with a set of blocks and make sure that it is accurate throughout the entire length of the screw. Goodell-Pratt Micrometers are accurate because the lead screws are not stretched or "pulled."

Long years of accurate life are assured because every spindle and lead screw is made of one single piece of **tool steel** and runs in an extra long bushing.

Goodell-Pratt Company

Toolsmiths

Greenfield Mass., U. S. A.



Better Consult Specialists

About Your



TAPS, DIES

And THREAD-CUTTING TOOLS

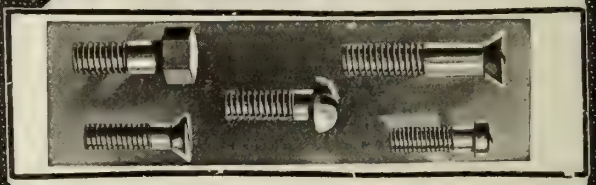
Let us also have your enquiries for combination centre drills, Morse taper drill press sleeves, special reamers, etc., etc.

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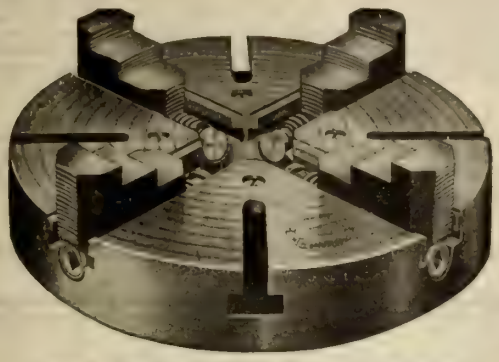
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Hartford, U.S.A.
Codes: Liebers
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are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



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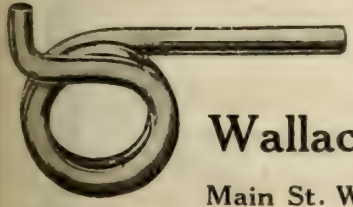
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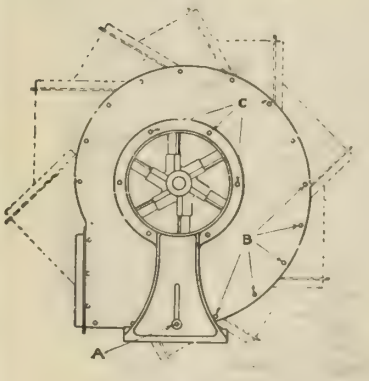
The Canadian Standard Reversible Mill Exhauster will keep your shop clean, remove sawdust, shavings, fumes, gas or any loose materials and disagreeable odors.

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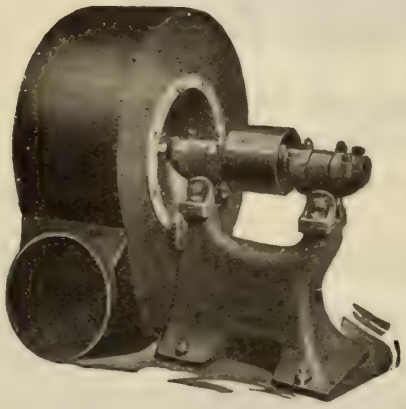
Blast Wheel — This wheel is so constructed that it will handle any kind of stringy material efficiently, such as sawdust, shavings, cotton lint. Will also handle gases, fumes, smoke, etc.





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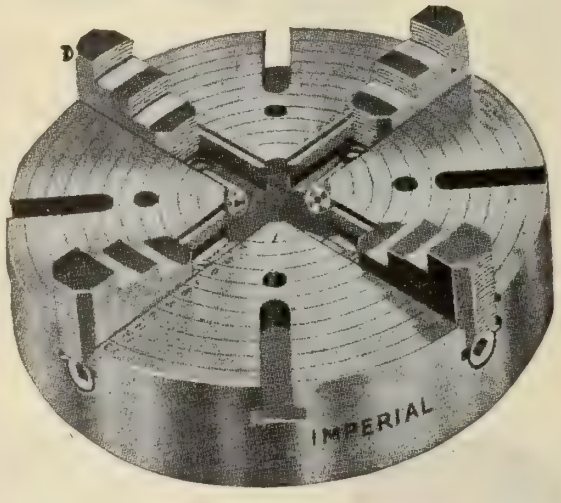
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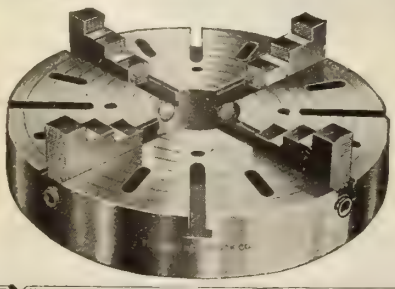
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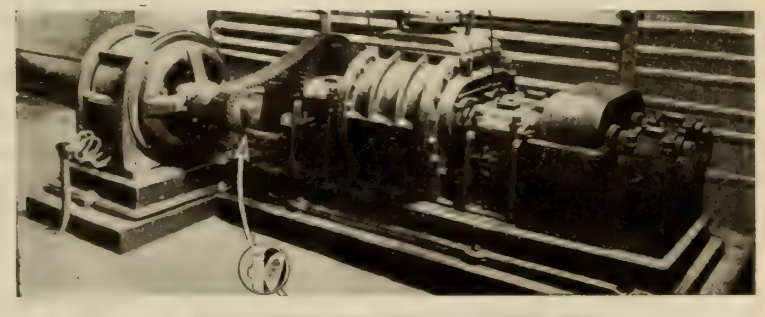
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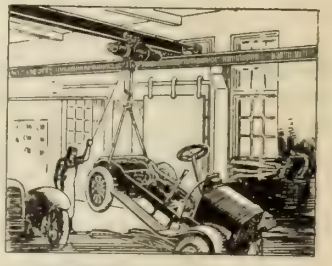
"THAT'S just what we've needed" has been said by hundreds in practically every business in all parts of the country when they learned of the Shepard Electric ***LiftAbout***. They sought a cheaper, faster way for moving loads and found it in this new small, but powerful, electric hoist. This "Big help at small cost" will pick up, carry, and put down the loads that must be moved in your business—save labor and take your load moving item from the debit to the credit column.

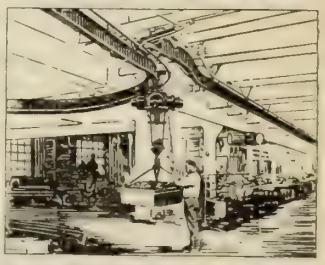
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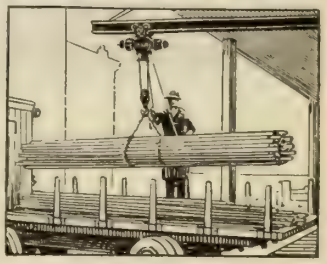
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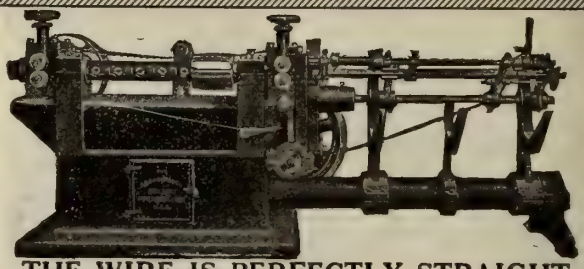


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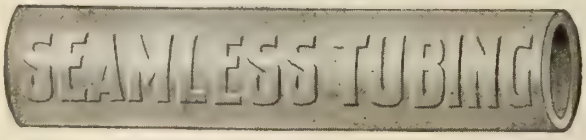
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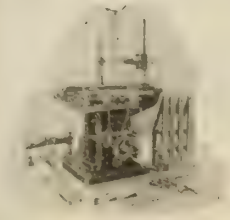
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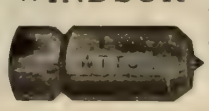


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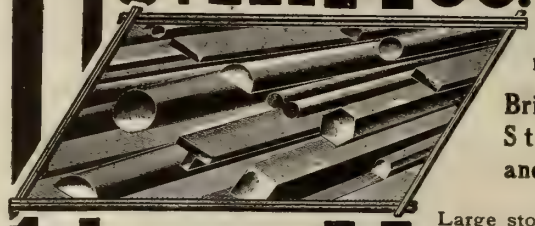
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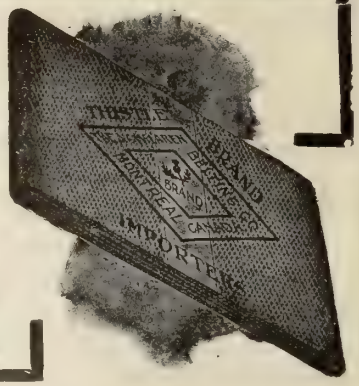
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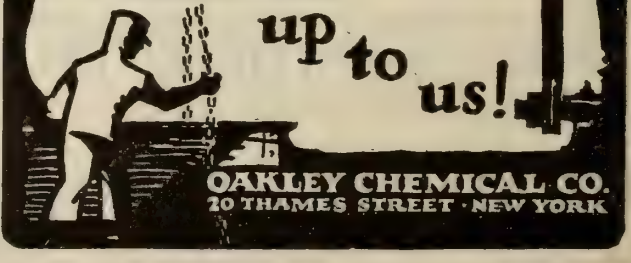
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Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

Acetylene, Dissolved
National Electro Products Co., Ltd., Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Band Saws,
Oliver Machinery Co.
Preston Woodworking Machinery Co., Ltd., Galt, Ont.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
Union Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Aluminum, Brass, Bronze, Copper, Die-Molded, Ferro-Alloy, Iron, Semi-Steel, Steel.
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Brown-Boggs & Co., Ltd., Hamilton, Ont.
Canada Metal Co., Toronto, Ont.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Can. Rumley Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Ltd., Toronto, Ont.
Dominion Engineering Works, Ltd., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Fittings, Limited, Oshawa, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn, Limited, John T.
Hull Iron & Steel Foundries, Hull, Que.
International Malleable Iron Co., Galt.
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Langley & Austin, Galt, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Mitchell Co., Robt., Montreal, Que.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Sully Brass Foundry Co., Toronto, Ont. Ont.
Tallman Brass & Metal, Ltd.
Wells, W. W., Toronto, Ont.

Chains (See Sprockets and Chains)
Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn. Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

For list of Dealers see the last page of This Buyers' Directory

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E. Eng.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.
Goldie & McCulloch Co., Ltd., Galt, Ont.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Bliss Co., E. W., Brooklyn, N.Y.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks,
Chicago Watchman's Clock Co., Chicago, Ill.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Pittings, Limited, Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd. Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Can. Desmond-Stephan Co., Hamilton
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que. Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Die Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drilling Machines, Bench
Burke Machine Tool Co., Conneau Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Northern Electric Co., Montreal, Que.
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Equipment, Elevator Safety
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Norton Co. of Can., Ltd., Hamilton, Ont. Montreal, Canada.

Engines, Capstan
Goldie & McCulloch Co., Ltd., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont
Simonds Canada Saw Co., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J

Fire Escapes
Roelofson Elevator Co., Galt, Ont.

BUYERS' DIRECTORY

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings, Limited, Oshawa, Ont.

Flexible Shafts
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H., Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Thread
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Limited, Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John. Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiten Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Wheels
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co. of Can., Ltd., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., B., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., B., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., B., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., B., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., B., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., B., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Cowan Co. of Galt, Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Spinning
Privibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Ill.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Moter Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence,
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Vertical
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Pattern Shop Equipment
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto,

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Crane Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., B., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Limited, Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Crane, Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shi.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
J. R. Baxter & Co., Ltd., Montreal, Que.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Stoll Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., B., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que.

Reamers, Expanding
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Limited, Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BUYERS' DIRECTORY

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Rebuilt
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.
Preston Woodworking Machinery Co.,

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R.I.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., B., Galt, Ont.
Oliver Machinery Co.
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber
Crescent Machine Co., Ltd., Montreal, Q.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Steel, Cut, Alloy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

BUYERS' DIRECTORY

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Tachometers
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. I. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwartz, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Tool Work
Brown Engineering Corp., Ltd., Toronto.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasseo, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Montreal.

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Limited, Oshawa, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N.J.
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Welding Machines, Oxy-Acetylene
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Supplies
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stopleg
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Shuster Co., F. B., New Haven, Conn.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co Montreal, Que.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

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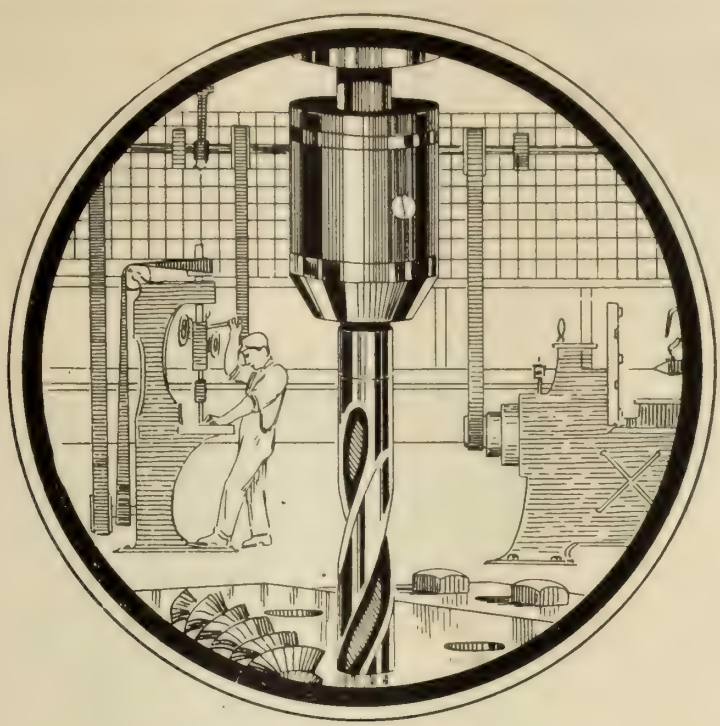
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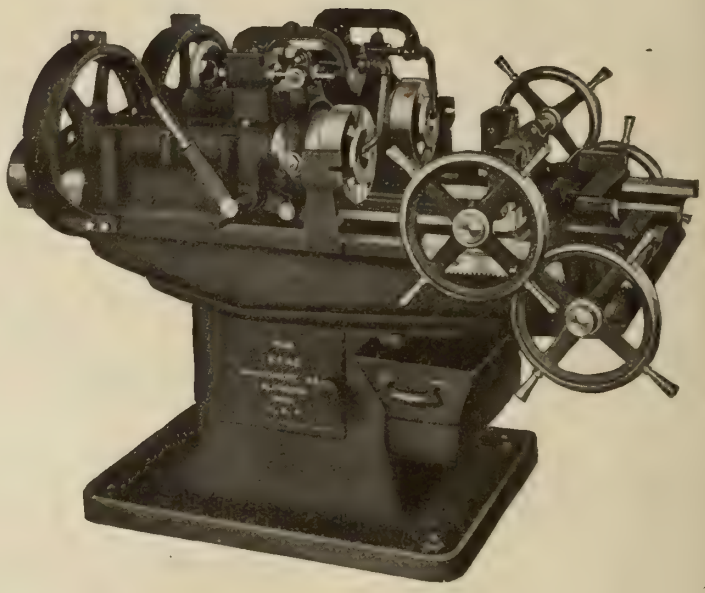
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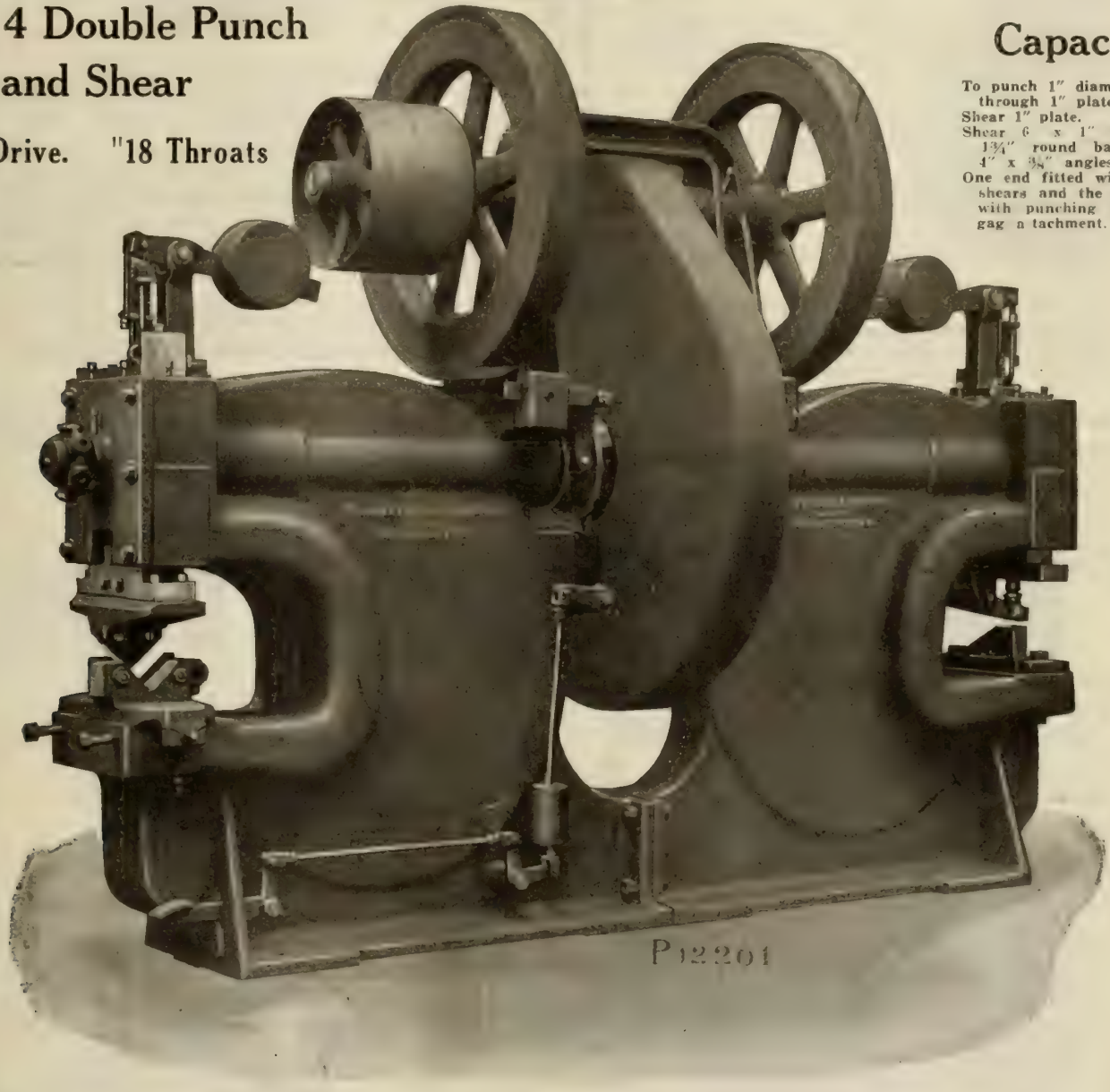
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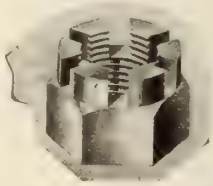
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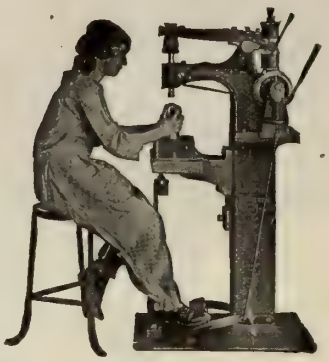
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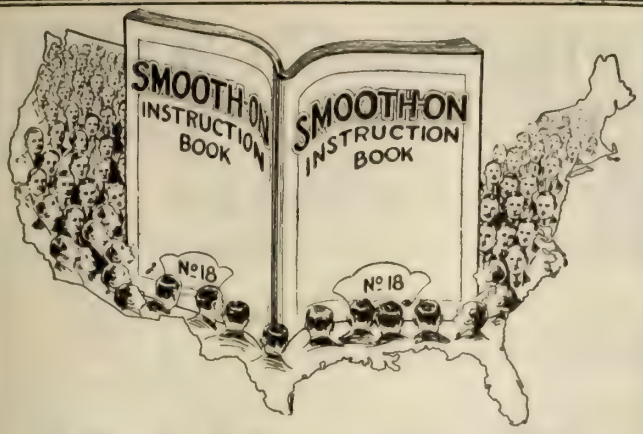
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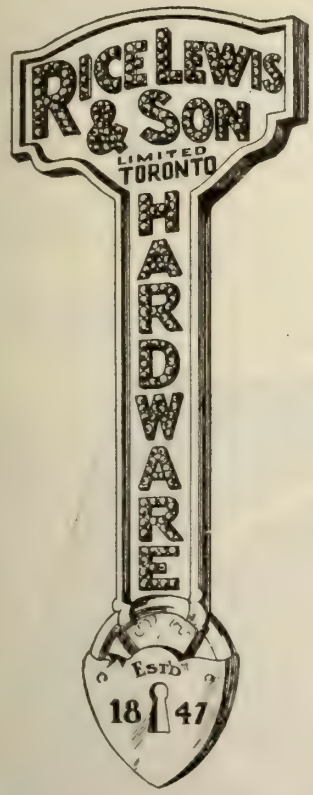
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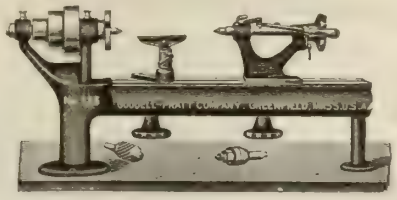


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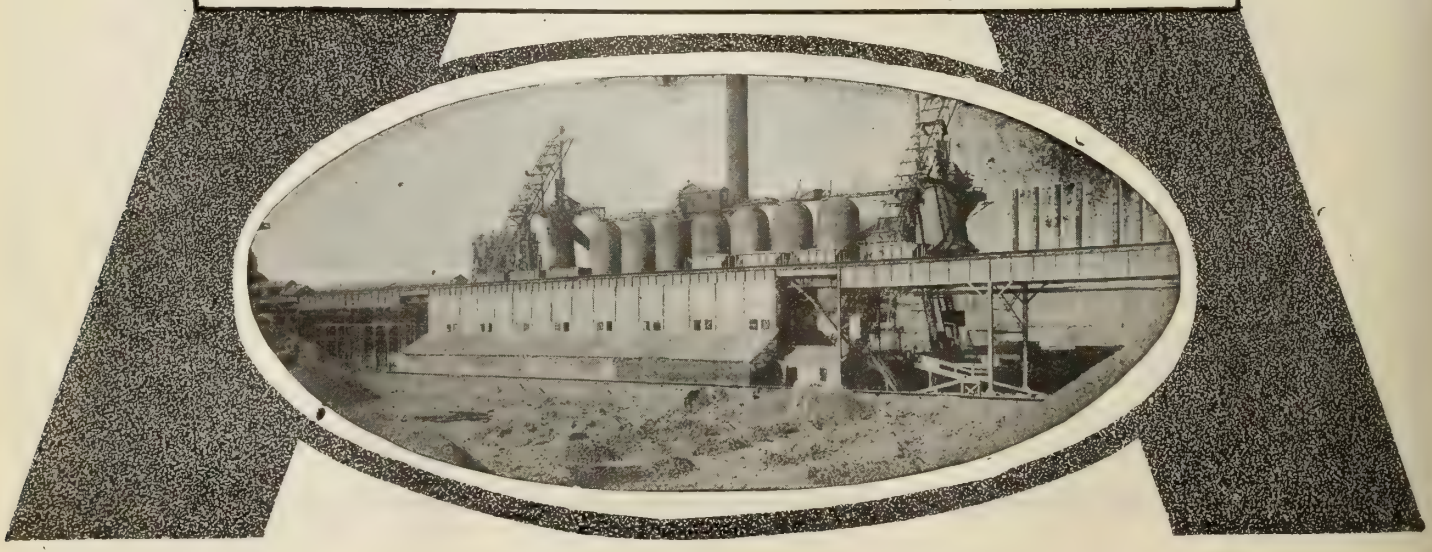
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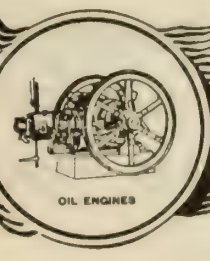
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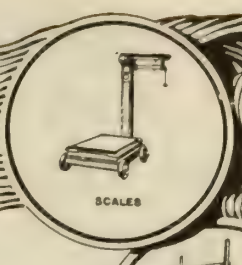
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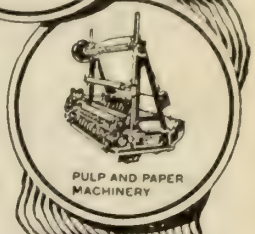


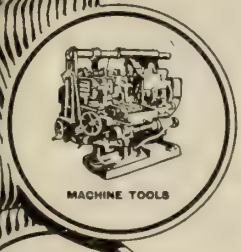


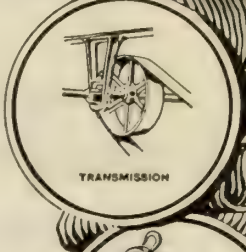


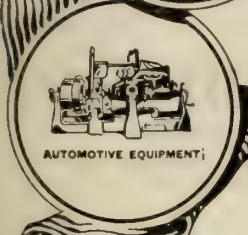


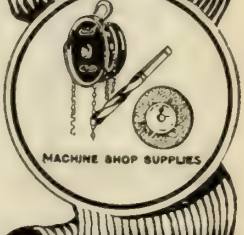




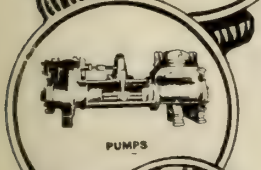














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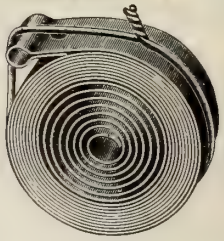
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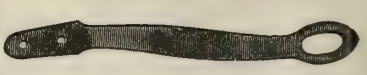
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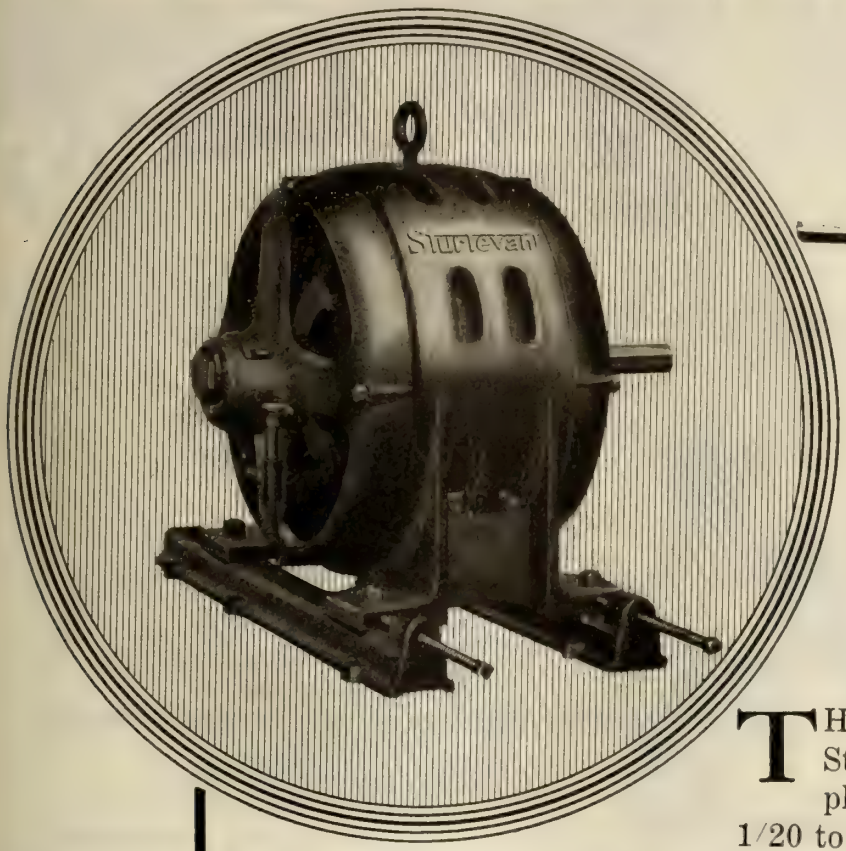




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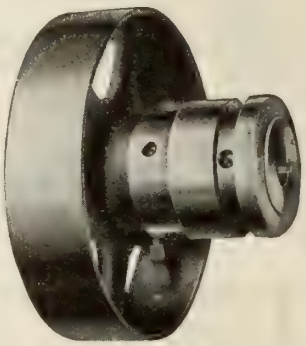
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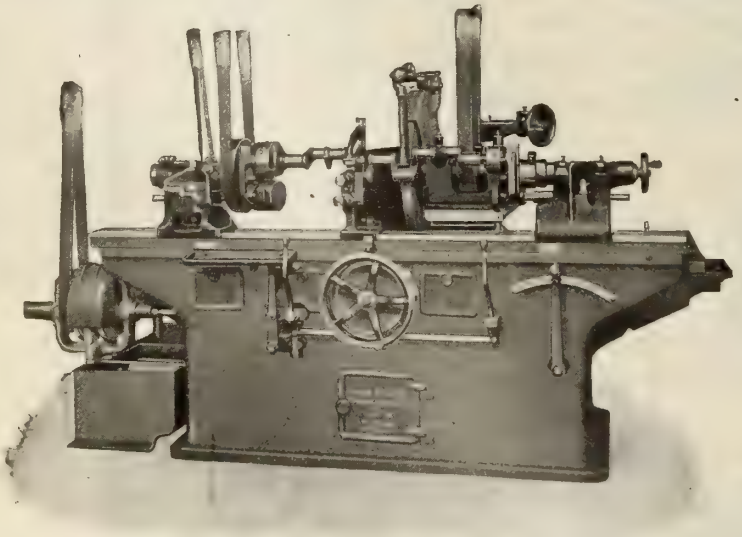
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Tee No. 264-H



Cross No. 266-H



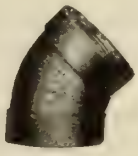
Reducer No. 267 H

The fittings have a large safety factor and will safely withstand all operating strains.



Long Sweep Elbow
No. 263-H

When galvanized these fittings are specially recommended for high pressure air lines.

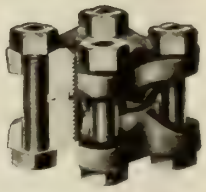


45o Elbow
No 262-H



Elbow. No. 260 H

The maximum recommended working pressures are dependent upon the size of fittings.



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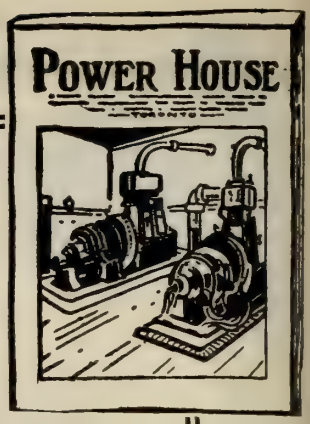
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38





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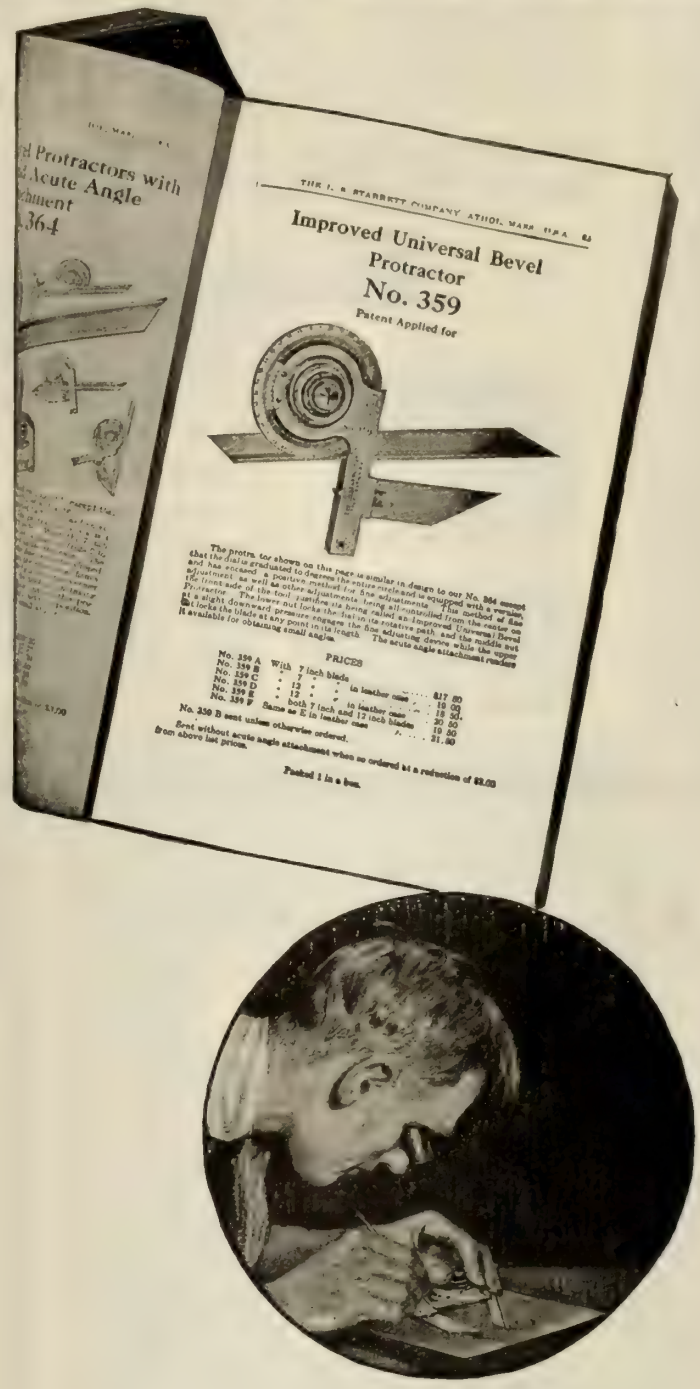
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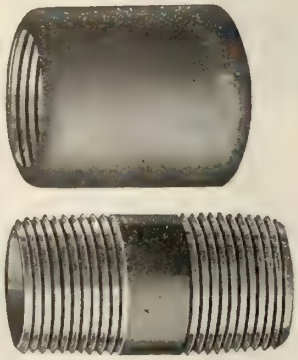
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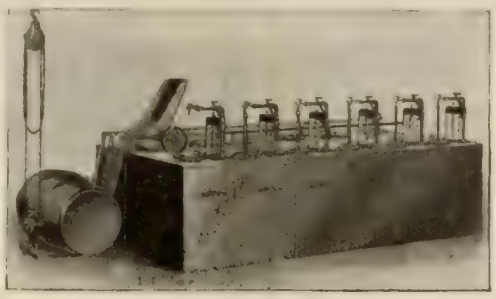
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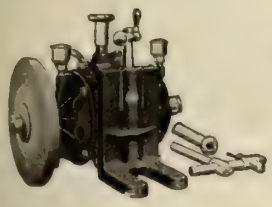
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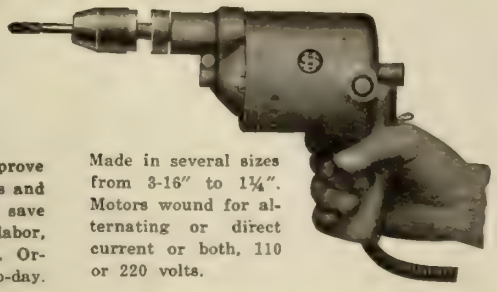
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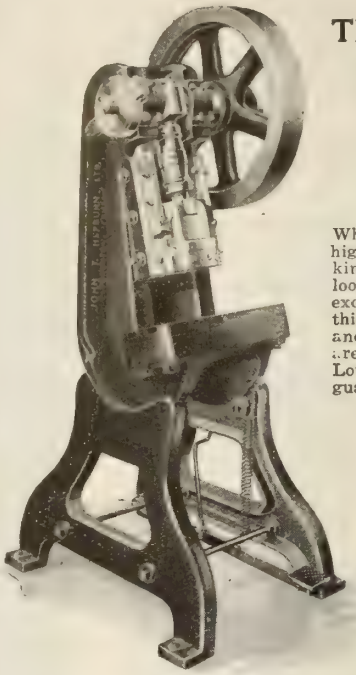


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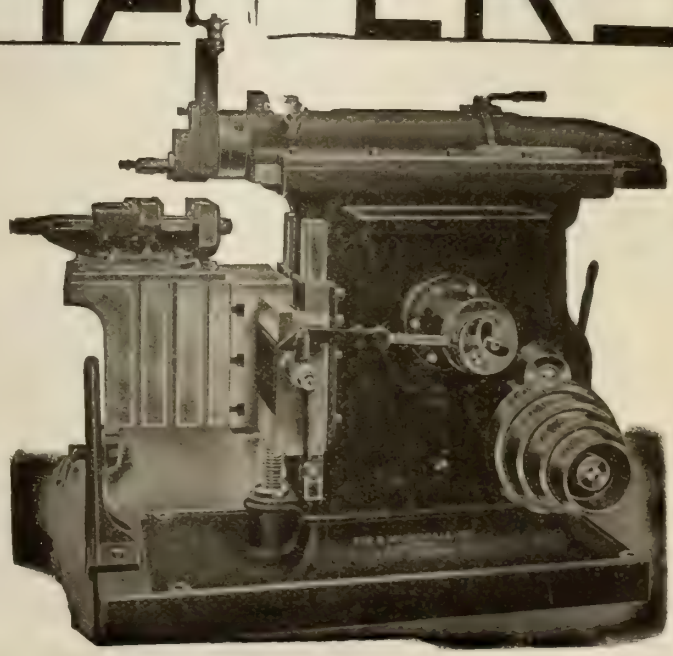
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McDougall SHAPERS

16 and 20 inch Crank

Modern methods of manufacture require modern tools. McDougall 16 and 20 inch shapers embody the best features of all machines which have been placed upon the market and can be depended upon to produce work accurately and fast.

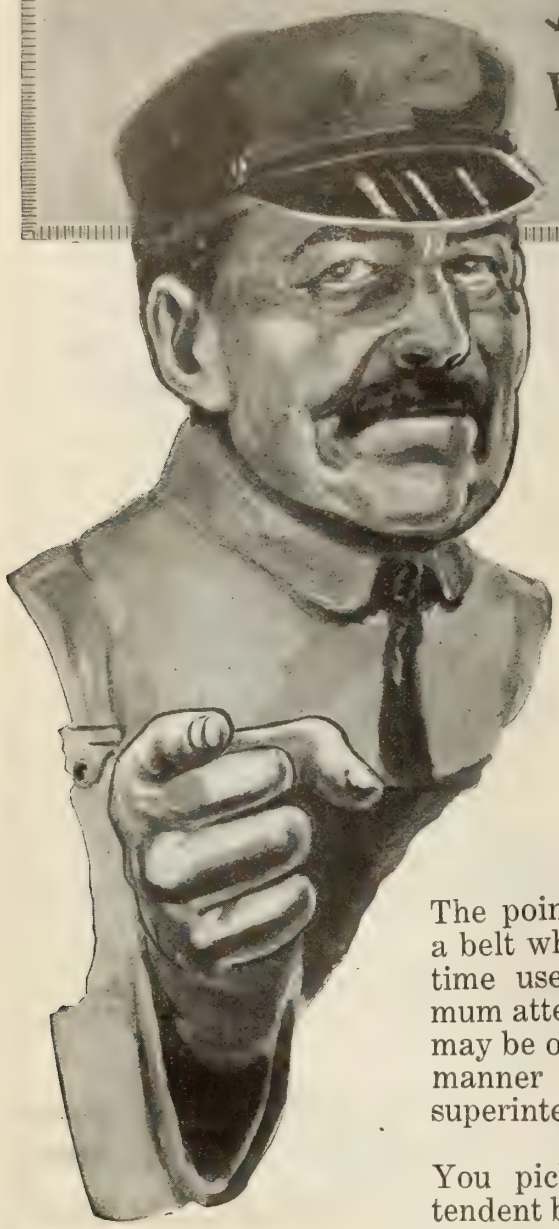
An important feature is the column. It is massive in construction, well braced and reinforced internally. Has ample opening under ram for keyseating or other long work. Bearings for ram extend beyond vertical line of column both front and back. The ram is of exceptionally strong construction. McDougall shapers have other points of interest you should know about. Write for full description.



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Changing Belts is Like Changing Men---*Costly*

BELTS are very much like human workmen. Every time they are changed production is impaired and costs mount to enormous proportions. The very act of changing and splicing a belt means a costly hold up of men and machines. Hundreds of dollars a year are wasted in this way.

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GENUINE OAK

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII, No. 15 April 13 1922

Better Illumination Means Greater Production

Output Increased and Accidents Reduced by Using Improved Lighting Systems—Measuring Instrument Determines Accurate Requirements for All Conditions—Proper Type of Reflector Eliminates Glare

INTO THE period of only two score years has been crowded the evolution of electric lighting. In this short space of time, we have seen electricity almost entirely supplant oil and gas wherever electric service has become available. The electric lamp has definitely established itself as the one most desirable illuminant. The advantages which have brought electric lighting to the fore have been largely those of safety, convenience and reliability.

Applying this knowledge to industry one has only to compare the good lighting installations with the many bad installations, to realize that eliminating delays—and so increasing production and doing better work—through improved lighting is something more than a theory.

Imagine yourself the workman in a well illuminated plant. The clearness with which details are revealed, the softness of the light, the absence of serious direct and reflected glare, and the cheerful, stimulating appearance of the room will then take on a new and more emphatic meaning. Not only are the attributes of improved lighting mentioned, responsible for substantial increases in production, but for marked decreases in spoilage, and for greatly reduced accident hazard as well.

Light Measurement

At the time new interest in lighting was beginning to be felt, came the development of an instrument called the "Foot Candle Meter," which makes the measurement of illumination a quick and easy matter. A glance at the scale of the instrument shows the intensity directly in foot-candles, the accepted unit of illumination measurement. The foot candle meter is a simple, inexpensive instrument, measuring 8 by 6 by 1½ inches, and weighs approximately three pounds in its leather case. The meter has a stationary comparison lamp and scale. The brightness of this comparison or standard lamp is regulated by a small rheostat and volemeter. When the standard lamp is held at the proper brightness by the volemeter reading, the spot on the scale that appears to fade out is receiving an equal amount of illumination from the comparison lamp and from the outside source of illumination. Thus indicating directly the value of the illumination. This instrument is the "yard stick" of illumination and is as necessary in any large plant as are scales for checking up the weight of merchandise purchased. Lighting is not a matter of wattage consumed but of how much light you get from that wattage.

By actually measuring the light right down on the job, as indicated by the illustration, guess work is eliminated, and the plant manager can make sure that his men are getting sufficient light to enable them to see quickly and clearly and comfortably for long periods.

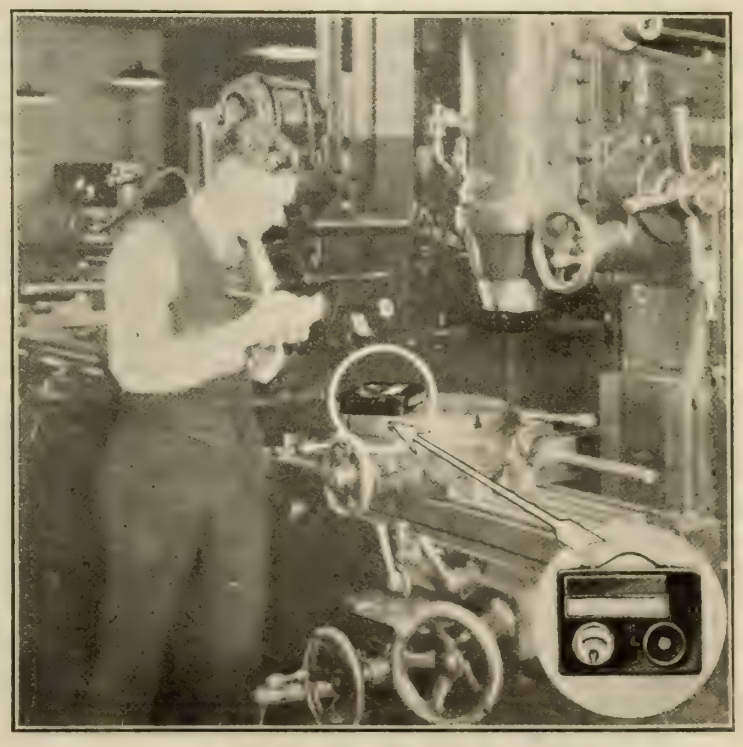
By the occasional use of the foot-candle meter, when on a trip through the plant, the executive can check up and make sure that the lighting is performing its function in the production program.

Definition of Terms

Briefly, one lumen on one square foot gives one foot-candle.

The lumen is the unit of quantity of light, and is used to measure the output of a lighting unit or the illumination falling upon a surface. It is the quantity of light which will fall on a surface one square foot in area, one foot distant from a light having a value of one candle. All Mazda lamps are rated in lumens according to total light output.

The foot-candle is the unit of illumination. It is the illumination produced by one lumen per square foot falling upon a surface, and is usually measured by



Determining the quality of illumination, by means of measuring instrument.

the foot-candle meter. It is one candle power at a distance of one foot.

At two feet the illumination would be one-fourth foot-candle (not one-half foot candle); at three feet, one-ninth foot-candle, etc., in accordance with the law of increase squares. It should be noted that candle power refers to strength or intensity of light emitted from the light source, whereas the foot-candle refers to the strength or density of illumination falling upon the object or area illuminated.

Foot-Candle Illumination

The desirable illumination varies rather widely, depending upon the conditions in any particular installation, such as accuracy of the operation and fineness of detail to be observed. One need have no hesitancy, however, in stating that more light than is generally used today may be used economically and profitably.

Daylight, on a bright day will easily measure up around 200 foot-candles; the usual run of factory interiors will measure under artificial light in the neighborhood of three foot-candles. Obviously, in a well designed artificial lighting system, there is little likelihood of there being such a thing as too much light.

Don't mistake glare for light. Glare is light out of place. Correct this by the use of the proper type of reflector and use bowl-frosted lamps. Shade the lamp and direct the light.

Three general levels of illumination may be considered:

5 Foot-Candles:—Satisfactory for work of a coarse nature, such as rough assembling, rough packing, coal and ash handling, and similar duties, where the eyes are not called upon to see small details quickly and accurately. This intensity of illumination would also prove ample for lighting warehouses, storerooms and aisles and passageways, which are to be kept free from obstructions. The light would be enough to dispel any sense of gloom.

10 Foot-Candles:—Considered good lighting for most kinds of work, including jobs like fine forging and welding, moulding and core-making, medium bench and machine work, grinding, buffing and polishing. The light value however is not sufficient for examination of fine details.

15 Foot-Candles:—Is excellent lighting, and will be illumination enough for most classes of work. In addition to permitting quick and accurate execution of all work except the most exacting, lighting of this kind stimulates the workman and makes for fast and accurate production.

Practically every shop or mill requires artificial light, at least a part of the time, and no factory executive can afford to overlook the opportunities afforded by good illumination and lighting improvement.

In the next issue information will be given and suggestions made as to the methods that may be employed to calculate and improve general illumination design where inadequate lighting now exists.



John T. Scott.

JOHN T. Scott, the author of this article, was born in Essex County, England, in 1885. At Birkbeck College he received a general education going from there to London University for his technical education in electrical engineering.

After graduation, he joined the staff of Marconi Wireless Telegraph Co., where for three years he was engaged both in the test rooms and manufacturing plant.

He has also had several years of commercial engineering experience in Europe, including Scandinavia, France and Germany. During the war he had charge of munition production at the plant of the J. G. White Engineering Corporation.

For the last two years he has made a special study of lighting and illumination problems. He is at present engineer in charge of standardization work at the Sunbeam Lamp Work's Division of the Canadian Electric Co., Toronto.

Mr. Scott is a member of the Illuminating Engineering Society in Toronto and New York, also a member of the lamp committee of the Canadian Electrical Association at Montreal, and knows his subject thoroughly.

HORSE POWER CHART

By W. F. Schaphorst

This solves the much-used formula

$$\text{Horse Power} = \frac{\text{PLAN}}{33{,}000}$$

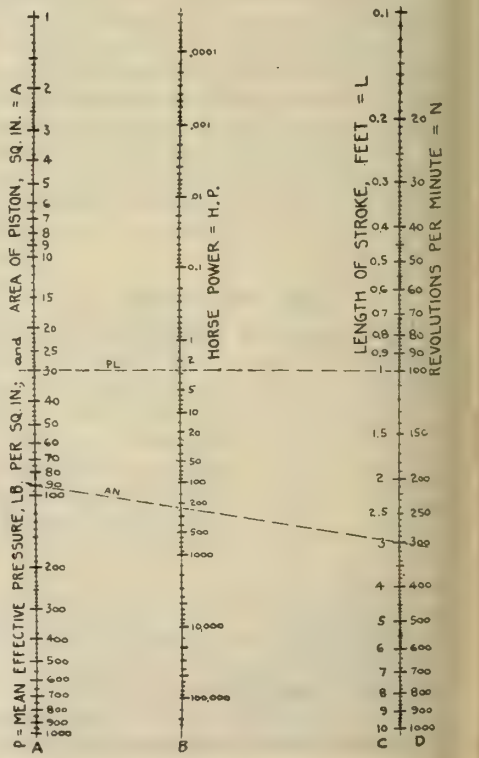
For example, what is the horse power of the crank end of a steam engine, the mean effective pressure being 30 pounds per sq. in.; the piston area being 90 square inches; the length of strokes one foot; and the number of revolutions being 300 per minute?

Connect the 30 (Column A) with the 1 (Column C) and locate the intersection with Column B. Then connect the 90 (Column A) with the 300 (Column D) and locate the second intersection with Column B. Now locate the mid-point between the intersections in Column B. It is a simple matter to find the mid-point by folding a piece of marked paper, by means of a pair of dividers, by measuring with a rule, or any other easy way of bisecting a line.

The mid-point, Column B, gives the horse power of the crank end as being very close to 25 h.p. Multiply it out "longhand" and you will find the exact power as given by the formula to be 24.5 h. p.

The chart will therefore prove itself to be highly useful in checking over your figures, in case you are desirous of being absolutely sure of your computations. Generally, it will be found close enough for most practical purposes.

It will be noted that the range of the chart is very great indeed—running up to over 100,000 h. p.—thus including every steam engine ever built. The lowest range is 1/10,000 of a h.p., which would be a most delicate toy engine.



Simple Cost System Proves Efficient

Checking Progress of Work—Following the Job Through the Factory—Keeping Record of Rejected Parts—Using Both Sides of Card Gives Complete Story of Piece

By J. H. MOORE

THE IMPORTANCE of a careful check on parts passing through the factory is unquestioned. Unfortunately, there exists a laxity in this respect, with the result that in many cases the finished piece costs more than it should. A time and operation checking system should be as simple in character as possible, otherwise confusion and dissatisfaction will result. For example, the W. H. Banfield Co., Toronto., have adopted a checking and routing system which is very complete yet easily handled, and believing manufacturers will be interested in this method, we have selected some sample cards used in the system which will be of special interest.

When Order Comes In

Upon an order being received, the clerk fills out an order form as shown at Fig. 1. This is made in triplicate, white, yellow and blue, one staying in the office, one going into the production department, and the other to the shipping room. When shipment is completed the head shipper returns his copy to the main office, when the order is marked closed.

Suppose we follow the order form which went to the production department. From standard operation sheets this department makes out three cards as shown at Fig. 2. These are all marked the same with the exception of the department number, one going to the inspection department., one to the control board room, and one following the job as it proceeds through the factory. A sheet on lighter stock, but made out exactly similar, stays in the production department as a record.

Studying Fig. 2 we find that the number of each operation is given, the nature of the work, and the department in which the work is finished. Thus, operations No's 1 to 4 are completed in department 2, operation No. 12 in department 32 and so on. The order number is given in upper left hand corner, also the quantity required, and spaces are provided to mark in the finished pieces O K, or rejected, also the date completed. The part number, and name

PRODUCTION RECORD — SCHEDULE

Oper. No.	Date	Pieces Good	Pieces Rejected	Date Parts are Due in Depts	Date Parts are Received	Pieces Sent to Stores
1	4/2/22	340	2	12/2/22	11/2/22	12/2/22

RECORD OF PRODUCTION

ORDER NO.	DATE	PIECES STARTED	DATE	PIECES FINISHED
B1092	17/12/21	1,000	4/1/22	1,004
C1200	7/2/22	800	8/3/22	805

Fig. 3.—Reverse side of card. Fig. 2.—Showing schedule and quantity production. Fig. 5.—Section of card showing record of production.

REJECTION SLIP

Model... C Unit... 42
Part No... P353 Name... Horn
Order No... 1208 Operation... Weld ... Dept... 32
Date... Feb. 23rd 1922 Quantity... 14 ... Disposition Rectify

Cause of Rejection: Poor Weld

Unused Material
Useable Scrap...
Total Scrap...

Charge..... and credit ..... with $.....

2 Send Copy 1 to Cost Dept.
" " 2 to Production Dept.
Copy 3 to remain with rejects

Rejected by J. H. Black

Fig. 6.—Rejection slip, showing cause of rejection.

SHIPPING ORDER

Your Order No. 1
Date March 21st

W. H. BANFIELD & SONS LIMITED
TORONTO, CANADA

Export No.
This number must appear on invoice

Date March 24th

Pack For Export Shipment
Sold To John Blank & Sons
Ship To Blankville
Via B & T Co Terms 30 Days

Quantity	Description	Quantity in Package	Quantity of Packages	Class of Package	Package Numbers	Weights Gross	Weights Legal Net	Measurements in Inches Height	Measurements in Inches Width	Measurements in Inches Depth

Shipped On By Invoice No. Date
Marks
Remarks
Passed By Shipping Clerk

THIS CARD TO FOLLOW JOB
M'F'G ORDER & ROUTE CARD

Order No.	Mat Req. No.	Quantity Routed	Pieces Good	Pieces Rejected	Date Completed
C0000	00000	1000			

Part No.	Name of Part	Dept. No
P-353	Horn	1

No.	OPERATIONS	Machine	¢	Tools, etc
1	Blank & Draw	Dept 1		
2	2nd Draw			
3	3rd "			
4	1st Trim			
5	Anneal		6	
6	Pickle		3	
7	1st Form		1	
8	2nd Trim			
9	Pierce (Cup)			
10	2nd Form (Close)			
11	Insp. (Visual)		20	
12	Weld (Outside)		32	
13	Grind		20	
14	Roll			
15	Size		1	
16	Pierce (2 Holes)			
17	" 1 "			
18	Form (2 Lugs)			
23	Stores "C"			

Date Issued	Scheduled to Start	Scheduled to Finish	Run No	Approved:
23-2-22.				

Fig. 1.—(Left) Receiving clerk's order form made out in triplicate, 3 colors. Fig. 2—(Right) Route card showing details operations and complete record on each job.

are provided for, and at the bottom of card, the date issued can be noted, the time scheduled to start, finish, etc. Thus, on one card we have the complete story of the piece. The reverse side of the same card looks like Fig. 3, this registering the quantities made in each operation and passing forward to the next department, or stores as the case may be. This of course acts as a further check on the pieces.

Fig. 4 shows the style of standard operation card kept in the production department files, and it is from this card that all the necessary information for starting an order is obtained, including nature of material required, weight, etc.

After the work has been completed, the control board operator collects the follow-the-job and inspection cards, checks off the quantity claimed to have been completed, with the quantity delivered to stores, and then after filling in his own control board copy, marking all particulars regarding scrap, rejections, etc., he turns in all the cards to the production department who close out the order started, as registered on the back of the card shown at Fig. 4. The illustration Fig. 5 depicts a portion of these entries and shows the style of the card. This completes the record on the job from start to finish, so far as the production department is concerned. The control board copy bearing finished details is marked order closed, and forwarded to cost department, who in their turn close out their records and arrive at the finished cost.

In order that readers will understand how rejections are taken care of, we show at Fig. 6 a sample rejection slip. The parts are accounted for on this form, whether the pieces are scrap or suitable for rectification. If the latter, they are sent to the detention stores until they accumulate sufficient quantity to warrant setting up machine for rectifying. Credit is given for this quantity at a value leaving sufficient margin for the necessary expense of rectifying. One copy of this form is sent to cost department, one stays in the production room, and another remains with the rejects.

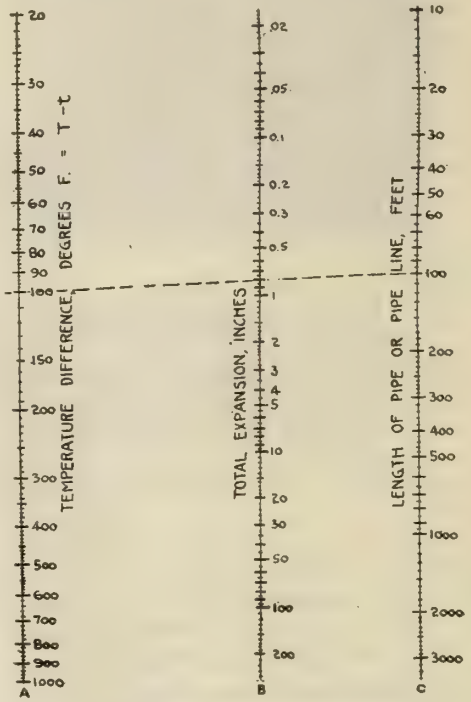
From the foregoing brief description it will be seen that at any time the pieces are under control. The follow-the-job card cannot leave a department before all the pieces are out of that department, and all particulars relating to the part are always noted on the back of the card. From start to finish this follow up system is simple and effective.

A Useful Expansion Chart

By N. G. NEAR

MACHINISTS will find this chart useful for determining the expansion to be allowed in piping rods, tubes, etc., for various temperature differences without doing any "long-hand figuring" whatsoever.

To use the chart simply lay a straight-edge across it once, or stretch a fine black thread across it, as indicated by



the dotted line, and the problem is solved without further ado.

For example, a certain pipe line is installed which is 100 ft. long. It will be subjected to a temperature variation of 100 degrees F. What will be the total expansion in inches?

Connect the 100 degrees temperature difference, Column A, with the 100 ft. length, Column C. The intersection with Column B gives the answer as 0.8 inch. That's all there is to it. Very simple indeed.

Inversely the chart can be used for determining the allowable temperature difference where a definite amount of space is available for expansion and contraction. Thus if the length of the pipe line is 100 ft. and the allowable expansion is 0.8 inch the same line would show that a temperature difference of 100 degrees F. would be the limiting amount.

Also, if the factors in Columns A and B are known, the unknown in Column C is immediately found. In other words, if any two of the factors are known the third factor is very quickly found, and without any computing whatever.

It will be noted that the range of the chart is wide enough to take care of almost any expansion or contraction problem that the machinist may have to contend with. The temperature difference, Column A, varies all the way from 20 degrees to 1000 degrees. It is very seldom, if ever, that we have as high an amount as 1000 degrees. The length of pipe line, also, is great, varying all the way from 10 ft. to 3000 ft., or more than a half of a mile. And the total expansion between these limits varies all the way from 0.02 inch to 200 inches. It is interesting to note that if we had a pipe line 3000 ft. long, with a temperature difference of 1000 degrees, the expansion would be over 200 inches.

About 88 per cent. of the world's supply of asbestos is furnished by the Province of Quebec, and about 85 per cent. of the world's demand for nickel is mined in the Sudbury and Cobalt districts of the Province of Ontario.

Card No. 1	STANDARD OPERATION CARD	Start Dept. 1
UNIT		Model E
NAME of Part	Horn	Part No. 9P353
No. Req. (1)		Drawing No. L B 657
Used on Assembly ( )	E Motor Complete	Assembly No. P B 103
Material Specification	C R Steel	Supersedes XY24
		Superseded Jan 1921
Size .032 Length 6 1/2	Width 8 Adv. Wt.	Use Scrap None Act. Scrap None
Min. Run	Standard time to complete	Weight Pds. per M. 480

OPER NO.	OPERATION	STAND. TIME	MACHINE	TOOLS, JIGS, FIXTURES AND GAUGES

Fig. 4.—File record card kept in production department.

How Industrial Accidents Can Be Prevented

Compensation Last Year Amounted to Over Six Million Dollars —Who is Responsible?—How Hazard Can be Minimized— Worker's Attitude of Mind Often the Cause of Accident

By SAMUEL PRICE

YOU may mitigate the results of accidents, but this does not make up for the pain and suffering. Compensation does not restore the life destroyed, or the limb lost or crippled. These pertinent truths were forced home by the author during the recent joint safety convention held in Toronto, where he spoke on "Ontario's Accident Prevention Policy." In telling about the accidents that have been happening in Ontario industries he said:—

The casualty list is a heavy one. The sufferers very numerous. The only redeeming feature is that some relief is now provided for all accidents happening in industries covered by The Workmen's Compensation Act. When a workman is killed or injured in his employment, justice as well as humanity requires that some recompense shall be made, and the Ontario Act, I am glad to say, is the most liberal among those of the provinces in the benefits that are provided. That help is being given to those who suffer as the result of accidents is a great satisfaction, and the appreciation that is shown by many who would otherwise be in need is very gratifying.

Nearly 500 cheques are being despatched daily to various parts of the province, bringing support and relief to workmen who have been crippled or injured in their employment, and widows, children and parents of workmen who have been killed. More than 100,000 people(including workmen's families) are every year more or less dependent upon these payments for their maintenance. About $21,000 per day is being awarded in benefits. The total for the past year was $6,189,000. For the seven years the present act has been in operation the total benefits have amounted to nearly $28,000,000.

Compensation Does not Restore

But though we thus relieve and mitigate the results of the accidents, and employers are called upon to furnish the money, we do not wholly make good even to the workmen and their dependants the monetary loss, to say nothing of the pain and suffering, which they sustain. Compensation does not restore the life that is destroyed or the limb that is lost or crippled; and no matter in what proportions he direct loss m be borne by workmen and employers the result is economic waste, with usually everyone very much the loser. The producing power of the country is also diminished.

In an industrial army of about 450,000 workmen, 45,191 accidents were reported in 1921, 386 of them fatal. There were 272,000 accidents, 2,784 of them fatal, during the seven years' operation of the act. This is a total equal to the combined population of Hamilton, Ottawa, and Windsor.

This is the accident record in Ontario for industries covered by the The Workmen's Compensation Act. There was an average of 151 accidents a day last year—one about every three minutes of the working day. This is one accident for every 10 workmen. It would take only 10 years at this rate to have an accident for every workman in employment. The accident frequency or rate per hundred of full year workers has not changed greatly during recent years. The comparison for compensation cases is: 1917, 6.57; 1918, 6.54; 1919, 6.56; 1920, 6.97. There has been a decrease in the frequency of death cases; permanent disability cases have remained about the same; temporary disability compensation cases have slightly increased; and medical aid only cases have very considerably increased.

Less than one per cent. of all the accidents reported result in death; about 6 per cent. in some degree of permanent disability; about 56 per cent. are temporary disability cases involving compensation; and about 37 per cent. involve medical aid only and no compensation, the injury not disabling the workman for as much as seven days but requiring the services of a doctor.

Cost of Accidents

The most costly class of case are the permanent disabilities, involving nearly half the total accident cost. For 1920 the permanent disability cases in schedule 1 industries (omitting the odd figures) cost a total of $2,143,000, or an average of $990; the death cases cost $933,000, or an average of $3,779; the temporary disability compensation cases cost $1,617,000, or an average of $71; the cases involving medical aid only cost $78,000 or an average of $5.00. The average cost of all compensation cases was $195, of which $26 was for medical aid. The average cost of all accidents was $123, of which $18 was for medical aid. About 15 per cent. of the total accident cost is for medical aid.

In figuring the accident cost, the amount necessary to take care of pension cases as long as the pensions will last is included, the amount of assessments collected being what will be necessary to make payment in full for the accidents that have happened. The fund set aside for the payment of pensions that have been awarded is sometimes erroneously referred to as a reserve. The only real reserve that is set aside is a small fund, known as Disaster Reserve (one per cent. of assessments), now amounting to $218,000, intended to assist in meeting any catastrophe or extraordinary call that might be too heavy a burden on any class of industry. In nearly half the temporary disability cases the workmen get back to work within two weeks after the accident, and in over two-thirds of them within three weeks. The average time loss in the temporary disability compensation cases for 1920 was 19.62 days. This average time loss has slightly decreased since the early years of the act, the figures for each year from the commencement being 20.83, 22.95, 21.33, 19.75, 19.66 and 19.62.

The kinds of injuries are very numerous and variable. It may be of interest to mention some of those that most frequently occur. There were 151 permanent and nearly 800 temporary eye injuries; 272 permanent leg and foot injuries; 156 permanent arm injuries; and 1669 permanent hand or finger injuries; among temporary disability cases there were over 8,000 cuts, lacerations, and punctures; over 5,000 bruises, contusions, and abrasions; 1,800 fractures; 2,500 crushes; 1 500 sprains, strains, twistings, and wrenchings; 1,700 burns and scalds; and nearly 200 dislocations.

It is a significant fact that less than one-third of all accidents reported are on machinery. The guarding of dangerous parts of machinery, while highly advisable in its way, is not the only way in which industrial hazard will be materially reduced. Workmen must educate themselves to the imperative need of exercising the habits of greater carefulness and thoughtfulness in the performance of their respective duties.

Causes of Accidents

Stepping on and knocking against objects caused 2,455 accidents during the year; letting objects or material fall caused 1,341; the falling of workmen caused 3,952; 10,609 accidents resulted from the handling of objects or material, in loading carrying, piling, etc. How are these accidents, which may be referred to as arising from the general hazard rather than as arising from machinery or the particular nature of the industry, to be eliminated or reduced? First, I think it is important that there should be proper surrounding physical conditions, suitable space, efficient or-

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Author is chairman of the Workmen's Compensation Board and delivered this address before the recent Joint Safety Convention at Toronto.

ganization, and orderly arrangement of the factory or plant. I think a still more important thing is the state of mind and attitude of the workers, foremen, superintendents, and managers. Is there sympathetic co-operation in the work and in the desire to avoid mishaps? Is it looked upon not only as a misfortune but also as a reflection upon workmen, foremen, and management to have preventable accidents? Is the employer actively in earnest about preventing them? Does he hold his superintendents and his foremen personally responsible when they happen? Will he deal with them as sternly for having workmen under them carelessly and needlessly injured and maimed as he would for having his machinery or material carelessly and needlessly broken or destroyed? I believe this is the most important factor in accident prevention.

The prevention of industrial accidents can only be successfully achieved through the mutual understanding and co-operation of the executive heads and the workmen. It is not sufficient to issue printed instructions regarding certain hazards. The workers should realize that those higher up are personally interested in their welfare and should therefore endeavor to see that every possible precaution is taken at all times.

For illustration, it is a very striking fact that many accidents—a very undue proportion—happen to new men just commencing to work in an establishment, often within a few hours, frequently within a few days, after starting. Here is a hint to employers and foremen. Take a little pains, show consideration and sympathy with new hands till they become accustomed to their surroundings. So far as machinery goes, the old offenders, abrasive wheels, saws and presses and stamping machines, continue to take their heavy annual toll of eyes, hands, and fingers, and sometimes the lives of workmen. Goggles, guards, and carefulness would rob these three offenders of much of their destructiveness.

Another very frequent cause of accident is molten metal getting into workmen's shoes, which could be prevented by proper footwear. All these are things that have been frequently discussed before, but until there is greater diminution in such accidents they cannot be too often mentioned. One other particular kind of accident I will refer to, namely, the injury of comparatively young boys employed upon machinery—fingers, hands, or arms lost upon presses, saws, planers, etc. These are far too frequent. This should have the earnest attention of every employer.

Make Use of Information

The Board supplies to your accident prevention associations particulars of all compensational accidents as soon as reports are received, giving name, address, age, occupation, nationality, marital condition, and language of the injured workman; name, industry, and location of plant of the employer; date, hour, and cause of the accident; and the nature of the injury. This information can be used to great advantage by these associations and their inspectors, and I am sure, with the energy and earnestness now being displayed by the management of these organizations, it will be made good use of in observing and studying the causes of accidents and suggesting and applying means of prevention.

Next thing in importance to prevention of accidents is to prevent or mitigate their evil consequences. Whether a cut, scratch, or other wound is to become infected will largely depend upon the prompt and efficient application of first aid treatment to sterilize the wound and keep out infection. Employers should provide first aid equipment in their factory or plant and have it in charge of someone competent to use it, and should insist upon workmen immediately reporting wounds, even though slight, and having them attended to. The importance of this is not sufficiently realized.

The figures respecting blood poisoning cases are startling. From six to nine per cent. of all compensation cases have infection at some stage, and the cost of such cases is at least ⅛ of the total accident cost, amounting probably to ¾ of a million dollars a year. In 1920, the nine per cent. of the blood poisoning cases included 56 cases of joints immobilized by infection, 28 amputations due to infection, and no less than 24 deaths due to infection. This is a terrible toll, and without doubt much of it could be prevented. The last complete figures are very disappointing. They show a very serious relapse. There had previously been a distinct improvement over earlier years. The percentages from 1915 are, respectively, 8.8., 8.3, 6.2, 6.7, 6.7, and 9 per cent. By far the worst record was that of the packing house class, in which the percentage for 1920 was 24.86. It showed an improvement and then a relapse similar to the other industries generally.

This surely calls for energetic and drastic measures. The Board's regulation (88) requires employers to provide a proper first aid service and to post up notices warning workmen of the danger of blood poisoning and requiring them to immediately report cuts, punctures, scratches, and burns, to the office or first aid officer for attention. These notices (in different languages) are furnished by the board upon request. Another very important branch of first aid is resuscitation in case of drowning or electric shock, especially the latter. Many a life can be saved by the prompt use of proper and persistent measures of resuscitation.

Skilled Doctors

Then there is the question of skilled medical or surgical service where there is any serious injury. Whether a broken bone, a severed tendon, or a mangled member is to result in loss or impairment of function, depends in many cases upon the skill and care of the surgeon who is looking after the case. This, as we all know, varies very greatly, and it is good business and a great benefit to the workman to make sure that none but the most capable and painstaking surgeons are called to deal with accident cases.

Malingering

I have mentioned as means of mitigation of the effect of accidents, efficient first aid measures and skilful surgical attention. There is one other thing I would like to say a word about—getting the injured workman back to work. This will no doubt at once suggest the disagreeable word "malingering." But it is not wise to run away from disagreeable questions. Every care should be taken to see that workmen get back to work when they are able. Employer, doctor, workman, and Board, should all co-operate to this end, and here again is to be emphasized the importance of having doctors of the highest integrity and character. Malingering should not be tolerated. In the end it would be workmen generally who would suffer most by anything that would bring discredit upon the act. No doubt at the present time there is more than ordinary danger of malingering, but, frankly, I do not believe it prevails, or ever has prevailed, to any serious extent under our Ontario Act. The fact that the average time loss has not increased and that medical aid cases have increased more in proportion than compensation cases confirms this view. There is often too much loose and unwarrranted talk about malingering. When I hear it mentioned I always ask for instances or particulars, and we never fail to investigate any specific case that is brought to our attention. Generally, the complaints turn out to be unfounded or to have arisen from a misunderstanding, but where imposition or fraud is discovered it is sternly dealt with. Prosecutions have been entered and convictions obtained against both workmen and doctors for obtaining or attempting to obtain money under false pretences.

Rehabilitation

Of far greater importance is the problem of finding something for a willing but crippled workman to do, and often a crippled workman is in need of a little encouragement. Nothing I think raises an employer more in the good opinion of his own workmen and of the community generally, or conduces more to good feeling and relations than sympathetic interest and consideration for the workman who has been crippled in his employment. We have been hearing much in recent years about rehabilitation. I think one of the most useful improvements that could be made in our Act at the present time would be a provision enabling the Board to do a little more than it is now able to do in the matter of rehabilitation. The expense

(Continued on Page 32)

Turning Long Piston Rod in Turret Lathe

Unusual Job for This Type of Machine—Special Form Tools for Turning Tapers—Complete Rod Rough Turned Ready for Grinding in Thirty Minutes

AN UNUSUAL and interesting job of turning in a turret lathe is shown in the accompanying illustrations. The work is a large locomotive piston rod made from 3⅞ in. black steel bar with a tensile strength of 80,000 lbs. The finished rod is 50 in. long, and is turned all over ready for grinding in one-half hour.

In most engineering works, a piece of the dimensions shown would be machined on a centre lathe, but the above time indicates that the turret lathe method can be adopted with satisfactory results. The saving effected is not offset in any way by a costly equipment, as the only special tools used are two form tools for turning the short taper.

The rods are delivered to the turret lathe cut to length and centered at one end. At the first operation, shown in Fig. 1 the rough bar is gripped in a 25 in. Coventry chuck with the centred end outwards. The jaws hold on about ½ in. of the bar, and while being tightened up, the outer end is centralized and supported by a dead centre in the turret. With the centre still in position, a knife tool in the square turret prepares the end of the bar to allow the roller steady turner to be used. The whole of the bar up to the shoulder is then turned down to grinding size in one cut, using the roller steady turner. During this operation a form tool is fed in from the square turret to rough out the short taper.

The dead centre is then reapplied and the long taper at the other end is turned from the square turret, using the standard taper turning attachment mounted at the back of the saddle. The square turret is again used to face up the end form radius under the shoulder, this completing the first operation in 21 minutes. At the second operation shown in Fig. 2. the partly finished rod is gripped in soft jaws at the back of the short taper, while the other end of the rod is supported in a bush inside the spindle. This ensures the two ends being true with each other. The end is first centred, then the thread diameter is turned using the roller steady turner. A roller steady ending tool faces the end to length after which the thread is cut with a 3 in. Coventry diehead. With the dead centre in position the short taper and the extreme end are finish formed, with a tool held in a massive holder on the rear of the cross slide.

This completes the second operation which occupies 9 minutes. Thus this large piston rod is machined ready for grinding in 30 minutes.

Photos and information by courtesy of Alfred Herbert. Ltd.

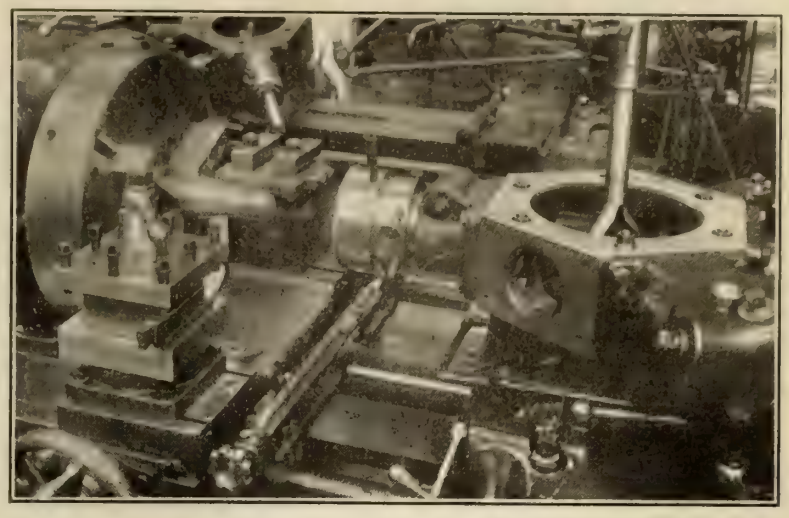


Fig. 2.—Tapering and threading piston end.

NEW BRITISH STEEL

One of the most fascinating phases of the steel industry is the development of special alloys in which chromium and nickel are employed. Alloys of this kind have come into fairly general use for motor car and aircraft work on account of their great strength and toughness, but they are liable to become brittle after tempering. This tendency can be corrected by quenching—that is to say, rapidly cooling—the metal in either oil or water. Unfortunately such quenching may cause distortion of the material, which can be straightened out only by mechanical means which strain the metal. In order to remedy this condition of affairs a British firm instituted a special research which has led to the production of a new alloy which has even better mechanical properties than the ordinary alloys and is not liable to brittleness.

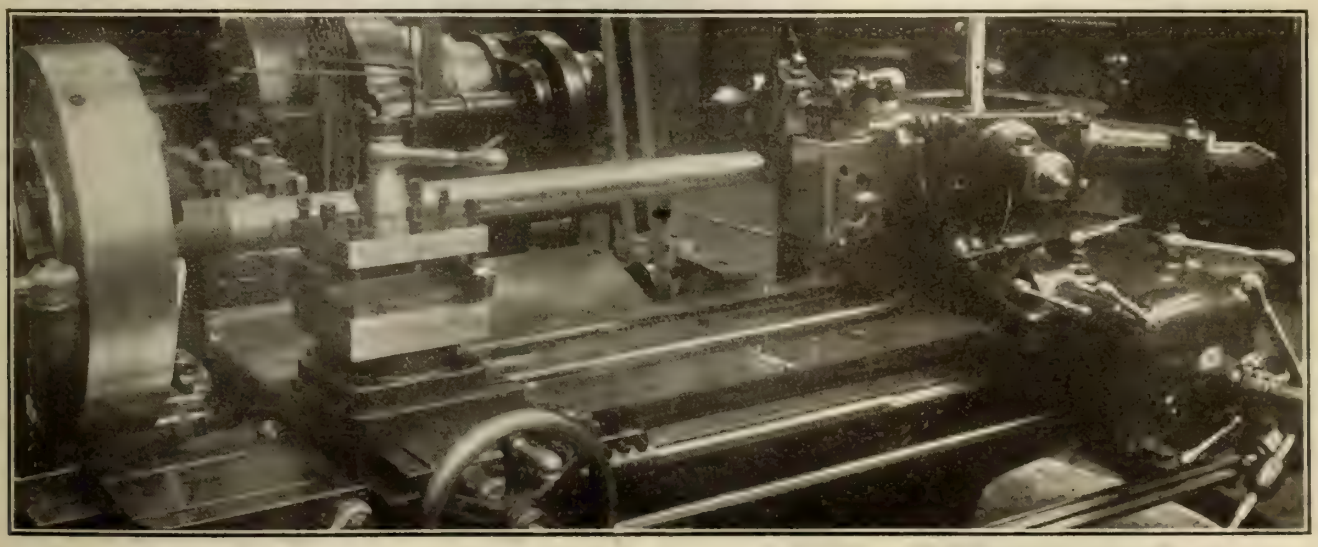


Fig. 1.—Machining 50 in. piston rod on turret lathe.

Practical Mining Methods Basis of Instruction

Enthusiastically Supported by District Business Men—Ideal Locality for Mining School—Experimental Plant Capable of Handling One and One-Half Tons in Eight Hours

THE EXISTENCE of a successful technical school in a town the size of Haileybury is to be attributed to the enthusiasm of the people of the community and especially of the high school board under the chairmanship of George T. Smith. It has had the liberal support financially and otherwise of the Department of Education. Our aim has been to combine training for expert positions in the mines and metallurgical laboratories of Northern Ontario with a thorough education in English, history, civics, and mathematics. The number of important technical positions filled by former students bears witness to the success of the school in its technical training.

Two activities not dealt with in the body of this article may here be mentioned: first, special short courses, and second, research work. Every session a number of prospectors and others enter to take up work in some special subject such as mineralogy or drafting. During the years 1919-20 and 21, upwards of thirty returned soldiers obtained special vocational training in the school, through the co operation of the Department of Soldiers' Civil Re-establishment and the Ontario Soldiers' Aid Commission. Milling, assaying, chemistry, and mechanical drawing were the subjects mostly taken by these men. During the past two years the Ontario Department of Mines has conducted a short course for prospectors which has been largely attended. As to research, a series of tests made during 1919-20 for the American Cyanamide Co., of Niagara Falls has resulted in the use of the cyanide made by this Canadian company in many mills instead of the imported article. Tests have also been made for certain mining companies leading to improved methods of ore treatment. In these tests the senior students assist, thus acquiring not only practice in the operation of the mill machinery, but an insight into the exact quantitative methods that characterize research work. The unique equipment of the mill, and the ease with which it may be adapted to various methods of ore-treatment suggest that the school might well be used frequently for such tests.

School Facilities

The Haileybury high school was built with the intention of serving the needs of the three towns, New Liskeard, Haileybury, and Cobalt. Owing to the location of Haileybury midway between the other two towns it was chosen as the school site, and as the most convenient means of accommodating the majority of the students in this district. The building is a three story brick structure, and was opened in 1910 with a total attendance of 11 students. The register has, since that time, shown a steady and encouraging growth; the enrolment for 1921-22 being 107 boys and 94 girls, a total of 201, and arrangements are being made for additional rooms in order that the further increase, anticipated for the next term, may be provided for. Students are in daily attendance from Cobalt and New Liskeard and the surrounding districts, some traveling 15 and 25 miles. Those not living in Haileybury find conveyance on the Nipissing Central Railway, an electric line, connecting the three towns, and on the Temiskaming and Northern Ontario Railroad; both of these lines giving students special low traveling rates. The school is widely known in the North, and is patronized by students from as far north as Cochrane and Schumacher and south from Sudbury and Parry Sound.

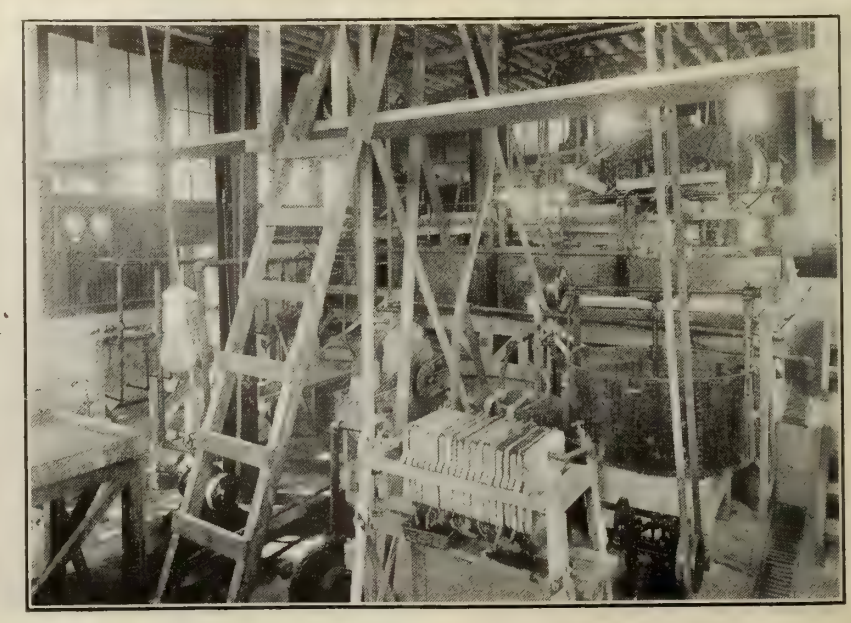
The mining department was introduced in 1921 with two primary objects: (1) as a means of giving boys desirous of following mining or kindred professions a practical and technical foundation upon which to start their life work; (2) as a preparatory course for those wishing to enter Queen's School of Mines and qualify as professional engineers. The classes were held in the high school building till 1917 when the mining building was erected.

Ideal Location

As a location for this course, Haileybury could almost be said to be ideal. The silver producing camp of Cobalt, five miles to the south, gives the student an ample opportunity of acquiring a practical knowledge of mining, milling, smelting and refining methods, machine shop practice, labor conditions in mining, power production and distribution, etc. In the immediate vicinity of Haileybury is to be found a diversity of geological formations, probably unexcelled on the continent This gives the student an opportunity of specializing in the knowledge of geology. The closeness of, and opportunities offered by, the growing gold districts of the north give an added impetus to this work. The mining course being run in conjunction with the regular high school work affords the students the many benefits to be derived from the latter. He meets in friendly rivalry his fellows of the academic courses on the athletic field or in the literary society, which checks any tendency to become too narrowly specialized.

The above facts were early recognized by Mr. W. A. Wilson, principal from the opening of the school till 1919, and it is largely through his efforts that the course was introduced and brought to its present state of efficiency. Local mining men were not slow to see the advantages of educating the boys of the district along mining lines and gave the department their full support. It was made quite plain from the first that a building separate from the high school would be necessary to carry on the special work of this course and accordingly in 1917 the present mining build-

Through the courtesy of W. H. Tuke, principal of the school, the material was compiled by two students, Frank McLellan and Wm. Beaton.



General view of the mining department at Haileybury School.

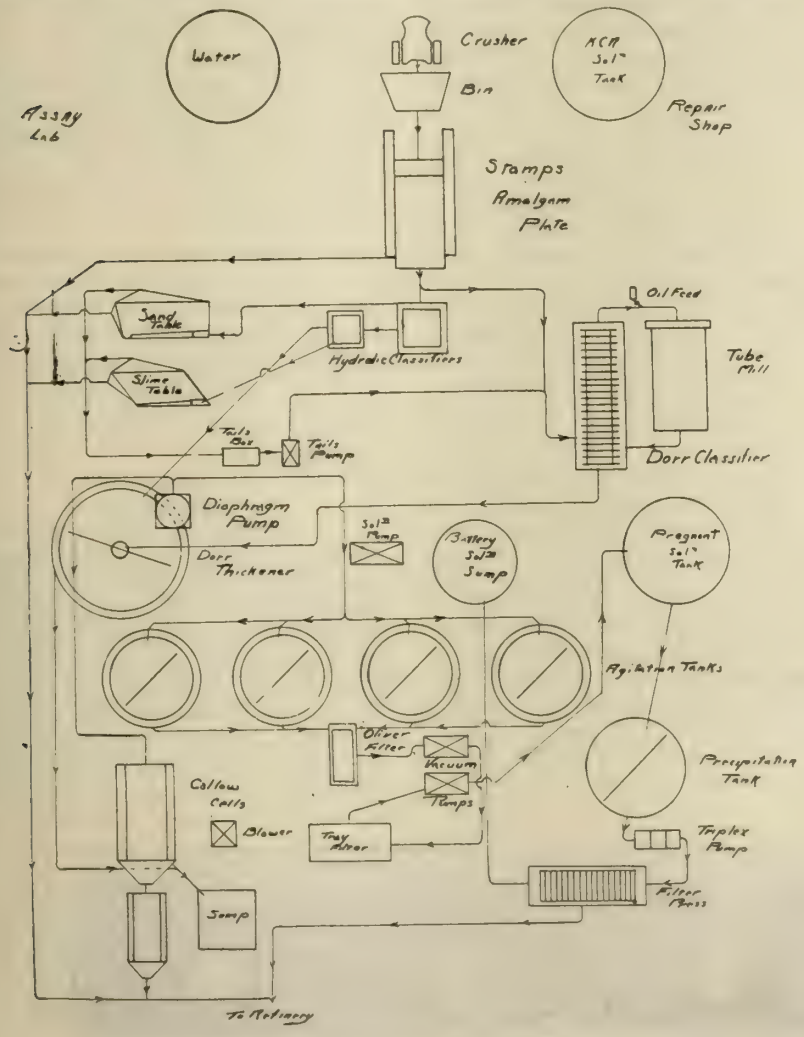
ing or "Mill" was erected. Its construction and successful operation are in no small part due to the interest taken by the various mining companies of Cobalt. A large amount of the equipment was donated by these and the designing of the plant and installation of the machinery was closely supervised by Messrs. F. D. Reid, J. J. Denny, and M. F. Fairlie, of the Advisory Technical Committee.

Plant Facilities

A visitor can not but be impressed by the up-to-date appearance of the plant, and the completeness with which every detail has been worked out to secure efficiency of operation and economy of space. Practically all the available room has been utilized for the machinery, yet nothing has been crowded. Every part is accessible and illuminated in the daytime by an abundance of natural light. All pulleys, belts, and shafts, have been placed in such a manner as to incur the least possibility of accidents, and at the same time make them most convenient for repairs and lubrication. All launders are systematically arranged and are open throughout their entire length for inspection.

The plant is capable of handling one and one-half tons of ore per eight-hour shift. The flexible and easy manner in which it can be converted from one process to another and adapted to treat almost any ore is a distinct credit to the designers and forms the most noteworthy feature of the equipment. Situated in the midst of the gold and silver mining districts, special attention was given to these phases of metallurgy in designing the building; but this does not detract from its value in teaching the underlying principles of milling methods used in connection with other ores.

The plant equipment includes: one 8 x 10 Sturtevant roll jaw crusher, presented by Seneca Superior Mining Co. of Cobalt, stamp battery of three 175-lb. stamps, donated by Col. Leonard of Coniagas Mines; one 4in. x 23 in. amalgamating plate; two-compartment hydraulic classifier of wooden construction, one 50 in. x 24 in. Wilfley sands table, one 50 in. x 27 in. Reid-Duster slimes table. The head motion for these tables was made by the Wabi Iron Works of New Liskeard, while the deck for the slimes table was donated by Mr. F. D. Reid of Cobalt. A model C Simplex-Dorr classifier operates in closed circuit with a 43 in. x 33 in. ball mill for fine grinding. The ball mill is also a product of the Wabi Iron Works; it has a normal capacity of one ton per eight hours and can be used for either wet or dry grinding.



Flow sheet of Haileybury School of Mines.

De-watering and Flotation

The first step in the de-watering process is a 72 in. by 45 in. Dorr Thickener, the product from which is removed by a diaphragm pump. The latter can discharge into a 48 in. x 36 in. pan filter, or an Oliver 7 in. x 36 in. continuous rotary filter, or into the cyanide agitation tanks, or into the flotation tanks. The ball mills, tables, pump, and thickener, are all operated by a 15 h. p. G. E. induction pump. The cyaniding equipment consists of four 24 in. x 48 in. agitation tanks, one 42 in. x 24 in. pregnant solution tank; one barren solution tank 60 in. x 43 in. and a precipitation tank 48 in. x 24 in. All tanks are of steel construction, built by the Wabi Iron Works.

The precipitation press is a 12 in. x 12 in. nine-leaf filter of the Merrill type. A ¾ in. x 2½ in. triplex pump is used for forcing the solution through the press.

The flotation department consists of a Callow pneumatic machine capable of handling 1 ton per eight hours. Air is supplied by a No. 20 Connersville blower at 5½ lbs. pressure; this blower also supplies the air necessary for aeration in the cyanide work. All of the machinery in the cyaniding and flotation sections is operated by a motor of the same type as that used in the grinding and table sections. In addition to the above mentioned machinery there is a large amount of smaller apparatus used in making preliminary tests on ores and for demonstrating the fundamental processes in metallurgy. These include a small Callow flotation machine, a wheel and roll agitator, miniature jigs, etc.

Power Transmission

All of the main and counter-shaft bearings are of the hanger type, supplied by the Dodge Manufacturing Co., through their Cobalt representatives, the Northern Canada Supply Co. Shafting, belting, valves, piping, etc., were all generously donated by various supply houses at Cobalt.

Electricity is used for all power purposes at a potential of 220 volts. The current is supplied by the Northern Ontario Light and Power Co. All electrical equipment is of standard approved type and so installed as to leave practically no danger to students. Water for milling purposes is supplied by a 500-gallon tank in the attic. It is arranged with an automatic float so that a constant head is assured. The primary source is the water-works system of Haileybury from which the supply is received free of charge. The assay department is provided with a set of Sturtevant rolls, a Braun pulverizer, buckboards, samplers, etc., and includes one pot and two muffle furnaces along with necessary flux and button balances.

The school has two chemical laboratories located in the mining building, besides the general laboratories in the

main building. One of the special laboratories is used for the junior students in general chemistry, the other and smaller room for the senior classes in qualitative and quantitative analysis. A supply room is conveniently located between the two laboratories. The senior room has a large fume chamber with sliding glass front sections, hydrogen sulphide generator, water distilling apparatus, electric drying oven, and electric hotplates of various capacities. Half the upper floor of the building is occupied by a room at present used for mechanical drawing. The accommodations for this purpose are of a temporary character, and it is hoped in the near future to have up-to-date equipment of tables installed. Provision is made for blueprinting. Equipment for surveying includes a transit, dumpy level, clinometer, planimeter, rods, chains, tapes, compasses, etc.

Other Departments

A limited equipment for wood and metal working has been installed. The former includes a number of tables and small tools, two lathes, and an Elliott wood worker. The latter consists chiefly of repair apparatus, a forge, pipe stock, dies, wrenches, etc. Extension of this part of the work is hampered by lack of room. There is not probably sufficient demand to justify the installation of complete wood-working or machine shop equipment, but additional pieces by which the student could be taught the basic operations, and especially what is needed for repair work in mines and mills could be used to advantage.

The course is at present planned for the average student to cover three years for a junior, or four years for a senior diploma. Completion of the latter permits the student, by special arrangement to enter the Queen's University School of Mines. Throughout the term English, history and mathematics are studied. Trigonometry is begun in the second year to prepare the student for the work in surveying. Physics, chemistry, geology and mineralogy form the foundation on which the more strictly technical subjects, milling and assaying, are built up.

It is felt that no intelligent use can be made of machinery or mechanical processes without a thorough understanding on the one hand of the scientific reasons underlying these processes, and on the other, of the materials with which the miner and metallurgist has to deal. In this connection some of the most important lessons are learned on the numerous field trips, which are made when the weather permits in autumn and spring. From these the geological structures and processes are studied both overground and underground, while in the latter location study is also made of the method of developing ore bodies. Most of the students supplement the knowledge gained in this way by working in the holidays either in the

(Continued on Page 32)

GRINDING HIGH SPEED STEEL

DURING the past few years, several very hard, dense steel alloys have been developed particularly for use in reamer blades, cutters, and tools. Probably most of the readers are familiar with the difficulties encountered in grinding these alloys such as checking, cracking, and distortion of the steel. We shall outline briefly the experience of one plant in overcoming these difficulties.

The steel in question was a high speed tungsten alloy. It was extremely hard and dense and very sensitive to rigid temperature changes such as might occur during grinding, if special care were not used. This steel was in the form of reamer blades 1 in. thick. The grinding was a very delicate proposition and required extreme accuracy.

After the reamers had been set up, they were ground cylindrically on a 14 in. x 96 in. plain grinder to the correct taper, leaving 0.020 in. of surplus stock as measured diametrically to allow for lipping the cutting edge. This lipping consisted of grinding a concaved flute along the edge of the reamer blade about ¼ in. to ⅜ in. wide and 1-16 in. deep. For this purpose a portable electric grinding machine was bolted to a steel arm projecting from the safety hood of the machine, so arranged that the spindle of this portable machine was at right angles to the table traverse. Wheels 3 x ⅜ x ⅜ in., grain 3846 grade K, alundum vitrified with a rounded face, were used. The electric grinding machine was then dismounted and the reamer finish ground cylindrically to as nearly perfect size as possible. The limits as measured diametrically were plus 0.00025, minus 0.000.

The next operation was that of backing off the blades and here the real difficulty arose. It was done in the same machine with wheels 14 in. x 1 in. x 5 in., which happened to be the only size available at the time. A number of different grains and grades were tried with every possible combination of feed, table speed, and dressing available on the machine, but the blades would invariably burn black and develop fine cracks after the table had traversed only half of the reamer length. This happened when grinding both wet and dry; in fact, it was found impossible to grind the material wet under any conditions. A Huntingdon dresser was used to open up the face of the wheel with little or no improvement in the results. A feed as light as 0.00025 in. per traverse caused bad burning. The blades would develop fine cracks which would gradually open up until pieces would break off altogether. (See cut.) Sometimes, after burning, cracks could not be seen, but the blade would break down while being used. The wheel face did not show any signs of loading or glazing and it occurred to the operator that perhaps he was not really removing stock, but rather that the wheel was simply rubbing over the steel and generating the heat which caused burning. Therefore, it seemed a question of forcing the wheel to remove the material.

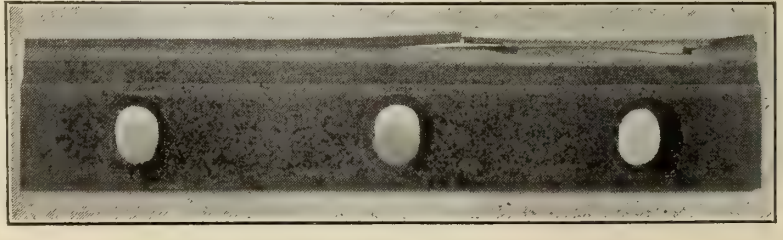
A fresh start was made and the wheel (Norton 3846-I vitrified) dressed with a Huntington dresser to a very coarse face. It was then fed into the work 0.002 in. and the reamer traversed by hand as rapidly as possible. The grinding was done dry. The result was very encouraging. Not a sign of burning appeared although we had taken a much heavier cut than before. The step was repeated with the same result. Apparently the problem was solved and all of the reamers were backed off in this way in a very short time and with absolutely no burning. Of course, the wheel showed some wear to each traverse, but this was negligible as lighter cuts could be taken on the final traverses of each blade to avoid the excessive wheel wear. An extremely fast table traverse was the real factor in eliminating the burning of the steel. This company has since changed to the use of a 3824 grade H Aldundum vitrified wheel for the backing off work.

The reamer blades were backed off to a very narrow land and afterwards honed. By mounting the whole finished reamer in a lathe and trying the blades at intervals with a bar of copper mounted in the tool post, the rubbing or honing of the edges to insure equal working capacity of the blades was readily accomplished.

From the Norton Records.

ERRATA

In the March 30 issue appeared an article on "Micrometers Make Standardization Possible." The following corrections should be noted:—page 22, third column, line 9 should read, "is 1-1,000 in. or 10-10,000 in. the difference." On page 27, third column and 16th line, should read "scale and the 1, 2, 3, 4, 5, 6, etc. lines on the Vernier of .001 in., .002 in., .003 in., .004 in. etc., respectively."



Effect of grinding with improper grade of wheel.

Gear Construction Material and Application

End to End Keys Best for Rawhide Pinions—Scrap Should Not be Used in Making Gears—Bronze Most Suitable for Worm Gears—Stamped Blanks for Light Work

By CHESTER B. HAMILTON, Jr., B.A.Sc.

IN CONSIDERING the production and application of toothed gearing let us first take up the material from which gears can be manufactured. Gears can be made from material of non-metallic or metallic character. The latter may be non-ferrous or ferrous, and the ferrous material may be cast iron or steel.

Non-metallic gears are generally used to eliminate noise. This is their only point of superiority over metal gears. All gears were originally made of wood, but long after iron became common material for machine parts, wooden cogs in mortices were retained for one of a pair of gears where quiet operation was required.

Rawhide is much used as a material for pinions. After special treatment it is cut into discs and glued into cylindrical blocks which are dried under compression. These blocks are usually sold to the gear makers in fifteen or eighteen inch lengths, which can be cut off as desired. Good practice calls for the supporting of the rawhide laminations between metal flanges, on the ends, the whole being held together by long rivets.

After assembling and riveting, the composite blank is then turned all over and the teeth cut clear through the flanges the same as any other pinion. Rawhide pinions should always be driven by keys, never set screws, as the latter apply the torque all at one end and are liable to loosen the rivets. The flanges are usually brass and the cutting speed of both brass and rawhide is high. Steel flanges reduce the cutting speed of the whole job to nearly the speed for steel, with no compensating advantages.

It is customary to save old gear cutters that are nearly worn out for use on rawhide pinions for two reasons. The duty is lighter, and they do not break but can be worn out to the end. The spaces between the cutter teeth are greater due to repeated grinding, and the rawhide chips do not pack in and jam the cutter, as is sometimes the case with new ones.

Oil and water, and excessive heat are all more or less injurious to rawhide pinions. High grade well cured rawhide is not as susceptible to injury as inferior material. Imperfectly cured hide can be detected by its bad smell when machining. The best hide is from the East Indian water buffalo. This is considerably superior to the ordinary beef hide, though more expensive.

Fibre is used to some extent for gears, but it is not generally considered a first class material. It is applicable for light duty. Its special virtue is that it is immune to injury from oil, and can therefore replace rawhide to advantage in some instances. In many places where fibre was formerly used, modern practice calls for a higher quality of metal gears, giving silence by reason of accurate helical generated teeth. There are three commercial classes of fibre, distinguished by their colors, grey, red, and black. Only the grey is fit at all for gears. The black is very weak, short-fibred and crumbly. The red is strong, but is loaded with a mineral filler which is very hard on tools.

Raw cotton, compressed to a solid mass by enormous pressure, is used very successfully for pinion blanks. This is not general however, the process being controlled by the patents of one firm, who do not co-operate with the gear industry at large in a way to promote the use of the material. The pinions are very strong and durable under almost all conditions.

Bakelite-micarta is the most modern material for non-metallic silent pinions. Bakelite is a condensation product of carbolic acid and formaldehyde. It occurs in three allotropic forms, which might be described as resembling a syrup, a gum and amber. Heat causes the changes from one form to the next, which changes are not reversible.

The fibrous, strength-giving element of the pinions is cotton duck, which is impregnated with the material in its first form and dried, cut into sheets, usually thirty by thirty-six inches, and stacked up in a hydraulic press. In this it is pressed and heated under pressure converting it into solid slabs of certain standard thicknesses, sheets of metal having been previously inserted at the required points of subdivision. The Bakelite is transformed successively to its second, and then third allotropic form, and finally fills all the interstices of the cotton duck with a rigid binder, of artificial amber. This is a first class gear material.

Pinion blanks are cut from the slabs with an ordinary patternmaker's narrow blade band saw. If the face of the pinion is greater than the thickness of any slab available, it may be built up by combining discs of suitable thickness and riveting the whole. It has the advantage over rawhide that flanges are not required, and also that it is not affected by heat, oil or water. In fact, the bakelite itself is unaffected by any reagent except boiling caustic.

Non-Ferrous Gears

The non-ferrous metallic gears can in general be classed under the term "bronze" where high duty is required, "brass" where the duty is light and speed of cutting or ease of working is the point, and thirdly, various, often nameless, alloys of low melting point which are used in the die casting process. This process has made great advances in recent years, both mechanically, and metals can now be die cast which have quite considerable strength, such as some varieties of brasses.

Generally speaking, brass, whether die or sand cast, or rolled, is not considered a high grade gear material. In fact, for a job of any size it is literally not worth its price, for a good bronze gear of equal strength would be sufficiently smaller to be cheaper. This of course does not apply to small gears where load carried and cost of material are almost negligible, and a metal is wanted that will cut at high speed, take a fine finish and not dull the tools, so that the close limits of accuracy used on small work can be maintained. Brass also sometimes replaces cast iron on account of its non-rusting qualities, especially for worm gears.

Good bronze, of suitable formula and well made, is a very high grade gear material. The so-called navy bronze of formula 88 copper, 10 tin, and 2 zinc, has been a standard for years, and owes doubtless part of its success to the fact that any intelligent brass founder can make it, which is more than can be said of some of the complicated special formulae in use. For worm wheels, where the action is largely sliding, the zinc can, if the unit pressures are not too high, be replaced with lead, which acts as a natural lubricant. This softens and weakens the metal a little. Phosphor bronze is deservedly popular, but requires more care.

There are at least two easy ways of spoiling it, which are common in small foundries. One is by the use of zinc, which will not alloy satisfactorily with phosphorus, or in the presence of phosphorus. The other is due to failure to alloy metallic phosphorus with the remainder of the charge and allowing it to burn off at the surface. In this case the phosphorus practically disappears, and though it does some good in the going, as a purge or cleanser, the result is not phosphor bronze. The latter trouble can be eliminated by using in the charge phosphor-tin alloy of known composition instead of metallic

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phosphorus. No scrap, only virgin metal, should be used for gears.

For Heavy Work

For such very heavy duty work as the worm gears in rear axles of motor trucks only the very best bronze is used. Some makers have special formulae, sometimes of a secret, or proprietary nature for which great claims are made. The heat treatment of bronze has developed some importance recently in this connection, for the refinement of grain and increase of strength and durability. Aluminum alloys have not so far been found suitable for gear material, though it is said that an aluminum bronze has recently been developed for which great claims are made. As with steel, the microscopic study of bronze is leading to new developments, and micrographic metallurgy is a most fascinating field.

Iron and Steel

The great majority of gears are of iron or steel, in some form or grade. Commercially pure iron, that is wrought iron or extra mild steel, is not a suitable gear material, as it is too soft to wear, and even if case hardened, lacks the rigidity necessary for the core to support the case. Further, there must be carbon enough in the steel to let it be cut cleanly and freely. Too mild a steel drags and tears, making a good finish and accuracy impossible.

Cast iron is at the opposite extreme, so far as carbon content is concerned, and perhaps should be concentrated first, as it is the oldest metallic gear material. The best cast iron for gears is of an intermediate grade. Hard white iron in which all the carbon is in the combined state is too difficult to machine, and is brittle. Very soft grey iron with an excess of graphitic carbon does not wear well. Low silica irons are to be avoided on account of their chill hardening propensities. An important item in castings for spoked gears is the selection of a mixture that will give low shrinkage, as a high co-efficient of contraction will surely lead to trouble from cracked arms and to unrelieved internal stresses.

Semi-steel had better been named "semi-cast iron," for it is not steel, but cast iron enriched and strengthened by an admixture of steel. The percentage varies, up to thirty per cent. steel being added in some cases, though it is usually much lower. In all cases where a considerable percentage is added, special attention must be paid to the chemical composition of the mixture, or bad results such as metal hard to machine, will follow. Semi-steel of low percentage steel can be made in the ladle by dissolving steel turnings in the liquid iron. This lowers the temperature considerably, and can only be used for castings of such form that high fluidity is not essential.

As there is an upper limit to the temperature at which the iron can be drawn from the cupola, so there is a corresponding limit to the percentage of turnings which can be added. This will vary with different foundries, different mixtures, and also vary with the class of casting to be poured. Thermit has been used in the mixing ladle with this method of adding steel, to maintain the temperature of the metal by replacing the heat absorbed by the fusion of the steel. The Thermit in a specially constructed can is fitted to the end of a rod and immersed in the liquid metal. The high percentage semi-steels require a different method of adding the steel. In this case steel scrap is charged with the pig and scrap iron into the cupola, and on melting comes down with the iron and combines with it in a liquid condition before tapping.

Steel castings for gears are usually made by the acid open hearth process. Basic open hearth is not much used for this purpose. Bessemer converter steel is also secondary to the open hearth on account of its liability to blow holes and kindred gaseous defects. A variation of the Bessemer, known as the Tropenas converter system, was formerly used to a considerable extent on account of the high fluidity of the metal produced, which was a great advantage in filling thin sections and intricate castings.

Crucible steel is not used for gears on account of the expense. The electric furnace is the most modern producer of high grade steel, in both the carbon and various alloy steels. This material is of superior quality, due to the better control of the process both chemically and physically, which is possible in an electric furnace. It has heretofore been too expensive to compete with any but the crucible, but of late improvements in the electric furnace, the high price of coke, and the development of hydro electric power on a large scale have placed this process in close competition with the open hearth.

Steel castings are generally much rougher and not so true to pattern as iron castings. Steel gears with moulded teeth are therefore found only in the largest sizes. Steel castings require to be thoroughly annealed after removal from the sand before they are fit to be machined as gears.

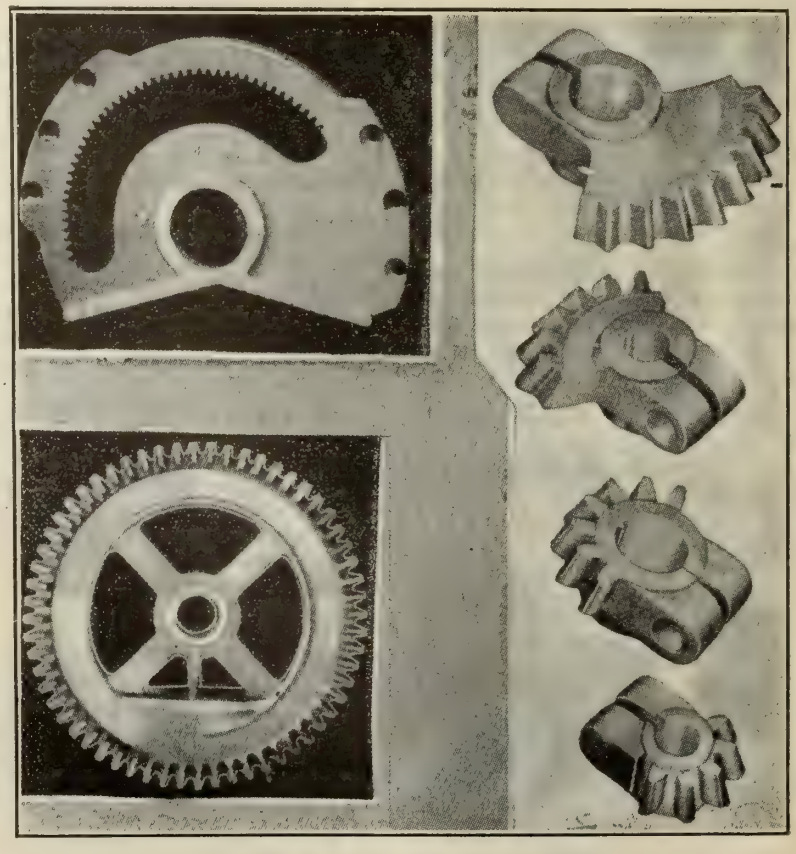
The modern alloy steels, involving the use of nickel, chromium, vanadium, etc., are used to some extent in steel castings, especially in the product of the electric furnace, but the bulk of the alloy steel gears are of rolled or forged material.

Wrought material for gears may be classified according to the process by which it is produced, as follows:—Hammer forgings, usually made under a steam hammer or hydraulic forging press from the billet or bar, are used where a comparatively small number of like pieces are wanted, and for large pieces, beyond the capacity of a drop hammer.

Drop forgings are made under a steam or board drop hammer with half dies in place of the two plane faces of hammer and anvil. As these dies are expensive, the process is adapted only to repetition work. The quality of the work produced is generally good, and, if due regard is paid to the finishing temperature, the material is improved by the mechanical working.

Stampings are made from rolled sheet or plate under drop hammers or crank

(Continued on page 32)



Examples of die-cast gears and quadrants.

How Science is Breaking New Trails in Industry

Alcohol to Compete With Gasoline—New Uses for Water and Electricity—Chemical Treatment of Cotton Against Fire Saves Millions of Dollars—Waste Fruits Provide Valuable By-Products

SUPPLEMENTING freight and passenger traffic on North American railroads and highways last year, a thousand airplanes were employed commercially in the United States and Canada, and these machines flew 6,000,000 miles, carrying 225,000 passengers and hundreds of tons of package freight. This advance in commercial aeronautical enterprise has taken place without the assistance or protection of law, in credits, insurance and the like. Its future is a challenge to the imagination. Not long ago an English business man chartered an airplane in Paris and for twenty-three days flew around Europe, touching at Brussels, Berlin, Warsaw, Trieste, Venice and many other cities. He is reported to have accomplished his business in one-tenth of the time that he would have consumed in going by train.

In view of the decreasing supply of gasoline as a motor fuel, according to Floyd W. Parsons in the Saturday Evening Post, laboratories are now at work producing alcohol that is equal to gasoline in providing mechanical energy, at the rate of from twenty to forty gallons per ton of parched shrubs or roots. The Germans get most of their power fuel from potatoes, and just as soon as business becomes normal and gasoline prices again advance, motor fuel from blackstrap molasses and from grain and fruits will be in the market competing with gasoline.

When the price of oil again gets as high as $1.50 a barrel, we are assured, the shale-oil industry will again awaken and the result will be another competitor to check any runaway market which may develop in oil. Shale-bearing rock is present in this country and throughout the world in even greater quantities than coal. Also ways are being devised to "break down" radium and to apply the same treatment to other elements which are found in comparative abundance throughout the world. For instance, the energy latent in metallic uranium, which is gradually given off during slow disintegration, is so enormous that the amount liberated by the complete disintegration of 100 pounds of the metal is approximately equivalent to that obtained by burning 18,500 tons of coal.

Science, the bed-rock of business, is still working to produce cold light like that emanating from the little firefly, and its production will affect finance and industry enormously. This is cited as one of many inventions which will directly affect our lives and businesses. We are to have new types of fuel-saving boilers, in which great economies will be effected, because instead of having to heat a large amount of water in a cumbersome boiler only one or two gallons will have to be heated at a time. There is promise of the successful development of hydrogen-gas motors propelled entirely by water. In such motors the water will be used over and over again, and, of course, should they be successful, there will be no transmission system necessary.

One inventor connected with a famous institution has already cooked all kinds of food with his solar cookstove. Every method of cooking except frying has been successfully tried on this stove, which consists of a concave, parabolic, cylinder reflector, through which runs a tube of ordinary cylinder oil to absorb heat from the reflector and apply it to the cooking compartment. Carefully adjusted insulation insures the retention of the heat in the oil overnight. A float device automatically regulates the cooking temperatures, while a simple clockwork mechanism keeps the reflectors facing the sun.

Abroad they have recently been experimenting with schemes for transmitting power by wave pulsations carried through pipes and conducted by a fluid, preferably water. This will be a sixth way of transmitting power, the other five being by steam, direct mechanical, hydraulic method, electricity and compressed air. In this new plan the power is communicated to water in one end of a conducting pipe, and the resulting waves carry it the full distance of the pipe's length. At present waves 120 feet in length are being sent through a one-inch pipe a distance of one mile to operate a riveting machine which delivers 2,400 blows a minute. The waves transmitting the power travel at the speed of sound in water. It is asserted that the pipe can be tapped at wave lengths or half wave lengths, and so may be made to serve a number of machines. Only the other day a Western druggist discovered a way of treating baled cotton so as to render it fire-proof. As a result, we read, the railroads now consent to carry this chemically treated cotton on open flat cars, and insurance companies are reducing their rates on these fireproofed bales as much as 90 per cent. No product of American farms is more dependent on bank credit than cotton, and the obtaining of credit by growers and shippers has been hampered because of the serious losses resulting from the chronic rotting of the staple during storage and shipment. The liquid treatment of the bales does not injure the cotton, but, on the other hand, does eliminate the former losses of from 80 to 400 pounds a bale due to rot.

Upon actual demonstration treated cotton showed no signs of fire damage after being transported 900 miles on flat cars next to the locomotive, although the bales were buried in cinders after the trip. This development will release some 40,000 box cars, formerly needed for moving the cotton crop, for the transportation of grain and other farm products.

In the farming and fruit-growing industry, we are told that, whereas the California and Florida fruit growers a short time ago were delighted to get $5 a ton for their cull oranges and lemons, this waste now is made to yield annually about 1,500,000 pounds of citric acid, 500,000 pounds of citrate of lime and 50,000 pounds of lemon oil. Our tomato-seed waste is being converted into an edible oil of high quality, as well as into a meal suitable for feeding cattle, hogs and chickens; and useless apples, even those that are intensely acid, are being made to yield calcium malate, the source of malic acid. The development of this latter process in Nova Scotia promises to result in the establishment of a new industry of considerable proportions.

NEW TURRET LATHE

The hexagon turret lathe is one of the most familiar of machine tools; in fact, it is so familiar that the possibility of radical changes in its design is not generally entertained. A British firm has, however, completed in its experimental shop an entirely new type of hexagon turret lathe. The improvements were suggested to the makers by the effects of heavy war service on ordinary types; and it represents a successful effort to remove the possibilities of damage and wear under the most strenuous conditions. One of the main features of the new machine is the covering of the scraped bed slides completely by cast iron guards. The covers fit closely to the slides and thus prevent dirt and chips entering between the surfaces in contact. Another chief feature of the machine is the way in which all possible points of danger are guarded against. All the actual machine operations are performed at the highest permissible speed, and the skill of the designers has been specially directed to increasing the speed at which non-productive movements are effected. Still another feature to which great importance is attached is the fact that the spindle is supported in single track roller bearings. Exhaustive experiments were made to prove that these bearings would stand the strenuous conditions imposed by continuous fast production. The machine is capable of turning lengths up to 30 in. at one setting and of taking bars up to 2 in. in diameter.

Practical Ideas from Practical Men

HIGH SPEED STEEL AND SOME OF ITS USES

By I. N. B.

There is no advantage in using high speed drills in automatic screw machines, where the cutting speed of the drill does not exceed 40 ft. per min. This refers to such machines as have no devices to increase the speed of the drills. For instance, a piece being machined 2 in. in dia., at 80 ft. per min., the stock would revolve at 153 r.p.m. The cutting speed of the drill is only 30 ft. per min., so that a carbon drill will answer as well as one of high speed steel.

As a general rule there is little to be gained by using high speed drills below ¼ in. dia. in ordinary drill presses, as they are not designed to operate at the necessary high speeds. To obtain an 80 ft. cutting speed for a ¼ in. drill the spindle would have to run at 1222 r.p.m. and few ordinary drilling machines will operate at such speed without excessive vibration.

Frequently high speed chasers are ordered for dies where the cutting speed seldom exceeds 25 ft. per min. Better results are often obtainable with the carbon steels. Owing to the high temperature required in heat treating the high speed steels, there is the possibility of damaging the points of the threads, and, due to the deoxidizing that takes place, surfaces must be ground to bring back the keen cutting surfaces, a condition that is very difficult in taps and dies.

DIES AND FORMING TOOLS IN AUTOMATICS

In using dies on automatics it should be remembered that the cutting of comparatively fine threads is equivalent to turning with coarse feeds, therefore the time allowed for cutting the thread should be equal to the time for the longest turning operation. There is nothing gained in getting the die on and off in the shortest time and then waiting for the completion of another operation.

The improper grinding of dies is another source of trouble. If the head is not true with the pitch the die will not follow true and each land will have to cut a path for itself instead of following in a true head. Hence the thread will be rough and irregular. A thread slightly less than full is easier to cut and the loss in strength is less than 5 per cent., and the thread is 50 per cent. easier to cut.

Forming tools designed to cut irregular shapes are given certain angle for rake and clearance so that any variation from design will make a difference in the finished work. Hence, all forming tools should be ground and set to gauge.

To attain the maximum efficiency in the performance of any machining operation, there are two general factors to be considered. Means must be provided for cutting the metal at a satisfactory rate, and care must be taken to reduce the idle time to the minimum. It is obvious that any material gains in effective cost reduction must result from a systematic application of past experience rather than mere assumption.

A PROBLEM IN TESTING

By G. Blake

The writer is engaged in the manufacture of small lathes, and until recently had been using a test bar for testing the alignment of the bearings with the bed. The method of testing is as follows: the test bar is inserted in the bearings and locked by the screws in the bearing caps, a block with a vee edge to correspond to the shears of the bed (front side) is used with a dial indicating gauge. The writer previously allowed an error of .002 in. in 24 in. the test bar projecting from the front bearing by about 28 in. The inspector set his gauge at zero at the headstock end of the test bar and passed the lathe if it did not show more than .002 in. at the tailstock end. This test was applied both to top and side of the bar.

A question was raised as to the amount of deflection of the test bar and the writer ventured the opinion off hand that he did not think it would amount to more than .0015 in. on the 28 in. length, but on referring to the text book and using formula given, it proved that the deflection was .008. This surprised the writer and consequently upset all our calculating. When the bar showed zero at the headstock end and .002 in. high on the top at the tailstock end at 28 in. overhang of the bar, it really was .010 in. high at the end instead of being only .002 in., as shown on the indicator, the deflection accounting for the .008 in.

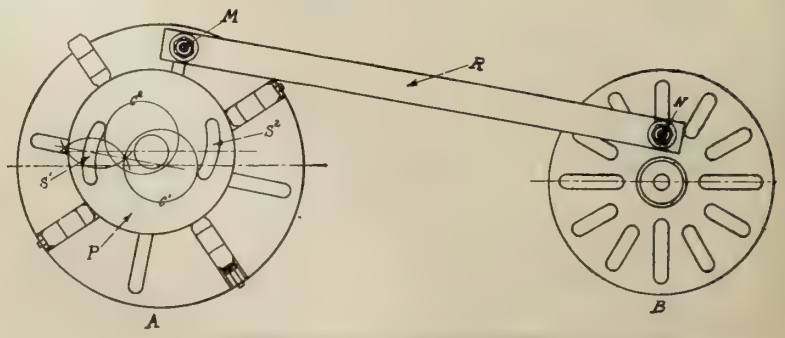
Next by taking a test at 12 in. overhang the deflection was less than .001 in. Now to prove if the deflection was actually .008 in. the test bar was again inserted at 28 in. overhang, the bearings tightened up so that the bar was rigid. The gauge showed at zero at the extreme end of the bar on the side test, that is the lathe in its ordinary position. The lathe was now turned on its side 90 degrees, the gauge again tried up against the bar, when it showed that the deflection was slightly more than .008 in. It actually registered .0105 in., showing that another factor had to be taken into account and that was the pressure of the spring in the dial gauge. A test was made on this and it showed that the pressure of the spring registered a deflection of .0025 in. on the test bar at 28 in. overhang; the diameter of the bar was 1¼ in. and it was made from ordinary good mild steel approximately 35 to 40 tons tensile.

We had the records filed away for future reference and decided that in future all our tests would be made on a bar projecting 12 in. from the headstock as the deflection on this length was under .001 in. All this goes to show how easily one can be led astray until actual experiments are carried out and very carefully checked.

CAM CUTTING KINK

By J. H. R.

An interesting method of cutting two diametrically opposed eccentric cam slots in a large disc is shown in the accompanying sketch. The slots S had an approximate length of 5 in. and a width of 1¼ in., the movement of the disc when in position on the machine, giving a radial travel to a pair of jaws of about ⅞ in. After the location of the slots had been laid out on the plate the metal was rough drilled to the boundary lines. The disc was then placed in the chuck of a large lathe, as shown at the left, and a bar clamped at the rear to act as an oscillating lever for smoothing out the slots. However, after a few strokes by the "strong arm" method, it was noticed that the face plate of an adjacent small lathe was just about in line with the chuck of the other, so the arrangement shown here was soon rig-



Cutting cam by means of two lathes.

ged up, with good results. The studs M and N were made of the desired length and connected by the bar R. The stroke was regulated by adjustment of the stud N. Starting up the small lathe B gave the necessary movement to the lathe chuck A.

GRINDING BILLETS AND BARS

By R. H. Cannon

All of the high speed and tool steel billets at a large billet manufacturing plant are cleaned by grinding. Wheels 14 in. x 2 in. x 1¼ in. are used on swing frame machines. All of the scale is ground from the rough billets first and then the flaws and cracks are completely ground out. The billets weigh between 100 and 400 pounds. From time to time objections were raised about the grinding wheel cost per ton of billets ground and attempts made to reduce this by increasing the hardness of the wheel. This resulted finally in the adoption of a grade W wheel. Wheel life was increased but the production was considerably reduced. The grinding room was being pushed hard by the other departments and finally asked our help to speed up production.

The first step was to analyze the cost of grinding. This cost was divided into three items: wheel cost, labor cost, and overhead. The latter was found to be the largest item or approximately 90c per man per hour. This being the case it could easily be seen that a hard wheel would increase the overhead per unit ground while a soft one by cutting faster would decrease it. There would be a certain point of course where softer wheels would increase the wheel cost per unit sufficiently to offset the increase in production. After weeks of careful record keeping and experimenting with a wide range of grains and grades, it was found that by using grain 20 grade R the cost per unit of production was greatly decreased and the production per unit of time nearly doubled.

The figures are as follows:

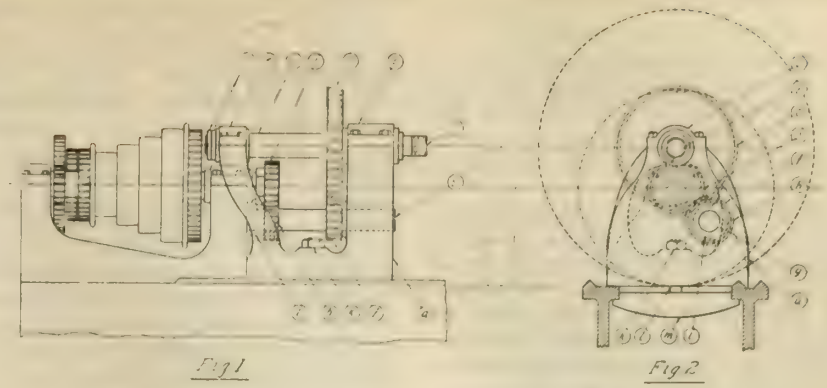
Grain and grade	20W	20R
Average wheel life—hrs...	61.2	22.6
Steel ground off per hr. lbs.	2.4	4.1
Total cost per lb. of steel ground off	$ .57	$ .43

Figures for another example of exactly the same kind are as follows:

Grain and grade	20V	20R
Average wheel life—hrs...	60	39
Steel ground off per hr. lbs.	1.32	2.21
Total cost per lb. of steel ground off	$ .85	$ .61



Grinding billets and bars.



Attachment for machining large work on small lathe.

Hundreds of instances could be cited to show that a fast cutting wheel, one that will get the most out of all items of expense incurred in grinding, is well worth the experimenting necessary to determine it.

This company had been saving money on wheels to be sure, but after the tests it was quite apparent that this saving had been eaten up many times by slow production.

BENDING SHAPES

By J. Henry

A secret of easy bending is heating a small area to a bright red or yellow heat and bending no more than necessary. Several heats may be necessary, each followed by angular displacement which in the total restores the part to the original lines. Heating in a forge fire is at disadvantage for bending and straightening oftentimes because of the impossibility of confining the heat to a small section. Hence the bend cannot be exactly localized where wanted.

When bending structural steel it will be necessary often to cut flanges and remove parts to make the bends without distortion. The cutting torch is a most convenient tool for the purpose, of course. The cuts can be so made that the flanges are readily welded again after bending, thus producing fabricated parts of any shape, still having the strength and characteristic of the original section before bending.

INCREASING LATHE RANGE

In the small jobbing shop it is often desirable to increase the swing of a lathe to accommodate certain work, and blocking up the head stock and tail stock is generally resorted to. The sketch here shown is of a device designed to overcome the necessity of raising the head stock when a large piece of work is to be machined. The auxiliary head A is made to fit the shears of the lathe and of a height x to suit the possible range of work the plant will be interested in. The spindle B of the attachment is given a long support by extending the rear bearing over the front housing of the head stock. The pinion J is fitted to the threaded nose of lathe spindle and the boss on the back is made hexagon for easy removal with wrench. The pinions H and F are integral or keyed to intermediate shaft G, the pinion F driving the gear C, which is keyed to auxiliary spindle B, the forward end being threaded to take the ordinary lathe chuck or face plate. The dotted circles in Fig. 2 show the increased range of machine.

CARE IN PLACING LOADS

By R. J. Hamil

In the operation of machine tools, particularly lathes with long beds, a condition that does not always receive proper consideration, and one that may result in affecting the accuracy of the work being machined, is the indiscriminate placing of loads upon the floor in close proximity to the machine. Especially is this true where the lathe is located on wooden floors that are easily subjected to deflection or vibration. The placing of a heavy casting or load of any kind near the machine may cause the bed to sag or develop a wind, that will be transferred to the work being machined, and likewise affect the free running of the moving parts.

Care should be taken, when locating a long machine, to see that the supports are placed in such a way and in such a position that maximum rigidity will be maintained under all possible conditions. If it is necessary to locate the legs on a weak portion of the floor, care should be taken when placing other material of a heavy character close to the machine. It is best, however, to provide adequate support when the initial installation is made.

This applies likewise to line shafting located on the ceiling of the lower floors of factories, where heavy loads in the upper department may throw the line shaft out of alignment.

STEEL BLUE ON BRASS

Dissolve 1½ drachms of antimony sulphide and two ounces of calcined soda in ¾ pint of water. Add 2¾ drachms of kermes, filter and mix this solution with another 2¾ drachms of tartar, 5½ drachms of sodium hyposulphite and ¾ pint, of water. Polished sheet brass, placed in the warm mixture, assumes a beautiful steel blue.

GEAR CONSTRUCTION

(Continued from page 28)

or toggle punch presses, usually the latter. Drop forgings are sometimes called stampings, but that is stretching the term. The stamping process is specially applicable to blanks for sprockets and similar thin work.

Rolled bar steel is the common material for pinions. It is usually sawed to length in either rotary cold saws or power hack saws, and finished in lathes. As it comes from the rolling mills its finish is rough and it is usually not very straight, but this is immaterial when it is to be sawn up into short pieces.

Cold drawn steel is the same material as the above, finished to accurate size, straightness and smooth surface, by drawing through a die. For pinions it is round, but for racks it is drawn square or rectangular. This is the best form in which to use bar steel in automatic, screw machines, etc., for the production of small pinions where the bar revolves, as only a truly straight bar can be safely revolved at high speed, and also uniformity of diameter is necessary to work properly through the automatic chucks and bar feed mechanisms of this class of machine.

The surface metal of cold drawn bars is compressed by the process and placed under tension. This manifests itself when teeth are cut in one side of a bar for a rack. The surface or skin tension on that side is relieved, and that on the opposite side pulls the bar into an arc of a circle, so that it must be straightened before using. If the skin is milled or planed off the back, this effect is minimized.

Heat Treatment

The heat treatment of steel-gears is far too big a subject to be considered in any detail here. In brief, steel can be used, in addition to its natural state as it comes from the rolling mill or forge, in three heat conditions, in each of which the selection of a steel of suitable analysis is presupposed, for any one steel could not be treated at will in any manner. First, a steel with a carbon content of over .45 per cent. may be hardened by heating above the critical point and quenching.

Second, any steel may be heated above the critical point but not quenched above that point. This will be called a toughening or an annealing process, according to the rate of cooling. Both of these processes aim to control the maximum temperature in order to refine the grain of the steel.

The third process goes farther, in that it actually changes the chemical constitutents of the steel. This is the cementation or case carbonizing process, by which a steel too low in carbon to be hardened, say .20 per cent. carbon maintained at a high temperature for several hours in an atmosphere of carbonaceous gas, from which the surface steel abstracts carbon. By suitable choice of the material which gives off the gas, and regulation of the temperature and time, the carbon content can be raised at the surface to over one per cent. and driven into the steel to a considerable depth, far beyond what is necessary in gear work.

This is followed by heat treatment, consisting of heating and quenching one or more times, at temperatures selected to give a strong tough core to the gear tooth, enclosed in a hard dense case which will resist wear. The scientific regulation of temperatures at all stages of the process is of extreme importance. For instance, under correct regulation of the carbonizing heat the high carbon case merges gradually into the low carbon core, with no sharp line of demarcation, thus preventing any tendency for the case, which is always more or less brittle, to shell off from the core.

In this, as in all heat treatment, microscopic examination of polished and etched specimens is one of the best indications as to the results being obtained in the furnace room. All furnaces should of course be equipped with reliable pyrometers, preferably of the recording type, where the importance of the work warrants the expense, and all thermo couples should be checked against standards at intervals.

(To be Continued)

PRACTICAL MINING

(Continued from page 26)

mines or in some of the mills or testing laboratories, or in some cases they engage in prospecting or assessment work. In this way an easy and natural transition is made from the school to the responsibilities of life.

Importance of Industry

The importance and possibilities of the mining industry in Ontario are too often not appreciated, especially in the southern part of the province. With almost a monopoly of the world's nickel supply; with great deposits of copper, silver, and iron; and with gold mines rapidly approaching the point where they will take first rank in the world as producers; not to mention the numerous minerals as yet of unrealized value such as cobalt, Ontario stands easily in the premier position of Canadian provinces, and is probably without equal in the world for variety of minerals and possibilities for the future. The responsibility of training a sufficient number of Ontario boys to become men of skill and character for the development of these unsurpassed natural resources rests heavily on the institutions engaged in this training. Needless to say those in charge feel this responsibility keenly. They also feel that the institutions at Haileybury, Sudbury, and Timmins, might profitably be attended by students from other parts of the province who feel attracted to the mining industries.

Sand blasting as applied to the cleaning of steel is an idea of recent origin and has become popular with engineers everywhere.

HOW INDUSTRIAL ACCIDENTS CAN BE PREVENTED

(Continued from page 22)

need not be great, and the work would need to be handled with care and judgment. Harm instead of good I think can easily be done by too much paternalism or ill-considered action. The best rehabilitation is to get the workman back if possible into the same or some other occupation in the employment in which he was injured.

In conclusion I wish to thank the employers of the province for the co-operation given in the administration of the act. We all desire an efficient, impartial and satisfactory administration, and employers generally have assisted, especially in attending to the exceedingly important matter of reporting accidents and giving necessary information promptly, without which speedy payment of claims is impossible. Our task is a heavy and responsible one, and never more difficult than at the present time. We are a buffer between the different parties. Workmen and doctors sometimes complain that we pay too little money; employers often think we pay too much. Demands from various sources are being constantly made with which we cannot honestly comply. In dealing with compensation and assessments the Board is a judicial body and must do its duty, in accordance with the provisions of the Act, as we are sworn to do it, without fear or favor. The influence and pressure that is too frequently attempted must be resisted no matter what the consequences.

We are not always able to do all that we would wish but, whatever the shortcomings, injured workmen and their dependents were never before looked after as they are being looked after now; and if our task is heavy it is an honor and a privilege to have so great an opportunity of doing good and of rendering useful public service. I believe upon the whole there is no better Workmen's Compensation Act in existence than our present one. It makes for better relations between employer and employee; provides relief for all accidents of consequence in employment; keeps the employer immune from actions in the law courts; and speedily, without litigation or expenses, puts directly into the hands of the bereaved widow or the crippled or injured workman $98 out of every $100 the employer has to pay for accident protection. Though the benefits are liberal the rates of assessment, by reason of the absence of overhead and other expenses incident to other systems, are not high in comparison with those in other places; and if you will reduce the accidents, the rates of assessment will automatically also drop.

Northern Cranes & Hoists is the title of a small booklet just issued by the Northern Crane Works of Walkerville, Ont. It contains a number of illustrations of their various types of cranes and hoists under different working conditions.

New Things in Shop Equipment

SPROCKET TOOTH HOBS

A new line of hobs for cutting teeth in sprocket wheels has recently made its appearance on the market. Each hob of the set is suitable for cutting any number of sprocket teeth of a given pitch and roll diameter. Thus it is claimed that each hob will do the work that ordinarily requires from six to nine cutters. In addition, when teeth are hobbed high production rates and accurate indexing is obtained. The hobs are designed to cut teeth in conformity with practically all the recognized standards. The tooth form possesses some interesting features which adapts it for production by hobbing. Its space angle gradually decreases as the number of teeth increases. The generating action of the hob tends to produce these changes, although not at the same rate. The pitch of each hob is greater than the circular pitch of the sprocket for all above a certain number of teeth, and less than the circular pitch for all under that number. The hobs are manufactured and marketed by the Diamond Chain and Mfg. Co., of Indianapolis.

IMPROVED LATHE CHUCKS

An improved line of lathe chucks made in all sizes from ten to thirty inches has recently been placed on the market. A special feature is the thrust bearings which are made in two parts and completely encircle the screws at a point about midway of their length. The stems of the thrust bearings are driven into round holes in the chuck body and are therefore self-aligning. The bearings hold the screws in place whether the jaws are assembled or not. The complete line of chucks are manufactured and finished to gauges and therefore spare parts are interchangeable. The Cushman Chuck Co. of Hartford, Conn., are the manufacturers.

AUTOMATIC CUTTING MACHINE

An automatic cutting machine intended for cutting such metal parts as dies, cams, crankshafts, and drop-forge tools, directly from steel plates, has recently been placed on the market. The machine has two carriages, one of which is mounted on the other. The upper carriage has on one side an oxy-acetylene cutting torch, and on the opposite side it supports the driving and tracing system. Any movement on the pattern is transmitted directly to the torch. A motor on the top carriage is used for power. This power is transmitted through a friction wheel. The machine is manufactured by the General Welding and Equipment Co. of Boston, Mass.

WORM-GEAR DRIVE FOR LINE SHAFTING

There has been placed on the market an enclosed worm gear unit for driving line shafting direct from a motor attached to the ceiling. The armature shaft is, of course, set at right angles to the line shaft. The apparatus has been designed to enable the smaller high speed motors to be utilized for line shaft drives, that are positively connected. At the same time large ratios of speed reduction can be provided. The manufacturers are the Cleveland Worm and Gear Co. of Cleveland, Ohio.

BUFFING AND GRINDING MACHINES

A recent devlopment is a line of floor-type buffing and grinding machines on which the motor is totally enclosed and its shaft is extended and threaded at both ends for accommodating the grinding and buffing wheels. The standard is of cast iron and carries the motor housing. A safety switch is placed on the front of the pedestal. A pulley is provided on the motor shaft for the driving of an air compressor if it is required to do so. The Valley Electric Co. of St. Louis, Mo., are the manufacturers.

PORTABLE BAND SAW

Recently there has been offered on the market a pattern-maker's band saw that is portable. The saw is driven by an enclosed electrical motor of ½ h. p Current can be supplied from any ordinary lighting circuit. The motor is positively connected to the lower saw wheel by a fabroil gear and a steel pinion, both of which run in oil. The motor speed is 1750 r. p. m. The machine is equipped with disc wheels. The table is a ground plate mounted on rocker bearings which permit of an adjustment from 45 deg. in one direction to 5 deg. in the other. An indicator shows the angle at which the table is tilted. All the adjustments are made without the use of a wrench, as handwheels and thumb screws are provided in all cases. The saw blades are made from a special steel and are operated at a speed of 3150 feet a minute. The table is 19 by 21 in. and is located 42 in. from the floor. The total overall height of the machine is about six feet. The manufacturers are J. D. Wallace & Co. of Chicago, Ill.

THERMALOAD MOTOR STARTER

This type of starter which has been recently designed for controlling the operation of alternating current, single-two-, and three-phase motors of from ¼ to 10 h. p., is well adapted to machine tool application, in that the number of control stations, which are of the push-button type, may be located in several convenient positions on a machine, so that the operator can instantly stop the machine when he desires. In the event of the load on the cutting tool becoming too great, the appliance immediately stops the motor. At the same time the apparatus allows the motor to exert six or seven times its normal power for momentary loads, or loads of very brief duration. In addition to this protection to the motor and machine, it also protects the motor from prolonged overloads as small as twenty-five per cent., and from overheating sufficiently to cause injury to the insulation. Polyphase motors are also protected from running on single-phase current. The starter is being manufactured and marketed by the Monitor Controller Co. of Baltimore, Md.

SAFETY DRILL AND TAP CHUCK

A safety chuck for use with drills and taps and having a positive drive, has recently been offered for sale. It has been designed principally for use where hand feed is employed. The present models of chucks are for small drills and taps, where the percentage of breakages is high. The safety device by means of which such breakages are prevented consists of two friction members and a soft steel driving pin, which pin is sheared when the tool is overloaded. The tool is held in a hardened collet by means of a Bristo hollow safety set screw, which bears on a flat on the tool shank. The soft steel driving pin is inserted through the collet and a hardened male friction member which is adjusted by the knurled nut on the outside of the chuck body. The female friction member is keyed to the body, the nut bearing on it, and thus preventing it from tightening or loosening, when the tool is run forward or backward. When the resistance to the tool becomes too great so that it sticks, the pin is sheared. There are three sizes of pin holes in the standard collet, the smaller ones being used with high speed drills. The pin is held in place by a spring plunger. The chuck is manufactured by the Save-All Tool Co., of Waltham, Mass.

SAW-CHIP REMOVING DEVICE

It has been definitely determined that the breakage of metal-cutting saws is very often caused by the clogging acti of the chips, which causes a heavy strain to be placed on the teeth. To eliminate such a condition a special wheel has

been brought out. It has teeth spaced to suit the teeth of the saw with which it is intended to be used. It is attached by means of a stud to some member adjacent to the saw, and is placed at right angles to one side of the saw in such a position that the teeth of the wheel engage the tops of the saw teeth as the saw revolves, and push the chips from these surfaces. As the saw teeth are kept free from chips when the device is used, the saw itself can be operated at faster speeds and with heavier feeds. The wheel is manufactured by Henry Disston & Sons, Inc., of Philadelphia, Pa.

STAGGER-FEED PUNCH PRESS

There has recently been placed on the market an automatic punch press on which the punch operates continuously and cuts blanks in a staggered relation to one another. When discs are being produced the machine leaves only a mere thread of metal between the holes punched out of a strip of stock. The machine is particularly suited to the production of such parts as can tops and bottoms and other small shells. The sheet stock is held in a carrier which travels in either direction past the reciprocating punch. It is not necessary for the carrier to be returned to the starting point after punching a row of blanks, because the moment the end of the row has been reached the action of the carrier is automatically reversed, and the next row may be punched as the carrier returns to the starting point. After the last blank has been punched from a sheet the carrier stops automatically. It is thus possible for an operator to run several machines at one time. His safety is provided for as at no time do his fingers come near the die. Another feature of the machine is that the scrap is automatically ejected. The machine will produce blanks from one to four inches in diameter and has a capacity up to 100 pieces a minute. The machine is manufactured by the Adriance Machine works, Inc., of Brooklyn, N. Y.

COMPOUND-SEAM CLOSER

A machine that is capable of producing air tight side seams on such articles as drums for calcium carbide and cans for calcium chloride has recently been placed on the market. The seam may be filled with a sealing compound, although the seam as closed by the machine is practically air tight. Offsets are first formed on the ends of the sheet to be joined, after which the sheet is rolled to a cylindrical shape and placed over the horn of the machine, with the offsets lying on the guide piece set into the top of the horn. The machine runs continuously and for that reason is not provided with tight and loose pulleys, or a clutch. The drive-pulley runs at 100 r. p. m. The treadle at the front of the machine is connected to a sliding member, and by depressing the treadle the work is moved forward along the horn and fed between the first set of rolls, which squeeze the seam together at the bottom. After these rolls take hold, the work is automatically fed through the machine. The second set of rolls flattens, and thus closes the double lock seam in one operation. The maximum length of work that can be handled in the machine is 42 in., and the minimum diameter for that length is 13½ in. The machine can handle material up to No. 22 gauge, soft steel. The weight is approximately 2700 pounds. The manufacturers are the Niagara Machine & Tool Works of Buffalo, N. Y.

SIMPLIFIED CUTTING TORCH

A new cutting torch has been designed, where two tubes instead of three, connect the head with the handle, and in which the pre-heating gases, either oxygen or acetylene or some other combustible gas, are mixed in the chamber between the handle and the head. The design requires a new style of tip. This is necessary as the gases are mixed before they reach the tip. The head is a copper forging which is free from pin holes and other defects, and can resist higher temperatures than bronze or brass castings. The ratio of the mixed gases is controlled by two needle valves. The cutting-oxygen valve is operated by a finger lever which can be placed and left in either an open or closed position. Thus the operator can cut work without holding his finger on the trigger after the operation has been started, and when he wishes to stop cutting, a reverse pressure on the trigger closes the valve. A spring holds the trigger in the closed position until it is operated again. The back end of the torch can be easily removed if it becomes necessary to clean the screen or to remove the oxygen cutting valve seat. The tips are made of copper and are held in a taper seat by a bushing nut. The tips are made with the cutting-oxygen hole at the centre and the preheating holes surround it. The number of pre-heating holes in a tip varies from two to six, depending on the combustible gas used, the manner in which the torch is applied and the metal being cut. For the purpose of cutting off rivets bent tips are supplied. Gases less combustible than acetylene and those that burn with a flame of lower temperature, such as butane, hydrogen, carbohydrogen, and illuminating gas, can be used. Best results are obtained, however, with acetylene as smoother and more even cutting is obtained. The torch is manufactured by the Davis Bournonville Co. of Jersey City, N. J.

In sand blasting steel, it is necessary to maintain a high and even pressure, as a low pressure will not cut off rust and scale entirely. When a high pressure is used, the rust and scale disappear and the steel is polished like dull silver

PORTABLE GAP LATHE

A very interesting, and at the same time a very useful, little machine tool has recently been placed on the market in the form of an 11-in. gap lathe having a maximum distance between centres of 24 in. The tool is so small that it may be used as portable equipment if it is so desired. There is furnished a quick change feed-box which consists of a clutch for engaging and disengaging the feed. A crank handle is provided for traversing the carriage when working on short jobs close to the face plate. Below the gap there is a shelf which serves as a support for the carriage when it is run over the gap. An adjustable plug, which is fitted on the left end of the apron, bears on the planed surface of the shelf and withstands the downward pressure. When working on jobs that require the carriage to be near the tail stock end of the lathe, the crank handle operating the carriage can be removed from the left hand end of the lead screw and placed on the right hand end, a short extension of the screw protuding from the end bearing for this purpose. The feed box offers a wide range of threads to be cut, which range includes all standard threads from 8 to 224 per inch, inclusive, and also the 11½ threads required for pipe threading. Reverse gears are also provided for the cutting of both right- and left-hand threads. The reverse gears are located within the swinging quadrant at the end of the head-stock. In addition the quadrant also contains compound gears for the drive within the feed box. A sliding tumbler lever engages any of the cone gears while a direct reading index-plate on top of the feed-box designates the proper position of this lever for any desired feed. The cross slide may be swiveled for angular turning, and when set for straight facing, taper dowel pins serve to locate it in its proper position. The counter shaft is mounted in self aligning bronze bearings secured to the rear legs. It may be driven direct from a line shaft through its friction pulley, or by a motor mounted on the bed. The friction pulley is of the cone type having a spring that keeps it in engagement. A vertical rod at the rear of the machine has a fork that engages the flange of the friction clutch. This rod is operated from the front of the machine by a lever. A braking action is exerted on the countershaft by this lever when the clutch is disengaged, and is sufficient to stop the countershaft instantly. The drive from the countershaft to the head-stock is through the medium of a three-step cone pulley. Back gears are provided which permit of six changes of spindle speed in geometrical progression. The motor recommended for this lathe is of ½ h. p., and can be supplied with current from an ordinary lamp socket. The swing of the machine at the gap is 16 in. and over the carriage 8¾ in. It is manufactured by the Artisan Mfg. Co. of Cincinnati, Ohio.

CANADIAN MACHINERY
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Figures Show Alarming Total

ON ANOTHER page of this issue appears an article dealing with Ontario's Accident Prevention Policy. It covers the work which has been done by the Workmen's Compensation Board, and while it is an able report, the fact remains that compensation only mitigates the result of accident, but does not restore the life destroyed, or the limb lost or crippled.

In 1921, 45,191 accidents were reported, 386 of which were fatal. During the seven years in which the Workmen's Compensation Act has been in force, there have been 272,000 accidents, 2,784 of a fatal character. This figure equals the combined population of Hamilton, Ottawa and Windsor. It is an alarming total, and yet it only includes the industries covered by the Act. Many other accidents are never reported, so that it simply makes an extremely bad situation all the worse.

A surprising and significant fact is, that less than one-third of all accidents occurred on machinery. The other two-thirds were caused through carelessness in one form or another. Stepping on, and knocking against objects caused 2,455 accidents during the year, while 10,609 resulted from the handling of material, loading, piling, etc. This clearly shows that accident prevention does not stop with the guarding of machinery, but that the state of mind and attitude of all workmen from the manager down is most important.

Another disclosure is that a large proportion of accidents happen to employees starting on a new job. This can be avoided by foremen taking more pains to explain the operation, and see that the new worker understands the task, before being left to his own devices.

A regrettable fact is that the report shows that several accidents could have been avoided through the use of goggles, and that molders were not making sufficient use of protective footwear. The increase in injury to young boys should be carefully investigated, and the cause removed at once, for the youth of our land must not grow up disabled and unfit.

The evil consequences of seemingly trivial cuts, is once more emphasized in the report, and we can only add to what we have often previously advocated, (i. e.) no matter how slight the cut or bruise, see a doctor at once, you owe it not only to yourself, but your dependents as well. Blood poisoning caused at least one-eighth of the total accident cost, or approximately three quarters of a million dollars. Surely this staggering total is sufficient answer for the careless and skeptical.

Manufacturers and employees should make it a point to lower the accident toll this year, and this can only be done through close co-operation. Workers should report any unsafe conditions to the foreman, and if he fails to immediately remedy the evil, report it still higher up. On the other hand let manufacturers co-operate with the men, and once a danger spot is reported, see to it that the trouble is remedied. The editorial following proves this point admirably for had proper inspection taken place, the report would have been made, the danger eliminated, and another home would still have the breadwinner at its head.

Something Wrong Here

AN EMPLOYEE of a brickyard in Toronto was killed the other day while attempting to put a belt on a shaft while in motion. The end of the shaft projected beyond the pulley, and the unfortunate man was dragged, caught through his clothing on the end of the shaft, and practically smashed to pieces.

Some interesting facts anent the system of factory inspection were brought out during the inquest. First of all, it was established that no copy of the factory act had been exhibited in the place for over five years. It was over a year since there had been a factory inspector in the place. One factory inspector giving evidence, said the place used to be in his district, and when under his jurisdiction he had ordered some guards to be placed around shaft or pulleys. He had been to the factory since the accident, but didn't notice whether his recommendations had been carried out or not.

The inspector now in charge of this district admitted that he had not made any visit to the place before the accident, giving as his reason that he did not know of the existence of the factory. He stated that when an inspector took over a district, he had to hunt out the factories in it, as there was no list provided.

There is a strong supposition from the evidence given at this inquest that had this accident not occurred, everything would have gone on in the same old way until something did happen. Preventive measures were not considered, and it does not seem to have been any one's business to look into the matter. There is a safety league convention in Toronto this week, preaching the gospel of safety first. There is a factory inspection department, and there are inspectors appointed and drawing a salary for preventing just such accidents as the one under discussion, yet according to the evidence of one of these inspectors the department has no information of the factories supposed to be under its jurisdiction. The inspectors have to "hunt these places out."

What seems to be needed is a factory inspection department that will inspect.

Sticking To The Task On Hand

THOMAS A. EDISON is noted for his wonderful personality and faculty for embracing the other man's viewpoint. He is spoken of as a man remarkably free from jealousy and eager to hail a new discovery. He firmly believes that a day's work means to complete as much as possible in the time.

Practically every successful man will give you the same recipe for success, viz., hard work, keep up interest in the job being performed, and study in your leisure moments. When we are inclined to feel dissatisfied with our present position, a self analysis is often a good medicine. Usually we discover that we ourselves are to blame for not having advanced further up the ladder of success.

Reductions and Increases Both Announced

Drills Come Down While Grinding Wheels and Pig Iron Go Up —Iron and Steel in Seasonal Demand—Small Tools and Supplies Taper Off Slightly—Scrap and Non-Ferrous Metals Weak

REDUCTIONS OCCUR IN SEVERAL LINES

CARBON and high speed drills are down in price. The decrease is approximately 10 per cent., and takes effect April 6. A machine tool manufacturer will also announce within a few days a reduction of 15 per cent. on his line of pipe machines. Another firm announce an increase in price on grinding wheels. These are the chief items of interest in the Canadian market.

Keen competition exists in the small tool field, but striking an average of business closed, March sales are at least 15 to 20 per cent. ahead of February, and in a few cases as high as 26 per cent. Compared with normal however, the average selling rate is about 50 per cent.

The demand for iron and steel shows seasonal improvement, and prices are firm in all lines. Orders are more numerous and much easier to secure than formerly. Much business shows considerable increase over February, and from present indications, April will be still better.

Machine tools are merely holding their own, but more new tools are being asked for than formerly. Prices are uncertain, because where the order is particularly desirable, keen competition and price cutting exists. Second hand and re-manufactured tools continue to move in reasonable quantities.

The same conditions hold true in the small tool supply business, prices in many cases being cut to a very low level. The recent influx of orders from the automotive industry has died down during the past week, and April business so far shows a slackening off.

Scrap metals remain inactive, non-ferrous metals being especially weak. New metals in the latter mentioned class are also in poor demand.

Pig iron shows an improvement, and prices are somewhat firmer. Small foundries are beginning to pick up, and as their stocks of pig are low, it means more business for the mills.

Oils, greases, and waste are selling at about the same rate as last week. Prices remain unchanged. Building is picking up quite a bit, and in the Montreal field added interest is being shown in structural material. So far, the railroads have not entered the market.

Reports from the American Iron and Steel Institute, show that steel ingot production in March increased more rapidly than anticipated. The rate on April 1, was approximately 35,000,000 tons a year, or practically equal to the total capacity in existence in 1914. If compared with present capacity, it equals about 66 per cent., as there has been an increase of about 50 per cent. in capacity since the war started.

The existing high rate of increase is not expected to continue for if such were possible, another five months would see production up to entire capacity. Unusually low stocks, extreme lowness of prices, and fear that the coal strike would interfere with production and shipment are really the causes for the rapid improvement. It is likely that the rate of increase will soon strike a level, tapering off in the summer when the steel market is always dull.

Prices in steel continue to show strength, and a few advances have taken place. Plates are now 1.50c, and most of the wire mills in the States have increased their prices on nails, staples, and barbed wire. Sheets are up $3 a ton, and mills have withdrawn all old prices.

Basic and foundry grades of pig iron are up 50 cents, Pittsburgh prices being $21.50 for Bessemer, $18.50 for basic, and $19.50 for foundry, f. o. b. valley furnaces, with $1.96 freight to Pittsburgh. The Buffalo market advanced $1.00 practically overnight, and it is thought that further advances may be announced later.

Toronto

April 12, 1922

THE IRON and steel trade continues to show seasonal improvement, but nothing more. The business being closed was expected, and in some cases, dealers claim they looked for a greater volume of orders. However, the average merchant feels he is getting his share. Prices remain firmer, but no increases are as yet reported, following up the recent advance in the States. Competition is too keen to allow for the advance, but another week may see a slight increase, as dealers are selling on a very close margin. Although merchants deny any knowledge of price cutting, there are isolated cases where desirable orders have been taken at reduced prices. Usually this is skillfully covered up, but nevertheless it exists. It is impossible to speak of any line moving better than another as the demand is general. Following are existing quotations:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—The demand for pig iron shows considerable improvement. Small foundries all over the country are showing signs of activity, and as their stocks of pig are exceptionally low, it means that the majority of this business is for immediate delivery. When the coal strike became operative April 1, one large producer of pig iron was fairly swamped with orders for a few days. Evidently users dreaded the possibility of a railroad tie-up as well as a coal strike, and ordered almost recklessly. This panicky feeling has passed, and orders being received are more conservative in character.

The price locally remains the same, $27.15, and if anything an increase, rather than a decrease can be looked for, as prices on the other side have advanced during the week.

Non-Ferrous Metals.—The demand for non-ferrous material remains poor. Prices are stationary, and as long as the consumer stays uninterested, it is doubtful if any change upward or downward will take place. The following table shows present quotations:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	26 00

Scrap Metals.—There is absolutely nothing of importance moving in this section of the market. Nobody wants to buy, and few wish to sell to the dealers, prices offered being so low. In other cases, dealers do not care to stock up further even at low prices, so things remain at a standstill. Present quotations are as follows:

Copper, light, per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools.—This section of the market merely holds its own. Several orders have been closed over the week, but nothing of importance. They are only for small machines, and the total value does not amount to much. An encouraging note, however, is that more

new tools are being asked for than formerly. Second-hand and re-built machines are moving at a fair rate, and while March business was not all that dealers could have wished for, it showed signs of promise. One manufacturer will announce in a few days a 15 per cent. reduction. Enquiries are numerous, and more serious in tone, many dealers feeling that several good things are about to break.

Small Tools and Supplies.—Although this market showed a decided improvement in March over February, the orders received so far this month are discouraging. It is interesting to note, that the average rate of increase in March business over the former month varied from 15 to 20 per cent., with a few exceptions being as high as 26 per cent. Some merchants feel that the remaining days in April will show up to better advantage, but time alone will tell whether their confidence is justified. Drills have dropped about 10 per cent., and keen competition exists.

One firm feels that general business in light machines and small tools shows sufficient signs of promise to justify the placing of two more travelers on the road, and have done so during the week. To show that increases as well as decreases can occur, a Canadian concern announces an increase in the cost of grinding wheels. They claim that the various reductions made from time to time have not been followed up by corresponding labor reductions, so that they now find the margin too fine. Manufacturing costs are so high, they claim, that the increase is absolutely necessary.

Miscellaneous.—The demand for oils and greases, waste, steel pipe, and other general lines remain about the same as last week. Steel pipe shows a very slight improvement, but hardly worth commenting upon. Prices remain firm, and are quoted as follows:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal.	1 35
Linseed oil, raw, single bbls.	1 00

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bls.	1 00

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

Montreal

April 12, 1922

THE MORE or less spotty conditions that have prevailed on this market for the last few weeks continue. Reports are conflicting if taken at their face value, but a number of merchants, visited, say that their March business is better than February. The rate of increase varies, but taking everything into consideration, the trend is upward.

Iron and Steel.—Structural steel is in slightly better demand than for some months past and several large concerns, like the Dominion Bridge Co. and The Canada Car and Foundry Co., have been making a number of enquiries for steel. In fact several orders have been placed. It is believed that the material ordered is for stock. It is known that these firms are figuring on several fairly large jobs, and that the closing of any one would bring them into the market. A satisfactory volume of business has been placed in small lots by contractors, and this helps to swell the total.

Merchant bars are moving a little more freely, and sheets have shown activity during the week. So far, no further news of the railroads coming into the market has been received. Prices have not advanced locally, but viewed in the comparative light of the increases in the United States, it is not unlikely that prices here are due for a slight increase. Local quotations are:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—Although there has been little change in the pig iron situation in the city, the demand from smaller foundries in the surrounding country has been considerably better, and quite a tonnage has been booked. The price remains the same at $29.80 for No. 1 iron. Buffalo producers have booked a large tonnage of iron ore for water shipment, east through the Barge Canal, and west for delivery at lake ports as far as Chicago. The water rates are much lower than rail rates, and many places in New England can get a water rate for $1.50 per ton less than the rail. This additional business is likely to keep Buffalo furnaces busy for some time, and it is quite likely that the small advances in quotations will be followed by further advances. There is every reason to believe that local demand will increase when consumers feel that prices are on the upgrade because of a legitimate demand.

Machine Tools, and Supplies.—Machine tools have not shown any sign of moving yet. The demand for woodworking tools, which has been fair for some time past, is increasing, and a fair amount of business has been done. The recent reduction of ten per cent. on some lines has not been in effect long enough to ascertain to what extent sales have been stimulated. There still appears to be quite a movement in second-hand and re-manufactured tools. These are changing hands at very close figures, and prices have to be shaded considerably before a sale is made.

The small tool and supply business continues to be good. There have been no outstanding features for some time, but prices remain quite firm and the volume of business is gradually increasing. Dealers carrying miscellaneous supplies, such as pumps, valves, and a general line of power transmission are securing good business from sources outside the city. Many rural enterprises such as creameries and cheese factories, that carry on operations in the summer months only, are coming into the market for the season's supplies. In other lines there is the usual seasonal improvement, and on the whole conditions are encouraging.

Non-Ferrous Metals.—Although the non-ferrous metal market in New York and London has indicated a stiffening in practically all metals, there has not been any general upward revision of prices locally. There has been no increased demand, hence no changes have been made. For some time past the small volume of business present in local circles has only been holding its own. Present quotations are as follows:

Lake Copper	16 75
Electric Copper	16 50
Castings, Copper	16 25
Tin	34 50
Spelter	7 25
Lead	6 50
Antimony	6 50
Aluminum	23 00

Scrap Metals.—The demand for scrap metals fell off a little during the week. Manufacturing plants are not picking up very rapidly, and it is difficult to foretell just when conditions will change for the better. Until the larger plants resume operations on a greater scale, little or no improvement can be looked for. Prevailing prices are:

Copper, light per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	7 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	18 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	3 00

Activity along the waterfront has reached its height, and a new season of navigation will soon be opened. This should stimulate the general volume of business.

Pittsburg

April 10, 1922

SPECIAL TO Canadian Machinery.—For the third month this year the monthly report of the American Iron and Steel Institute, giving the March steel ingot output of 30 leading steel producers, has shown a larger output than trade reports during the month would have indicated. The increase has been so rapid that people have been unable to realize the unexpected climb.

In December the rate of production had fallen to a trifle below 20,000,000 tons a year. Rates in the first three months of this year have been as follows: January, 22,750,000 tons; February, 26,850,000 tons; March, 32,550,000 tons. These are equivalent to average rates during the respective months, and as production has been increasing, the rate at the beginning of a month would be under the average and the rate at the close of the month correspondingly above the average. Plotting the figures, it appears that the rate on April 1 was approximately 35,000,000 tons a year. As closely as can be estimated, this 35,000,000 ton rate is equal to the total capacity in existence in 1914, while it is equal to about two-thirds of the present capacity, estimated commonly at 52,500,000 tons, as there has been an increase of about 50 per cent. in capacity since the war started.

Encouraging Increase.—The rapid increase in production is very encouraging to the entire trade, sellers and buyers alike, but at the same time it sounds a note of warning. At the middle of last July the rate was barely over 10,000,000 tons, July as a whole having shown a rate of 11,000,000 tons. It is obvious that actual consumption has not tripled in less than nine months. General business has undoubtedly improved rather steadily, but there could be no such change as indicated by the figures. The extremely low production of last July was explained by buyers of steel being in the act of reducing their stock, and it is just as reasonable to assume that of late they have been replenishing their stocks.

The pace of increase cannot be maintained, for a continuance would in three months, i. e., by the middle of June, bring a rate equal to the record high rate ever seen, and in two months more the entire capacity would be in operation. Underlying conditions are not thus far justifying any such exhibition.

Viewing the matter in another light, experienced observers are practically a unit in asserting that actual consumption is at nothing like a rate commensurate with the production. The conclusion is that buyers have been adding to their stocks. No one criticizes them for that. The buyers have been moved by three considerations: (1) The fact that their stocks were at an unreasonably low level, too low for the efficient conduct of business; (2) The extreme lowness of steel prices; (3) Fear that the coal strike, begun April 1, would interfere with production or shipment of steel.

The very rapid increase in steel production in the past three months therefore is not an argument that production will continue to increase in like manner but rather an indication that soon it will stop increasing, while in summer, when the market is always dull, there will probably be a declining rate in production.

Prices Stiffening.—Steel prices continue to show a stiffening tendency all around. The recent advance in bars and shapes from 1.40c. to 1.50c. has been followed by a similar rise in plates. Probably in some cases 1.50c. is shaded in these three products while on the other hand small orders with mixed specifications generally command a little more than 1.50c.

Most of the wire nails have advanced their prices on nails, staples and barb wire $2 a ton, leaving plain wire and wire fence unchanged. Undoubtedly the advance will be complete in a day or two more, whereupon the market will be as follows: Plain wire, 2.55c.; galvanized wire, 2.75c.; wire nails, 2.50c.; polished staples, 2.55c.; galvanized staples, 3.15c.; painted barb wire, 2.65c.; galvanized barb wire, 3.15c.; wire fence, 68 per cent. off list.

Having entered, at the old prices, all the desirable business offered in sheets, the sheet mills have withdrawn old prices and substituted prices at the $3 a ton advance that it was announced recently would be made. A very heavy tonnage of shipping contracts was entered as buyers generally felt assured they would not lose by covering up to July 1. The new prices are: Blue annealed sheets, 2.40c.; black sheets, 3.15c.; galvanized sheets, 4.15c.; automobile sheets, 4.50c.

The coal strike inaugurated April 1, was practically 100 per cent. effective at the union coal mines. Some trouble was expected at non-union mines, but the strikes prove much more important than was expected. There are not a few strikes in Westmoreland County, including the Irwin gas coal field, and there are some in the Greensburg district and the basin of the Connellsville region. In the lower Connellsville or Klondike region the strikes involve much more than one-half the productive capacity. Practically all the mines along the Monongahala River are out.

This means that mills and furnaces will draw upon their stocks more this month than they had expected to do, for it was thought that the non union production of coal would be very nearly equal to actual consumption. Stocking has been general but not universal. The average merchant furnace, depending on Connellsville coke, did not stock to any extent, and some of these furnaces will in all probability be forced to bank. Some operators are talking high prices for coke, but the furnaces are a unit in asserting that they will not pay over about $3.50, as they cannot afford to do so, while the banking of a few furnaces will help the pig iron market which, they say, has been below cost of production. As a matter of fact basic and foundry grades are up 50 cents already, on the basis of sales made in the past two or three days, the market being quotable at $21.50 for Bessemer, $18.50 for basic and $19.50 for foundry, f. o. b. valley furnaces, with $1.96 freight to Pittsburg. Predictions are that basic and foundry will not stop at these new levels, but will advance another 50 cents, or more, within a very few days. The Buffalo market advanced $1 practically overnight.

ARE PLANNING A HOME PRODUCT EXHIBIT

SPEAKING on trade developments in Edmonton, Alberta, since the start of the year, John Blue, secretary of the board of trade of that city, tells Canadian Machinery that Edmonton business men have come through the winter in very good shape. There have been few failures. Trade has not been so good as was expected; but not because of financial conditions. Coal men have suffered a little because of the extremely mild weather that prevailed during the year.

"We have just closed the Home Building Exposition," says Mr. Blue. "This was a venture on the part of the manufacturers and distributors of building materials, and was regarded as a complete success being visited in the six days by nearly forty thousand people. It has created a considerable interest among the people of the city in building new homes. Building returns so far exceed last year's for the same period."

A number of new manufacturing firms, in a small way, have commenced business, namely: The Roberta Chemical Co.: The Renton Oil Production Co., The Bell Metal Products Co., and the Patricia Pharmacal Co., have extended their operations. The Edmonton board of trade is organizing an Edmonton home products exhibition. It was intended to hold this during horse show week at Easter time, but owing to lack of facilities the matter has been postponed until the summer fair. Arrangements are being completed with the exhibition association to give over a wing of the manufacturers' building exclusively to Edmonton manufactured goods.

"Unemployment has turned the minds of a great many men to manufacturing in a small way," concludes Mr. Blue, "Edmonton has many men who have been industrially trained in the old country and who, through force of circumstances, are turning their hands and their brains to doing something to earn a livelihood, and it seems to me that out of their necessity is bound to grow a considerable industrial development."

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 2 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 00
Castings, copper	16 25	17 00
Tin	34 50	34 50
Spelter	7 25	7 25
Lead	6 50	6 75
Antimony	6 50	6 75
Aluminum	23 00	26 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.80
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 00	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 50	3 50
Medium brass	4 50	4 50
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00
	Per Ton	Gross
Boiler plate	$7 00	$7 00
Heavy melting steel	9 00	10 00
Axles (wrought iron)	17 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	18 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	18 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 25	...
Galvanized sheets, No. 28		5 55
Queen's Head, 28 B.W.G.	7 00	....
Fleur de Lis, 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 30
Linseed oil, raw, single bbls.	1 05

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets, 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored.13
Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

The Kelsey Wheel Co., Windsor, Ont., is in the market for a 175 to 250 h. p. 3 phase motor.

Corr and Garrick, 148 Victoria St., Sarnia, Ont., are in the market for an air compressor.

The Wettlaufer Foundry Co., Mitchell, Ont., is in the market for modern equipment for a proposed foundry.

The B. and L. Laboratories, Aylmer, Ont., is preparing to erect a manufacturing plant in that city.

The Winchester Dye Co., of Trenton Ont., intends investigating Renfrew, Ont., with a view to establishing a branch there.

The E. T. Wright Co., Kelley and Wellington St., Hamilton, Ont., is in the market for drawing press 3½ x 3¾ second-hand preferred.

The Chamber of Commerce announces the establishment of a new factory in London, Ont., for the manufacture of electric furnaces.

A new wing will be built to the Ottawa University at a cost approximating $175,000. The contract has been secured by John Quinlan and Co. of Montreal.

The Frontenac Foundry Co., 388 Cartier St., Montreal, Que., is in the market for equipment for a new foundry on Latailleur St.

The Provincial Paper Mill, Port Arthur, Ont., is in the market for 73 book machines capable of turning out 15 tons of book paper per day.

The McQuay Tanning Co., of Owen Sound, contemplate a large addition to their tannery this season. Several other concerns in the district expect to enlarge their present facilities.

A new high school is to be built at Carleton Place, Ont. Additions will also be made to the existing school. A by-law to raise the necessary money will be submitted to the ratepayers at the earliest possible moment.

The Canada Electric Co., 175 King St. E., Toronto, Ont., have been awarded the contract for electric wiring on a consolidated school being erected at Wellington, Ont., at an estimated cost of $115,000.

Records indicate that a heavy trade has been carried on in lumber by vessels of the Canadian Government Merchant Marine. Reports for the past season show that 188,000,000 feet of lumber was exported from British Columbia to various foreign countries. This is a phenomenal increase over any previous year, the average for several seasons past not exceeding 40,000,000 ft. This business has come from practically all parts of the world.

Mr. C. Little of Robinson, Little Co., 343 Richmond St., London, Ont., plans to build an arena. The cost will be about $150,000. Prices wanted on artificial ice-making equipment.

The following figures show the receipts at the Port of Toronto, Ont., for the last three fiscal years. For the year 1919-20, $43,622,135. For the year 1920-21, $31,490,719. For the year 1921-22, $43,616,887.

The Universal Casket Co., has decided to locate its plant in Welland, Ont. A site has been purchased in Maple Leaf park just outside the city limits. The approximate cost of the factory will be $40,000. It is proposed to employ approximately 200 men.

Erection of four buildings at a cost of $1,500,000 is contained in a request made by the Toronto University to the Provincial Government. This program includes a new forestry and botany building, an administration building, additions to the heating plant and a woman's building.

Dominion Linens, of Guelph, report a big improvement for the past year. It was stated at the recent annual meeting that for the first three months of this year the business showed large increase over a similar period of 1921, and the management anticipate the enlargement of the company's three plants.

The Board of Education of St. Catharines, Ont., B. C. McBride, Secty., 13 Welland Ave., will receive bids until April 11 for a three storey, 175 x 313 ft. school, including a steam heating system with temperature regulators and mechanical equipment, on Geneva St. Cost will be about $600,000.

R. H. Cunningham and Co., industrial furnace engineers, of Walkerville, Ont., have secured temporary premises at 351 Glebe St. As there is a large demand for the type of furnace manufactured by Cunningham and Co. their output for some time is already disposed of and will provide work for a good many men.

The Board of Education at a meeting held recently at Peterboro, Ont. took another step towards building an addition to the collegiate institute, to not only provide greater high school accommodation, but also provide room for technical instruction, by appointing a committee to engage an architect to bring in the plans.

The volume of contemplated new work reported in Canada during March amounts to $23,753,100. Business buildings amounted to $5,267,200. or 39 per cent. of the total; industrial building $260,000,000, or 1.9 per cent. A significant feature of the March construction record is the increase in business building over February.

Arrangements are well advanced for the establishment of the London Bridge Company in London, Ont. Premises are being rented temporarily and no time will be lost in getting ready for the work of fabricating steel. This plant will form a valuable addition to London metal working industries and may be an important factor in securing of other metal working plants at this centre.

The Niagara River Bridge Co., owner of the cantilever bridge which crosses the Niagara River, announces that a new bridge will be built this year. An application to parliament will be made at the present session to increase the capital for that purpose. The old bridge which will be used until the new one decided on is completed. The bridge is used exclusively by the raiload.

L. H. Laythe, sales manager of the Butterfield Co., Rock Island, Que. stated to Canadian Machinery that the month of March 1922 was the best in the history of their business. This is all the more surprising due to the fact that they had a very bad time in the last year and a half. They are manufacturers of twist drills and similar tools.

A woodworking company of moderate size located in Toronto has made negotiations with the industrial committee of the city council of Galt, Ont. relative to the plant being moved there. The company in question is stated to be located in cramped quarters in Toronto and is looking elsewhere with a view to expansion. The company's proposition was placed before the board of trade and the city council of Galt two or three days ago.

The Renfrew Creamery is having its present refrigeration capacity doubled owing to the increase in cream business. The Linde Canadian Refrigeration Co., of Montreal, the same firm that installed the system is making the addition. During the year 1921, the creamery put out nearly a quarter of a million pounds of butter and 13,000 gallons of ice cream. The staff has also been considerably increased.

At present there is a movement on foot among business and industrial men in Italy for promoting better trade relations between Canada and that country. It has been suggested that an Italo-Canadian consortium be created to develop the relations between the two countries and it has been advised that yearly exhibits of Italian products be held in Toronto. The consortium which was appointed includes Signori Luigi Rossi, of the Italian Trade Department; William Clarke, Sir Charles Gordon, of Montreal, who is representing Canada at the Genoa Conference; Signori Padgetti, representing the Canadian Pacific Railway, and Cavalier Riccardi, Italian Consul at Montreal

Mr. Neilson, a representative of the Renfrew Refrigerating Co., Limited, Renfrew, Ont., has reported that their factory has been working at full capacity for some time and that the entire output is sold. We understand that they will not be able to take orders for quite some time until a good advancement is made in their output which is being increased every day. This firm manufacture Barnet Refrigerators.

A statement of the cost of the new filtration plant purchased by the Utilities Commission of Peterboro, Ont., showed that $25,000 has been saved in its construction, an unusual occurrence in municipal works in that city. Of the $350,000 appropriated by these people, only $325,000 has been spent. In laying the pipe lines themselves the commission saved over $10,000. The plant is now in full operation and the condition of the water is much improved.

An encouraging note was sounded the other day with the announcement that a Brantford roofing company has taken on its entire staff, full time, after being on a half time schedule. Regular business from all parts of Canada was stated by the president as the reason for the increase. He took it that the orders coming in were evidence of a revival of building and of reconstruction and replacement work throughout the Dominion as a whole, for no one section was carrying the load.

The English Electric Co., of Canada, which was organized in August of last year, and has taken over the St. Catharines plant of the Canadian Crocker-Wheeler Co., has just completed an order for traction equipment. Tests have been applied and it is understood that the work has been in every way satisfactory. The new equipment is founded on the designs and models owned by the parent company, the English Electric Co., that has been entirely made in Canada of Canadian materials.

As soon as the weather allows, work on a large scale will be commenced on section one and two of the Welland canal, which contracts are in the hands of Porter Bros. At present the Canal zone is very muddy, and work is being carried on with difficulty. Section three at Thorold, Ont., is under Government contract, but it is believed that this section and those about Thorold will soon be let to private contractors. A large amount of rock excavation is done on the Thorold section, which is the most expensive section on the whole water works.

Building activity in Ottawa promises to be considerably increased this summer if the permits taken out during the past month are any criterion. Some 80 permits were taken out as compared with the 45 issued in the corresponding month last year. Of these 24 are for buildings having an estimated valuation of $3,000 or more each. Largest is for an apartment house to be erected on Chapel street by Mrs. E. Roquet at a cost of $15,000. Mr. A. Lowe is to erect stores on Bank street costing $12,000 and the Salvation Army will spend $4,000 on an extension to its social center.

The Dexter Lock Co., of Canada, is the new organization that has been formed to manufacture patent door locks in Hamilton similar to those produced by the National Brass Co., of Grand Rapids, Mich. The location of the industry was announced last week by C. W. Kirkpatrick, Hamilton, Commissioner of Industries. The new company have secured premises formerly occupied by the National Machinery and Supply Co. The Hamilton company have secured the Canadian and British Empire rights for the line of products in question. O. W. Cook the president and manager of the new company, was formerly connected with the Canadian Cartridge Co. Production will commence as soon as equipment can be installed. Fifty workers will be employed at the outset.

Contractors and builders in Pembroke, Ont., state that during this coming season close on to a million dollars will be spent in that city. Part will go to erecting stores and places of business in the gaps left by the great fire of 1918, which destroyed much of the business section of the town. Owing to the high cost of building these were not replaced, but contracts have recently been given for business places to be built in these vacancies. This is only one of the many indications that Pembroke real estate men and builders expect the coming season to be an unusually busy one. Considering the population of this city is only 7,600 the above figure may be considered as being quite a substantial one.

The Marconi Co. of Canada, announce they will shortly install apparatus on the roof of the Canada Cement Building, Phillips Square, Montreal, for the "broadcasting," of messages, replacing the present installation at their plant. The change being made owing to the superior advantage of the greater elevation of the Canada Cement building. The company is also beginning the manufacture of individual wireless sets in response to the tremendous demand for same that is springing up with the prospects of a popular trade at the present moment. It is expected they will be turning out 10 sets a day within a few weeks.

Mr. Claire Mussen, president of Mussens Ltd., Montreal, Que., was given a tremendous ovation on his appearance at the Rotary Club meeting held in Montreal, this week, the first since the recent spectacular announcement of the press that Mussens Limited, after seven years of honorable effort had paid over 100 cents on the dollar to their creditors following the liquidation of the company early in the war. The announcement has aroused wide-spread interest in Montreal, and Mr. Mussen has been the recipient of congratulations on every side for such a satisfactory conclusion of the previous difficulties of the firm at a time when the tendency in general has been towards further liquidation, rather than the reverse as in the case of Mussens Limited.

The Electric Steel and Metals Ltd., plant at Welland has been sold. After weeks of negotiation a deal has been finally closed, and the plant bought outright by a large concern in the United States. The total amount of money involved in the purchase will be well over a half million dollars. This includes the purchase price and an allowance for certain new constructions planned for in the near future. It is understood that the new company is a wealthy one, and in a position to enlarge and improve the plant just as soon as the steel market warrants it. It is expected that for a time, part of the equipment now installed, will be used, but that eventually the whole place will be revolutionized. An addition will be erected for new machinery. It is anticipated that much of the output of the new mill will be exported. It was for this reason, largely, that the site of the Electric Steel was chosen. It is planned to build a large sized wharf on the new and large canal, where steel may be shipped direct from Canada by boat.

Compared to present day stagnation in industrial activity in many cities, Fort William's industrial section in the west end of the city shows considerable animation, and as the warm weather approaches activity will increase. Among the big plants in active operation there are the Canadian Car and Foundry Co., the Fort William Pulp and Paper Co., the Canadian Iron Corp., various grain elevators, and the Barnett and McQueen Co., who have under construction upon the north bank of the Kaministiquia River a two million bushel concrete addition to the north western elevator. Good progress is being made at the big plant of the Canadian Car and Foundry Co., where over 450 men are employed repairing railway cars for the Canadian Government Railways. The new plant of the Fort William Paper Co., at the mission is just about the most active location in the city. It is running to utmost capacity and three shifts of employees consisting of over 200 men are employed night and day. Lack of orders has forced the Canada Iron Corp. to cut their working staff down to 90 and to only operate 4 days a week. The big factory is employed now in the manufacture of car wheels, but in a short time a start will be made in the manufacture of iron pipe for stock purposes and the staff will be increased to 140 and the working days extended to the full week.

H. H. Camp of the Steel Co. of Canada, Hamilton, Ont., says that while business in the heavier lines is not picking up very much as yet, the lighter material is selling better. Pig iron demand has strengthened quite a bit, and foundries generally seem to be improving.

Where To Buy Your CASTINGS

The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.,
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron and Semi-Steel Castings up to 10 Tons.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze and Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Contract Repetition Work, Grey Iron, Semi-Steel, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

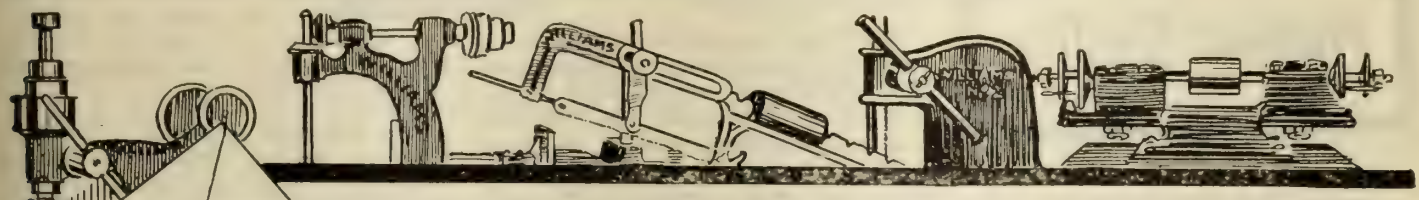
The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

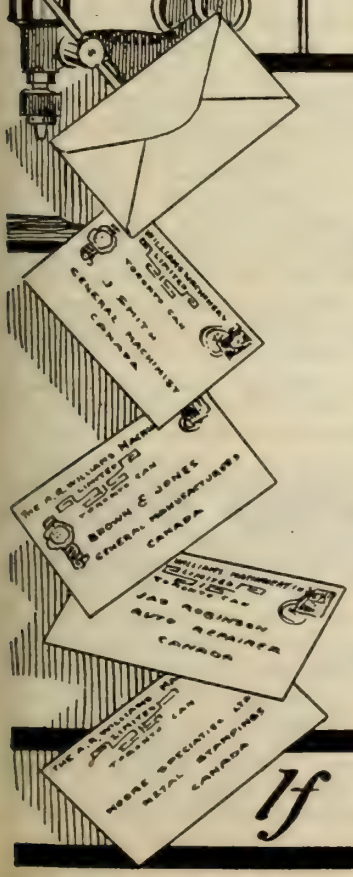
Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning Grey Iron a Specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
We make a specialty of Light Grey Iron Castings.





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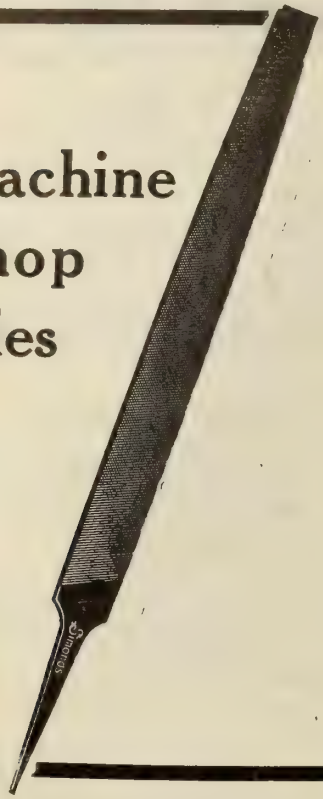
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64 Front Street W., TORONTO
HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

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Highest Quality

Good files are as necessary in a machine shop as any other tool—In fact, files like Simonds are really essential for smooth work. All Simonds Files are made absolutely uniform and hold their cutting edge longer.

Mechanics should try Simonds Machine Shop Files.

Simonds Canada Saw Co., Limited

Montreal, Que.

St. John, N.B. Vancouver, B.C.

The steamer Britannic, well known on the St. Lawrence, is being overhauled and refitted by the Montreal and Cornwall Navigation Co.

Navigation opened at Kingston on Wednesday when the steamer Wolfe Islander cleared for Wolfe Island to commence her regular schedule.

The steamer Colin W. of the Webster Line, which has traded for many years along the St. Lawrence, is being converted into a fuel oil lighter to be used in Montreal Harbor.

A large staff of men are engaged in the work of repairing vessels that wintered at Cornwall. The twenty-six craft there will be ready for the season's operation within a few weeks.

The Dunn Motor Works of Ogdensburg are in receipt of an order from the Pacific Orient Co. of Bangkok, Siam, for a two-ton shipment of their motors.

The Essex County Health Association is asking for tenders on the construction of a $150,000 hospital on Prince Road, Sandwich, Ont. The building will house tuberculosis patients of the county. Cameron and Ralston of Windsor are the architects.

The Bell Telephone Co. has started the erection of an exchange in Walkerville, Ont., at Lincoln Road and Huron Street, to cost in the neighborhood of $100,000. Up to date the Windsor exchange has been handling the service for all the Border Cities.

The Prince Edward, the United Hotel Company's new 10 story, $2.500,000 hotel at Windsor, Ont.. will be ready to receive guests by June 1, 1922, according to a recent announcement by the management. Neville P. Mowatt of Flint, Mich., has been appointed local manager.

Jones & Glassco Reg'd. of Montreal and Toronto, have been appointed the sole Canadian agents for the Unchokeable Pump Ltd. of London, Eng. The Unchokeable Pump is constructed on the centrifugal principle, but so designed that fibrous solids, skins, sacking, etc., will pass through it without difficulty.

The navigation season on the St. Lawrence will probably open about the 24th of this month, according to an announcement by officials of the Canada Steamship Lines. The Toronto-Hamilton Montreal service will commence on April 20. The City of Hamilton and City of Ottawa have been assigned to this route.

Work on the four steel freighters for the George Hall Coal and Transportation Co., now being built on the yard of the Tidewater Shipbuilding Co. at Three Rivers, is proceeding satisfactorily. These boats are 260 ft. long, 44 ft. beam and 21 ft. moulded depth. Their canal capacity will be 2,500 tons in addition to bunker fuel. Five hundred men are employed on the construction of the vessels.

Building prospects in and around Ottawa are particularly bright. Permits for the year to date total about half a million dollars, an advance of approximately $82,000 over this time last year. The bulk of this is for private dwellings and stores but some industrial work is included. Business in Hull is also brighter, with the promise of a good season ahead.

Mr. Skelton, vice-president of the National Steel Car Co. mentioned to Canadian Machinery a few days ago, that the truck business is picking up remarkably well. He says that orders are coming in more freely, and that the majority are for quick delivery. In fact a truck ordered for Vancouver was in such a hurry that test inspectors worked on it all night, even to test runs in order to speed up shipment. They expect to take on some further help in this department in the near future.

A. F. Healy of Windsor, Ont., has taken over the financing of the Detroit River Bridge. R. T. Scott has resigned the presidency of the R. T. Scott Company, Ltd., organized to sell the bonds of the Canadian Transit Co. and American Transit Co., and Mr. Healy is applying to the government to change the name to the A. F. Healy Company, Ltd. Mr. Healy is a director of both transit companies and of the Scott Company. Borings to locate the foundations of the bridge are still being taken but it is expected that the definite location of the bridge will be determined this month.

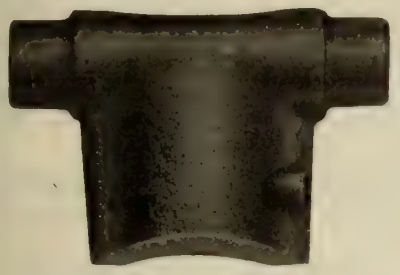
The Hamilton Foundry, Hamilton, Ont., are finding conditions somewhat improved. Orders from local factories are becoming more numerous, and while the quantity ordered is not very heavy, the total tonnage is increasing. Prices however are rather low, a very small margin of profit being allowed. In some cases, business is being taken at cost in order to keep the foundry going. So far no men have been let out, and it is very unlikely that this will occur now, for things seem to be improving slightly every week.

H. R. Williams, manager of the Beaver Truck Corporation, Hamilton, tells Canadian Machinery that business is picking up in a remarkable manner. He says that at the present time they have more enquiries on hand than they can comfortably handle, and that by next week they should be running in full swing. Almost double the volume of business over the boom period is marked on the books for quick shipment, and Mr. Williams says they look for a record year, as many manufacturers have put off buying as long as they could, but are now finding they absolutely require better truck facilities if they are going to keep in the swim.

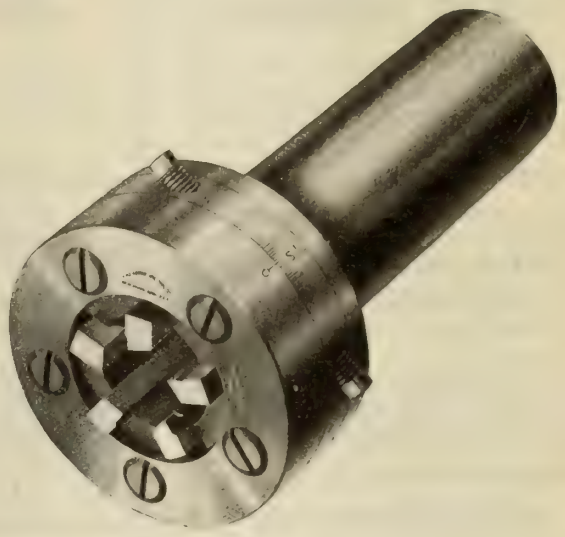
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Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.

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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

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MECHANICAL ENGINEER IS OPEN TO consider partnership or interest with manufacturer with a view to producing new high grade lines of engineering equipment. Must have good reputation and manufacturing facilities. Box 808, Canadian Machinery. (C.16M.)

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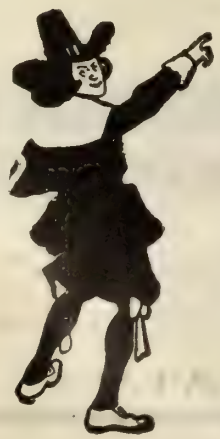
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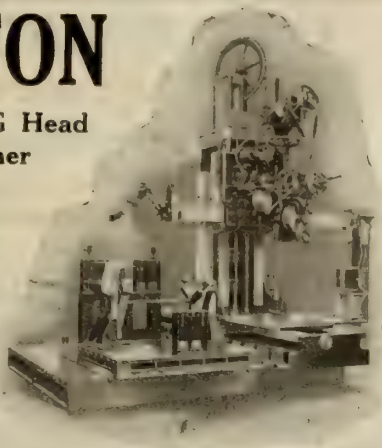
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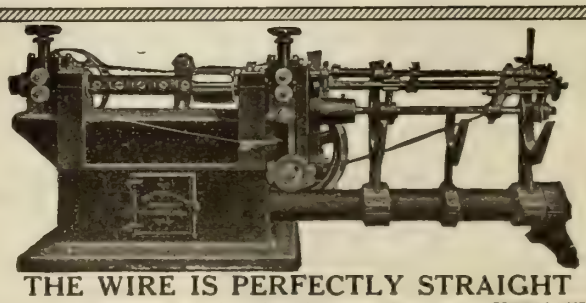
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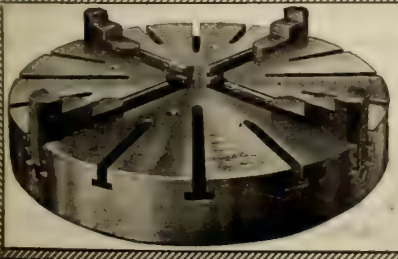
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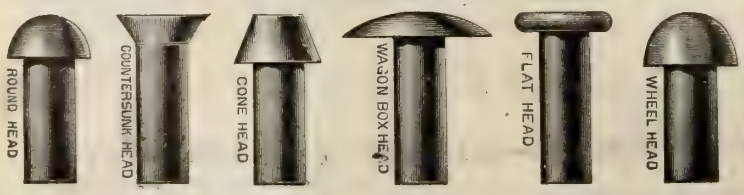
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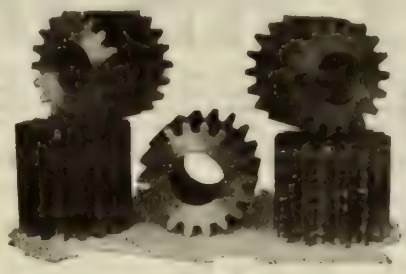
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FOR CLASSIFIED SECTION TURN TO PAGE 46

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Boring, Drilling and Milling Machines, Horizontal
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Can. Fairbanks-Morse Co., Ltd., Montreal.
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Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

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Canada Metal Co., Ltd., Toronto, Ont.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
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Steel Co. of Canada, Ltd., Hamilton, Ont.

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Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

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Canada Foundries & Forgings Co., Welland, Ont.
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Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
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National Acme Co., Cleveland, Ohio.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont.

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N.Y.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Castings, Aluminum, Brass, Bronze, Copper, Die-Molded, Ferro-Alloy, Iron, Semi-Steel, Steel.
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Brown-Boggs & Co., Ltd., Hamilton, Ont.
Canada Metal Co., Toronto, Ont.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Can. Rumley Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Ltd., Toronto, Ont.
Dominion Engineering Works, Ltd., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Fittings, Limited, Oshawa, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn, Limited, John T.
Hull Iron & Steel Foundries, Hull, Que.
International Malleable Iron Co., Galt,
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Langley & Austin, Galt, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Mitchell Co., Robt., Montreal, Que.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Sully Brass Foundry Co., Toronto, Ont. Ont.
Tallman Brass & Metal, Ltd.
Wells, W. W., Toronto, Ont.

Chains (See Sprockets and Chains)
Falls, Ont.
Morse Chain Co., Ithaca, N.Y.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn. Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

BUYERS' DIRECTORY

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks,
Chicago Watchman's Clock Co., Chicago, Ill.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Limited, Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Hand (See Hoists, Hand)
Dominion Bridge Co., Ltd., Lachine, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Petrie, Ltd., H. W., Toronto, Ont.

Deckle Straps
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Die Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drilling Machines, Bench
Burke Machine Tool Co., Conneau Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Williams Machinery & Supply Co., A. R., Montreal, Que.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montrea
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co. New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Walker Twist Drill Co., Walkerville, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Northern Electric Co., Montreal, Que.
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Equipment, Elevator Safety
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Norton Co. of Can., Ltd., Hamilton, Ont. Montreal, Canada.

Engines, Capstan
Goldie & McCulloch Co., Ltd., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Beslofson Elevator Co., Galt, Ont.

BUYERS' DIRECTORY

Fire Extinguishers
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings, Limited, Oshawa, Ont.

Flexible Shafts
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
McDougall Co., Ltd., E., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H., Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Thread
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Limited, Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John. Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., E., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Generators, Electric
Northern Electric Co., Montreal, Que.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., E., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Wheels
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co. of Can., Ltd., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John. Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hose, Rubber
Can. Consolidated Rubber Co., Ltd. Montreal, Que.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John Dundas, Ont.
Dominion Engineering Works, Limited Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Bilton Machine Co., Bridgeport, Conn.
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Kalves, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Kmrl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lamps, Electric
Northern Electric Co., Montreal, Que.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Polishing (See Polishing and Buffing Machines)

Lathes, Railwing
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Cowan Co. of Galt, Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
m.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence,
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Vertical
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Monel Metal
International Nickel Co. of Can., Ltd., Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Moulded Rubber Goods
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nickel, Bars, Sheets, Wire, Etc.
International Nickel Co. of Can., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Hydraulic
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Pattern Shop Equipment
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia Pa
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Crane Ltd., Montreal, Que
Jardine & Co., A. B., Hespeler, Ont
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Limited, Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools
Crane, Ltd., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
J. R. Baxter & Co., Ltd., Montreal, Que.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. B., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que.

Reamers, Expanding
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Limited, Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BUYERS' DIRECTORY

Rolling Mill Equipment
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Rubber Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Machinery Makers
Can. Consolidated Rubber Co., Ltd., Rubber Machinery Shops, Kitchener, Ont.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto,

Saw Frames and Blades, Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.
Preston Woodworking Machinery Co.,

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Leg
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R.I.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co.
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Resist, Alloy
International Nickel Co. of Can., Ltd., Toronto, Ont.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Can. Consolidated Rubber Co., Rubber
Crescent Machine Co., Ltd., Montreal, Q.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Mans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

BUYERS' DIRECTORY

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Tachometers
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co. of Canada, Ltd., Toronto, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H. Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill
Bertrams Ltd., Edinburgh, Scotland
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Truing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto Ont.

Tool Work
Brown Engineering Corp., Ltd., Toronto

Torches, Blow
National Electric Products, Ltd., Toronto Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glasco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Mon

Unions, Pipe
Crane Ltd., Montreal, Que.
Fittings, Limited, Oshawa, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
National Electric Products Co., Ltd.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Davis-Bournonville Co., Jersey City, N J
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
National Electric Products Co., Ltd.

Welding Machines, Oxy-Acetylene
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electric Products Co., Ltd.

Welding, Electric
McLaren Belting Co., J. C., Montreal Que.
Steel Co. of Canada, Ltd., Hamilton, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electric Products Co., Ltd.

Welding Supplies
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electric Products Co., Ltd.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stopleg
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Shuster Co., F. B., New Haven, Conn.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electric Products, Ltd., Toronto Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery Co., A. R., Toronto Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co Montreal, Que.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

HANNA

HANNA

GUTTA PERCHA & RUBBER, LIMITED
TRADE P.M.S MARK
TORONTO, CANADA

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Is Just Around the Corner

Favorable indications of improved business mean that you will soon want every minute at your factory to be filled with a full sixty seconds of production. You will begrudge every second spent in adjustments or in overhauling machinery and belting. Remember the money-making value of reliable, efficient belting—"P.M.S" Belting!

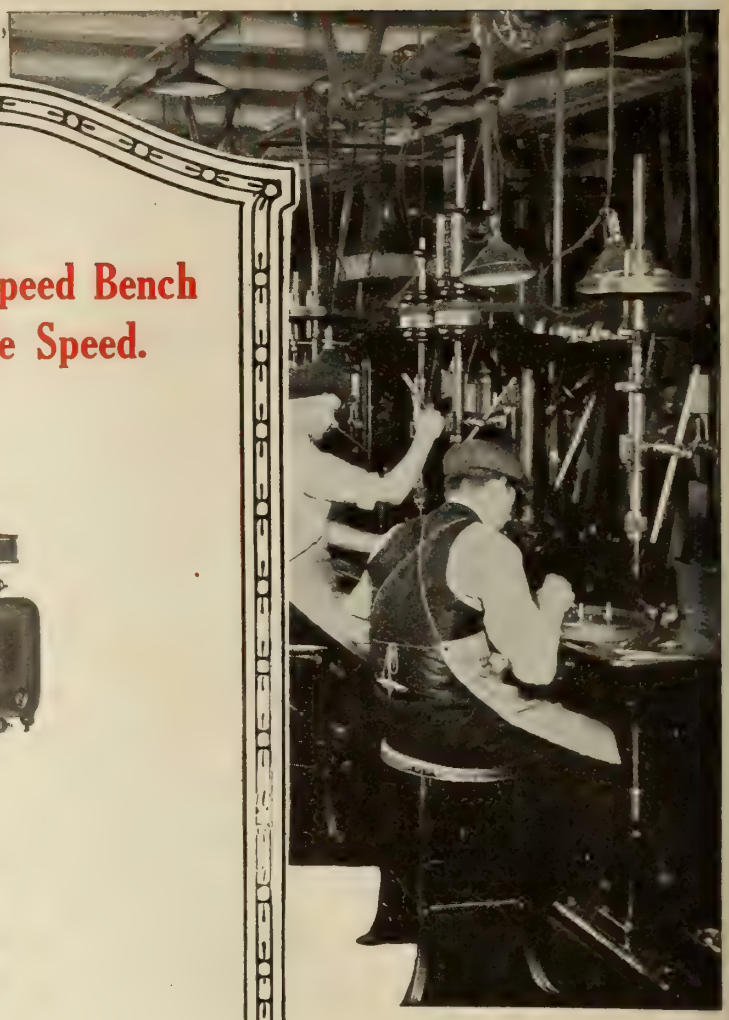
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This is the very thing to get your transmission into reliable, dependable shape. "P.M.S" Belting is made of the toughest and strongest Sea Island cotton fabric; extra heavy, and rubberized to make it non-slip and moisture-proof. "P.M.S" Belting is proof against Heat, Cold, Wet or Dry conditions.

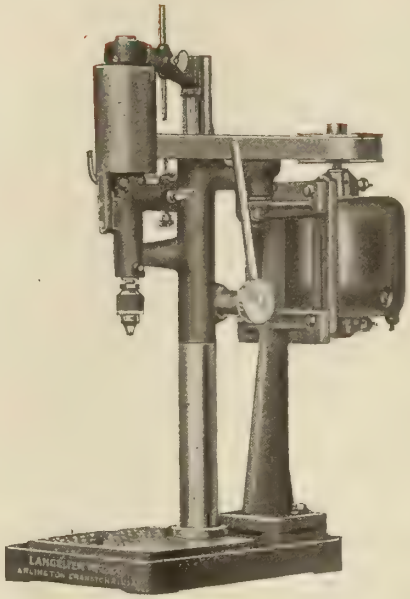
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Head Offices and Factory, Toronto

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No. 1 Motor Driven Single Speed Bench Drill 8,500 R.P.M. Spindle Speed.



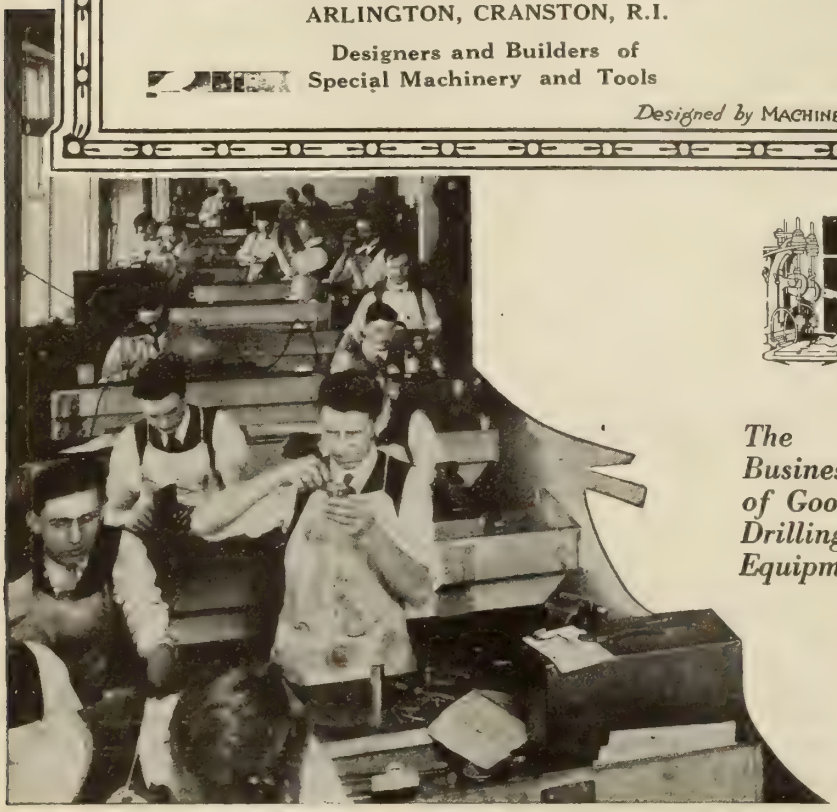
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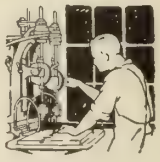
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Designers and Builders of
Special Machinery and Tools

Designed by MACHINERY





Jacobs Quality Chucks

The Business End of Good Drilling Equipment



CANADIAN MACHINERY
and MANUFACTURING NEWS

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READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

BERTRAM
MACHINE TOOLS

18-inch Crank Slotting Machine

A. C. Motor Drive Through Speed Box

10 H.P. Motor—1,000 R.P.M.

The John Bertram & Sons Co., Limited
Dundas, Ontario

MONTREAL
723 Drummond Bldg.
VANCOUVER
609 Bank of Ottawa Bldg.
WALKERVILLE
103½ Sandwich St.

TORONTO
32 Front St. W.
WINNIPEG
1205 McArthur Bldg.
HALIFAX
Roy Building



Merit Keeps Them On The Job

ON HEAVY tapping like this, P & W Staybolt Taps show their quality. They bite into the work with a precision and ease that makes them favorites with the men who use them.

They are not only good when new, but are heat treated and seasoned to maintain this goodness. That's why you'll find them still on the job when others "just as good" are in the scrap pile.

PRATT & WHITNEY STAYBOLT TAPS

To meet all your boiler requirements, we build P & W Staybolt Taps in five standard styles, as well as Spindle Staybolt Taps with and without threaded end and also Combined Reamer and Tap to tap continuous hole in the reamer hole of the far boiler plate.

Our reputation for precision and high quality stands behind these tools. Buy them in any of the styles and sizes listed in our Small Tool catalogue which is yours for the asking.

These taps and our complete line of Small Tools are on sale at our offices in Boston, Philadelphia, Birmingham, Rochester, Cleveland, Detroit, St. Louis, Cincinnati, Seattle, St. Paul, New Orleans, San Francisco.

PRATT & WHITNEY COMPANY OF CANADA, LIMITED

Work: Dundas, Ontario

MONTREAL
723 Drummond Bldg.

HALIFAX
Roy Building

TORONTO
32 Front St. West

WALKERVILLE
103½ Sandwich St.

WINNIPEG
1205 McArthur Bldg.

VANCOUVER
B. C. Equipment Co.



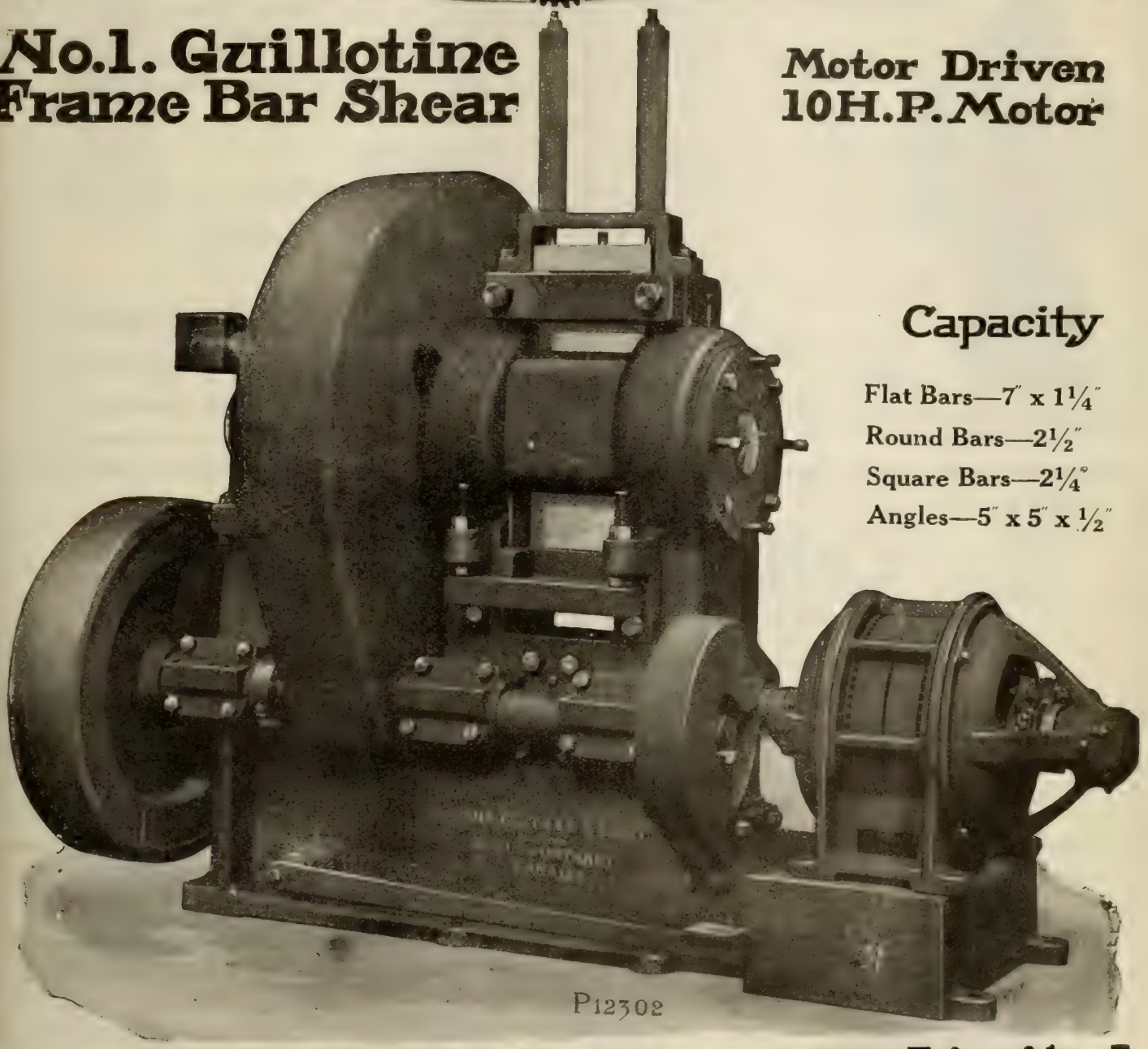
The BERTRAM Page

MACHINE TOOLS

J.B.&S.Co.

No.1. Guillotine Frame Bar Shear

Motor Driven 10H.P.Motor



P12302

Capacity

Flat Bars—7″ x 1¼″
Round Bars—2½″
Square Bars—2¼″
Angles—5″ x 5″ x ½″

The John Bertram & Sons Co., Limited

DUNDAS. ONTARIO. CANADA.

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Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. **Write.**

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Hartford, Conn.

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temperature instruments

We are always ready to apply our knowledge and experience to the solving of temperature difficulties.

What is YOUR Problem ? ? ?

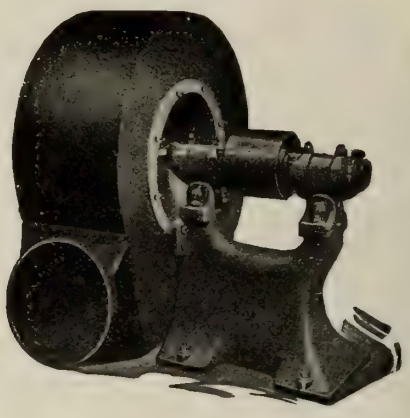
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Taylor Instrument Companies
110 Church St., Toronto

Theres a *Tycos* and *Taylor* temperature instrument for every purpose

"CANADIAN" MILL EXHAUSTERS

Handle Any Material



The Canadian Standard Mill Exhauster will handle any kind of material efficiently—sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc:



They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

Catalog 410-77—gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co., Ltd.

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The Name "RAYMOND" Protects You

By always insisting on RAYMOND better-built Springs you get the long service that comes from expert heat treating facilities and modern testing and laboratory equipment. All shapes and sizes of Springs in Carbon Steel, Vanadium Steel Brass and Phosphor Bronze.



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I made **Harris Heavy Pressure** Bearing Metal before you were born. It will wear out two, three or four other so-called just as good Babbitt Metals, and we only ask a reasonable price—a very cheap one—considering the care, responsibility and service we guarantee.

Send for a box. Its Copper Coat, High Tin and Clean Close Grain will appeal to you. You want advice. Please take this. There is no better all round Babbitt Metal in the world. You would trust us for anything we wanted to buy from you.

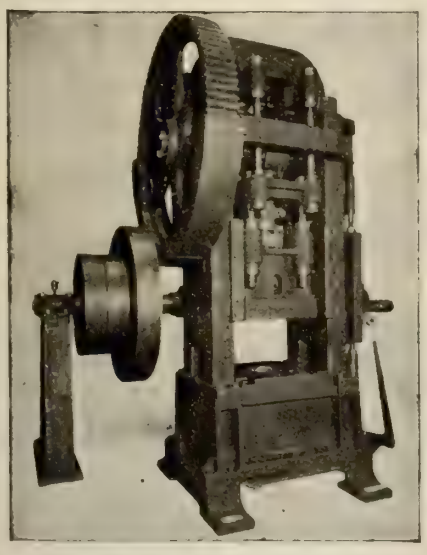


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TORONTO WINNIPEG HAMILTON VANCOUVER MONTREAL

SHEET METAL WORKING MACHINERY

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Bliss Cam Drawing Press

Bliss Cam Drawing Presses

Bliss Cam Drawing Presses are built in a large number of sizes with both straight side and overhanging frames. Weight 750 to 38,000 lbs.

They are specially adapted for cutting and cupping articles made of heavy stock such as gongs, telephone cup stampings, oilers, heavy ferrules, hub flanges, fork and handle cups, crank hangers, seat lugs, post tees, etc., etc.

Write stating your requirements, there is a size that meets them.

"For Efficiency and Economy"

"Specify Bliss Presses"

"Standard the World over"

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No 200

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TORONTO, CANADA

A Chain is as Strong as the Weakest Link—
Your Power is No Stronger than its Weakest Belt

If defective belts mean loss of power that is costly to develop, it pays to have Belting that is absolutely dependable and that is efficient in transmitting every dollar's worth of power produced.

An enviable reputation for those very qualifications has been established by

"P.M.S" BELTING

Manufactured Exclusively by

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Branches in all Leading Canadian Cities



Regrinding is Vital to Continuous Truck Operation

Trucks that pile up heavy gas and oil bills, that show a lack of pep on grades or in heavy going, that smoke and knock, are laboring under faulty cylinder conditions. Such vehicles should be hauled off the road, have their power plants knocked down and a thorough inspection made of their cylinder bores.

In nine out of ten cases the cylinders will be found scored and out of round.

This results in far too much clearance between cylinder walls and piston rings and permits gas to escape into the crank case and oil to work up into the combustion chamber.

Trucks are usually worked to full capacity over long shifts. They are required to make hauls that "bleed" them to their last ounce of energy.

Therefore, they should have their cylinders reground and be fitted with new oversize pistons, rings and wrist pins at least once each year.

Regrinding proves to be as economical to the owner of the single car as to the operator of the fleet.

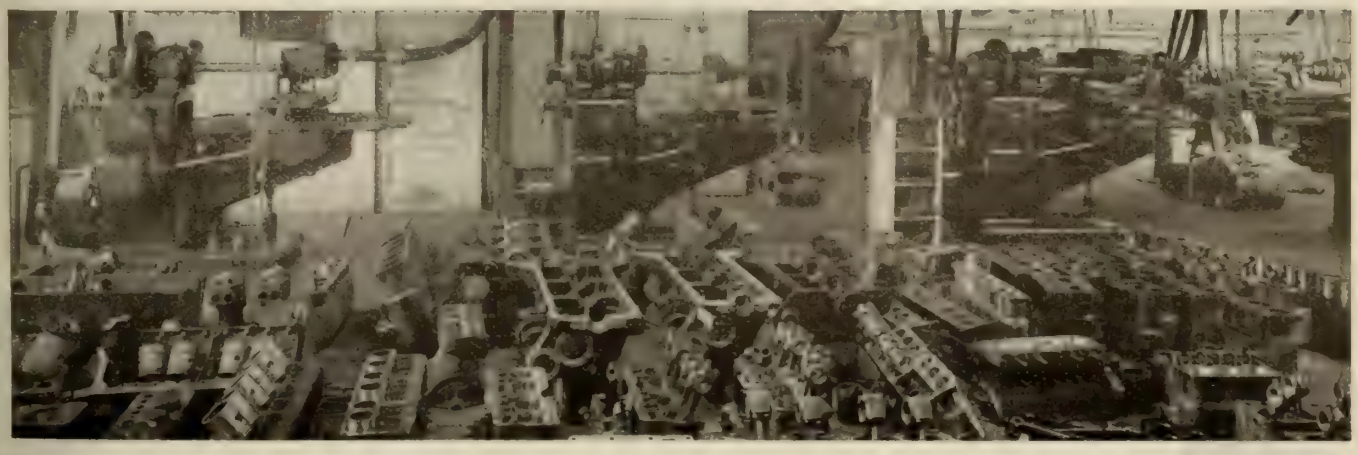
Scores of garage, service station and small machine and repair shop owners have noted the growing demand for ground cylinder bores and have turned to the Heald Cylinder Grinder as an able aid in gaining their share of the business with astounding results.

The Heald will handle all sizes and classes of work quickly and conveniently. To-day you may have a hole 2⅜ in. in diameter by 11 in. long in a part weighing only a few pounds. To-morrow one 8 in. in diameter by 18 in. long in a casting weighing 600 or 800 pounds.

The Style No. 55 is simple, moderately priced, self-contained and has a very large capacity and range, easily taking care of all styles and sizes of blocks. Many just going into the regrinding business are purchasing this machine. Let us give you facts and figures. Establish a business that has nothing to do but grow.

THE HEALD MACHINE COMPANY

51 New Bond Street **Worcester, Mass.**







Better Tools Make Better Workmen !

And there are no better tools of their kind than WILLIAMS' Superior Drop-Forged Hammers. All kinds, all sizes.

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(ELECTROLYTIC)

National Electro Products Limited is the largest manufacturer of Electrolytic (pure) Oxygen and Hydrogen in Canada.

WE PRODUCE GASES EXCLUSIVELY BY ELECTROLYTIC DECOMPOSITION OF WATER. We are, therefore, in a position to furnish Oxygen and Hydrogen far superior to like gases made by any other process.

After Exhaustive Tests We Have Decided to Handle The Well-Known

The Torch for Welders OXYGEN PUROX HYDROGEN Who Want the Best !

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Our entire organization—technical and sales—is always at your service.

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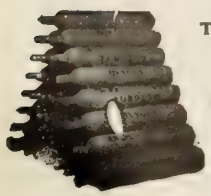
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When you order "Liquid Air" Oxygen or Dissolved Acetylene it is delivered to you at the very time you want it delivered, with no exorbitant costs added for freight or long distance haulage. This is only made possible by "Liquid Air" chain of factories situated at convenient centres all over Canada, operating in conjunction with service stations situated at a point in your own immediate neighborhood.
Wherever your plant or workshop is situated you have a constant supply of Oxygen and Acetylene immediately available and Liquid Air service demonstrators are at your disposal at all times to help and advise you on all matters pertaining to the Oxy-Acetylene Process.
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LIQUID AIR Co
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THE JOHNSON FRICTION CLUTCH

As Used on the

TURNER TURRET →

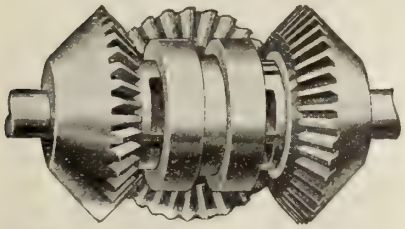


One in the back gears. Another in the tapping reverse.

Size used, No. 5 special double.

"Friction Control" means better machinery.

Courtesy of The Turner Machine Company Danbury, Conn.



Johnson double clutch between bevel gearing.

There is nothing more essential to the efficiency of a machine than a dependable friction clutch. Use the Johnson and take no chances.

Write for our Yellow Catalog and Booklet, "Clutches as Applied to Machine Building"

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
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QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

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Hull Iron and Steel

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Steel, Chrome, Manganese and Nickel Steel Castings

Annealed and Unannealed

Cement Mill and Mining Machinery Castings, Stamp Mills, Crushing Plants, Excavating Outfits, Steel Car Wheels, Locomotive Driving Wheels and Frames, etc.



Machine-Moulded Gears

"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber is something to be considered.

Specify "HISCO" Products

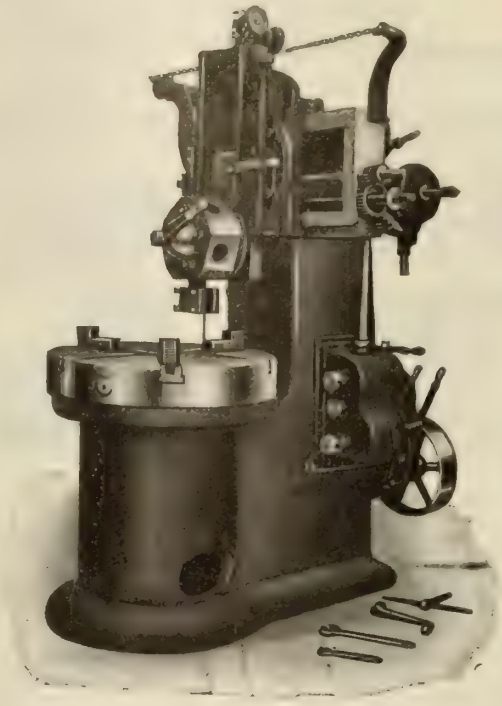
Petrie Expert Service Will Save You Money

Tell Us Your Troubles

Fifty years of experience in meeting the requirements of the machinery trade of Canada is back of the Petrie Service.

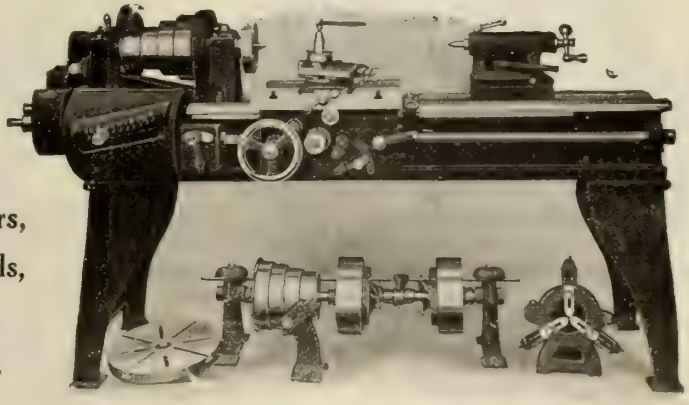
There is no machinery or supply requirement of the machine shop that we cannot fill, promptly and efficiently, from our immense stocks occupying 130,000 feet of floor space.

In addition, our organization includes a staff of experts specially trained to handle any problem that may arise in the shop. The benefit of their experience is at your disposal without obligations. Why not put your problems up to them, it may mean big savings to you.



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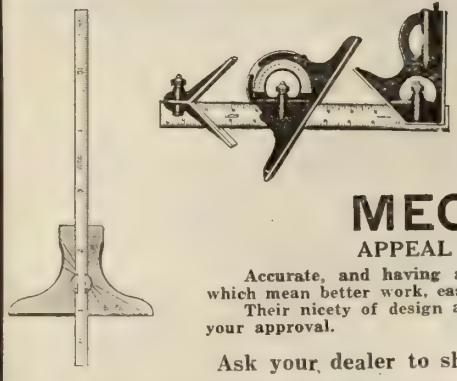


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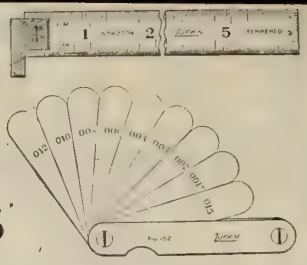
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H.W. PETRIE

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LUFKIN RELIABLE MECHANICS' TOOLS





APPEAL TO EVERY PROGRESSIVE MECHANIC

Accurate, and having all the other essential qualities of precision tools; also many improvements which mean better work, easier done.

Their nicety of design and finish appeal to the eye. Their performance day in and day out will hold your approval.

Ask your dealer to show you a LUFKIN Send for Catalogue of Mechanics' Tools.

THE LUFKIN RULE CO. OF CANADA, LTD. WINDSOR, ONT.

PARKER VISES Are Reinforced



They "GRIP LIKE A GRIZZLY"

A solid steel strengthening bar cast into the slide the full length gives added strength and makes the slide nearly indestructible.

Built strong enough to stand up under ordinary use and then reinforced to withstand overstrain and abuse—that's one reason why Parker Vises have been making good for 80 years.

Renewable jaws, semi-steel castings, patented swivel base, set screw and spring in handle, extra strong screw and nut, are some other reasons.



One of the "70"

Get the Whole Story in Folder No. 12.

The Charles Parker Co.

Master Vise Makers

Meriden, Conn., U.S.A.

GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
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VERTICAL BORING and TURNING MILLS
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With Adjustable Cutters
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For Time Recording in Factories
Separate Catalogs on each Product
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ELIMINATE VALVE INEFFICIENCY



NEW AIR-TIGHT BLAST GATE

Light, Strong, Compact, Inexpensive, Quick-Acting. Threaded or Flanged connections.

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We are using your Blast Gate as an outlet valve on a starch tank. This tank contains a very heavy grade of starch—just liquid enough to flow. This heavy substance clogs the ordinary valve but your blast gate has, to date, given perfect satisfaction.

C. H. Masland & Sons, Inc.

Hundreds of former valve users have found the remedy by installing Rockwell New Air-Tight Blast Gates.

This wonderful control device has proved an ideal substitute for expensive, heavy, cumbersome and slow-acting gate and globe valves when used for:

Air and Gases of Various kinds

Blast furnace coal and lime dust
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Soot chutes
Starch

Present industrial conditions make it urgent that you investigate the economy and efficiency of this New Air-Tight Blast Gate. Ask our Canadian distributor for Circular 210-T.

W. S. ROCKWELL COMPANY

Furnace Engineers and Contractors

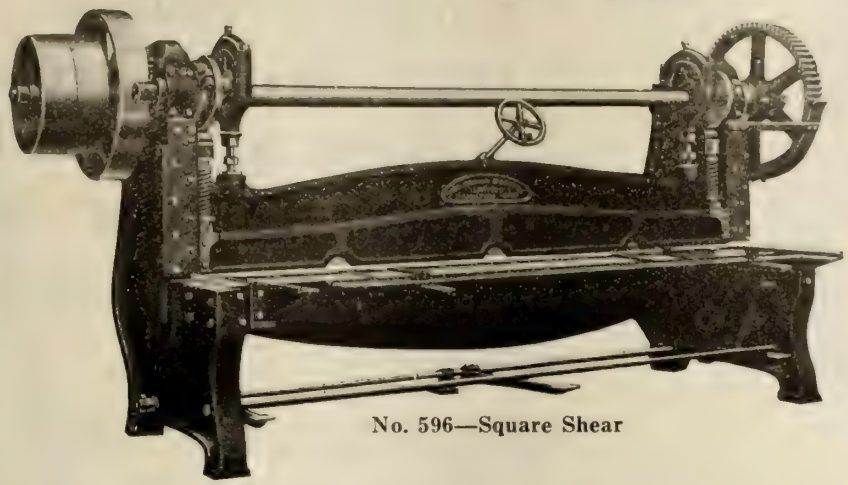
50 Church St. (Hudson Terminal Building) New York

CANADIAN DISTRIBUTOR: Drummond, McCall & Co. Ltd., Montreal

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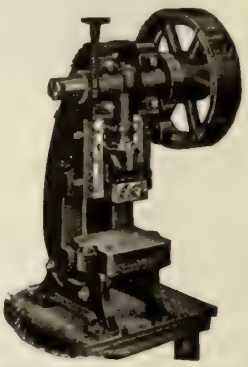
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B B



No. 596—Square Shear

Presses, dies, shears, punches, drop hammers, canners' processing machinery evaporating and special machinery; all guaranteed.



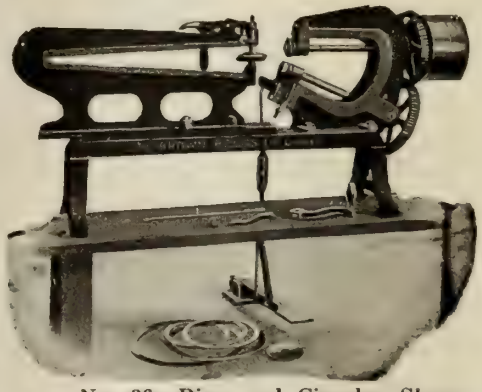
No. 10—Bench Press

Stamped With Father Time's O.K.

Father Time, with the same hand, lifts up the strong and destroys the weak.

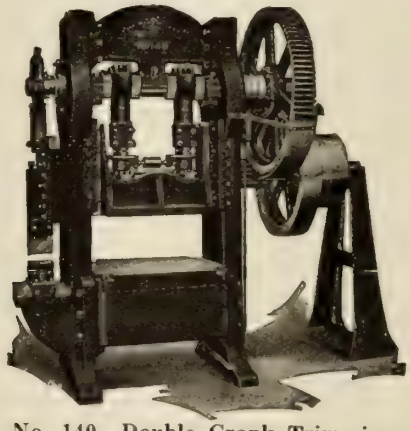
To "B.B." Sheet Metal Workers' tools he has been kind. With an approving eye he has watched for more than fifty years as they gained in public favor and national use.

Always the newest designs—free from friction and noisy gears—built by competent workmen in an always modern plant; these are the reasons why "B-B" Tools have stood the severe test of time.



No. 36—Ring and Circular Shear

Toronto Office, Holbrook Bldg., A. B. Walker, Representative.



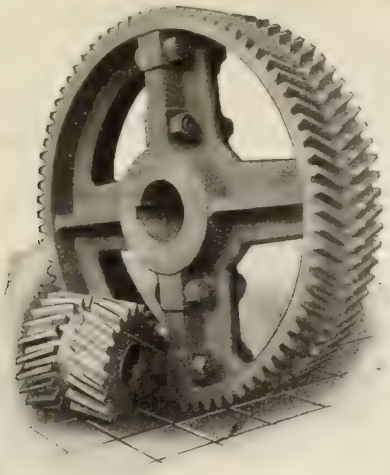
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THE BROWN-BOGGS CO. LIMITED

HAMILTON, CANADA.

Herring-bone Cut Gears





The Highest Type of Gear Drive

GEAR DATA FOR YOUR NOTE BOOK
Cut this out,—more coming later

"DON'TS"—ON THE USE OF GEARS

From The Hamilton Gear and Machine Co., Toronto

Don't run two soft, low carbon steel gears together. They will not wear well. Use harder steel or two different metals.

Don't use moulded or cast tooth gears for any but the slowest speeds and roughest surface. Use Cut Gears.

Don't let oil or water on a rawhide pinion. For damp or oily places use an extra quality of hard white or grey fibre.

Don't use cast iron pinions. A pinion tooth is weaker than a gear tooth of the same metal. Therefore use a tougher material for the pinion.

Don't use brass for gears. A few cents a pound more will give you bronze, which is more than double as good. Use No. 1 Government bronze:—80% copper, 10% tin and 2% zinc.

Don't forget that the Hamilton Gear & Machine Co. has the only real gear shop in this country; that their modern plant with heavy, up-to-date machinery is at your service in any emergency. Use telegraph or long distance 'phone.

Don't run gears unguarded, if there is any possible way to put a shield around them. This is to protect the gears from damage, whether you value your fingers or not.

Don't omit details when asking prices or placing orders for gears. The fuller the information the better price and delivery you will get.

Write for Quotations

Hamilton Gear & Machine Co.

76 Van Horne St. - Toronto

A file cannot be re-sharpened. Yet it is just as imperative for a file to be absolutely sharp as for a saw or chisel. It pays to discard a file at the first sign of wear, and get a new one.

Maximum sharpness means minimum time and effort on a filing job.

These brands stay sharp for a long time, giving fullest service for money spent.

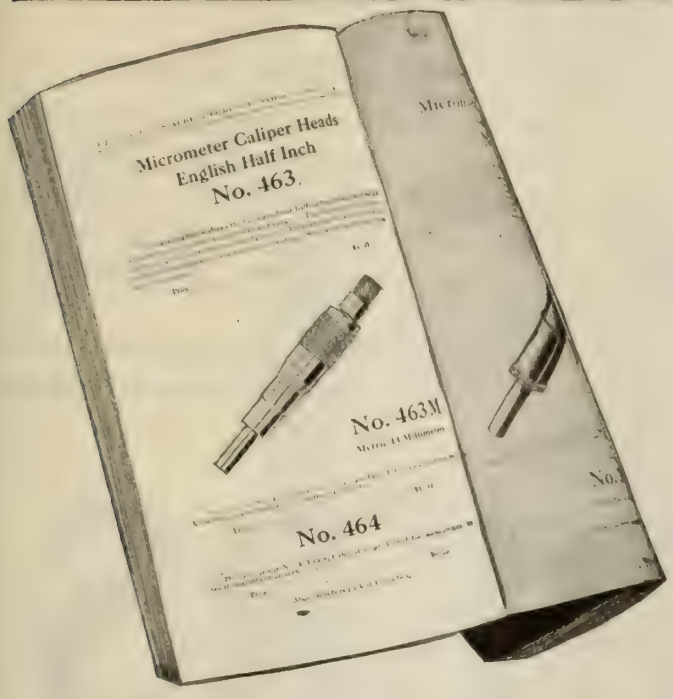
Kearney & Foot
Great Western
American
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Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario

Have You Seen These Tools?



MICROMETER CALIPER HEADS

Nos. 463 and 464

Starrett Micrometer Caliper Heads are designed to facilitate the taking of fine measurements in connection with tools or machines to which they are attachable. Recent additions to the Starrett line of these micrometer heads are No. 463, a half inch micrometer head graduated to thousandths of an inch, and No. 464 which is similar to No. 463 except that it is graduated for measurement by ten-thousandths of an inch. Both No. 463 and No. 464 are supplied with or without the Starrett ratchet stop. Consult your copy of the new Starrett Catalog No. 22 3. page 162, for full description and full-size illustration of these new tools. If you have no copy of this catalog handy, write us and we will promptly send you one free.



THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled

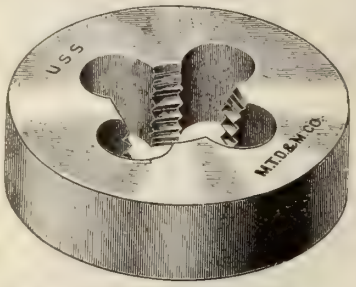
ATHOL, MASS.

Every man interested in fine tools should have a copy of the Supplement to the Starrett Catalog. Send for this Supplement showing the latest additions to the Starrett line.

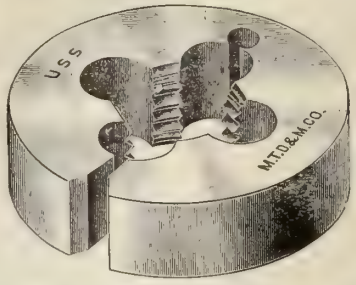
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STARRETT TOOLS — STARRETT HACK SAWS CUT QUICKER LAST LONGER

Use Starrett Tools



MORSE TWIST DRILL & Machine Co.,
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"MORSE" ROUND DIES

Are Real Dies,

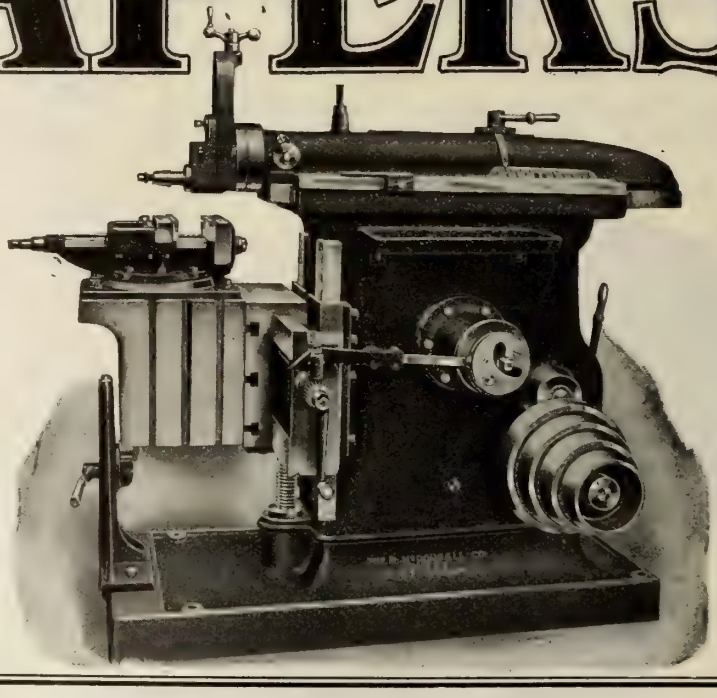
cutting Clean, Accurate threads and holding their size. Can be had in either Solid or Adjustable Types, Singly or in Sets. In V, U.S.S. or Whitworth style of thread.

McDOUGALL

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Modern machines characterized by simple, clean-cut design and inflexible rigidity combine the best features of machines hitherto on the market, but with all unnecessary complications excluded.

We shall be glad to send you complete specifications and descriptions.



The R. McDougall Co., Ltd.
GALT, ONTARIO

THE CANADIAN FAIRBANKS-MORSE CO., LIMITED
Sole Agents

THE MORSE CHAIN CO.

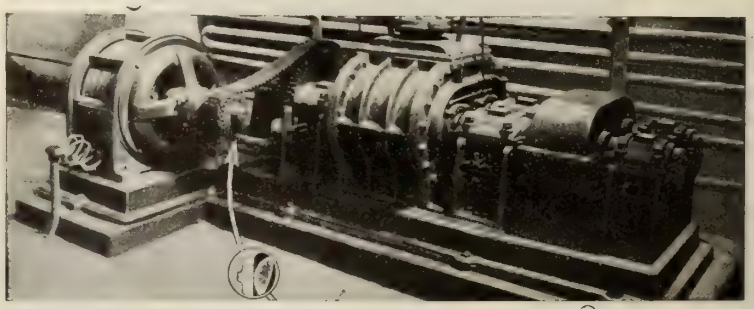
are the
Largest Manufacturers in the world
of
High Speed Silent Chains

The superiority of Morse Rocker Joint Silent Chain has never been seriously questioned.

They speed up production, cut belt expense and overtime wages.

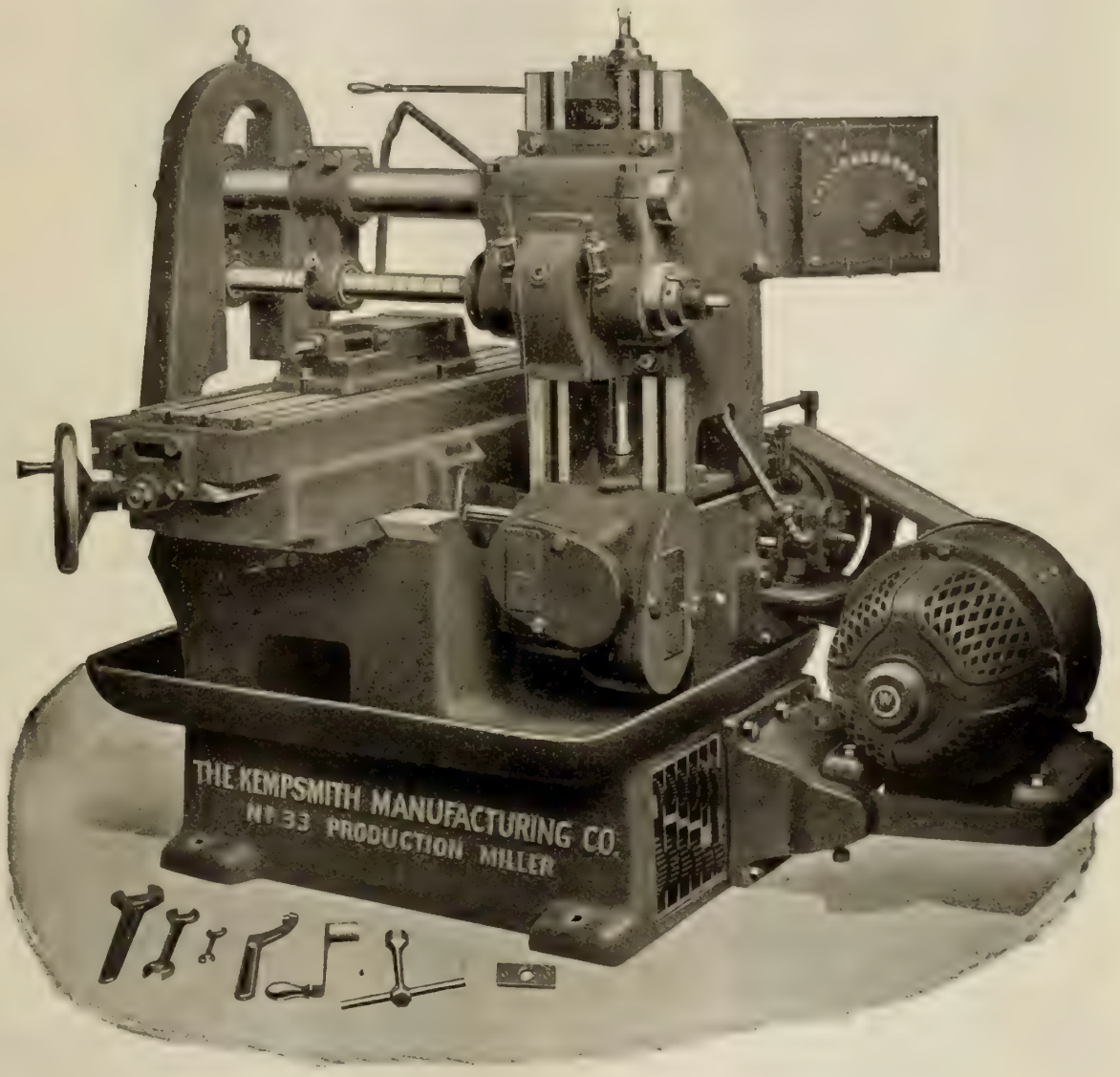
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KEMPSMITH No. 33 Production Miller

Paramount in Production

A machine designed for the rapid production of duplicate parts.
Our literature will tell you all about it. Write for it.

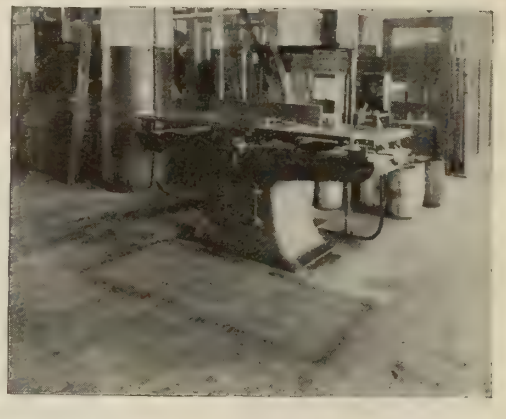
THE KEMPSMITH MANUFACTURING CO.

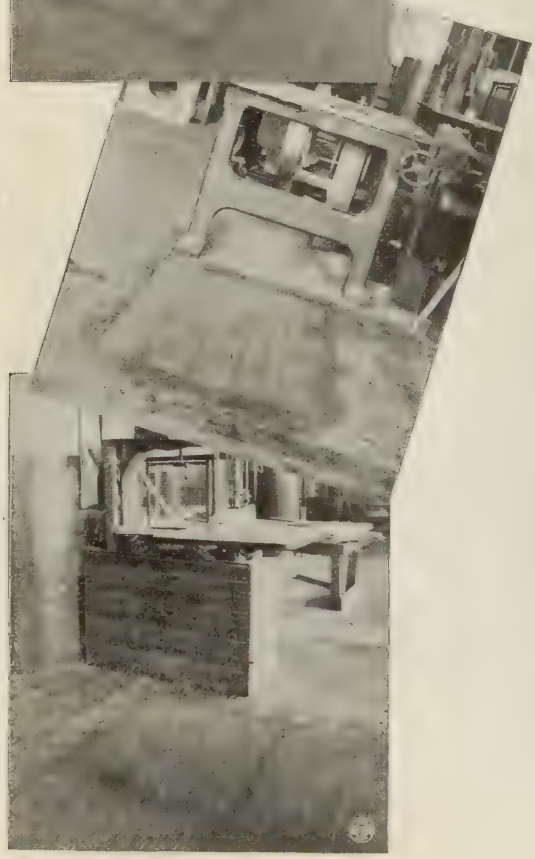
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MANUFACTURING NEWS

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Examples Where Vertical Milling Saved Money

Suitable Fixtures Facilitate Production—Multi-Tooth Cutters Replace Single Point Tool—Particularly Adapted to Die Sinking—Special Attachments for Continuous Milling.

By J. H. MOORE

AMONG MANY other production tools, the vertical miller has proved itself to be of exceptional value especially on duplication work. This statement must not be misunderstood, because, a vertical milling machine is likewise useful on general manufacturing work, but where the operation can be plotted out ahead, a suitable fixture made, and so on, it is in such cases that the productive possibilities of the machine show up to best advantage.

The variety of parts which can be handled is surprising, and in many cases, vertical milling has superseded other methods of machining. For example Fig. 1. Here we see a vertical miller machining an electric motor bracket. Some might consider this a job for boring mills in fact it was first of all completed on a boring machine, but the time saved by using the vertical miller proved conclusively the wisdom of finishing the work in the manner shown.

These frames are cast steel, and must be surfaced where they bear on the laminations, as well as bored for clearance. When finished on the boring mill, the full capacity of machine could not be used, as the interrupted feed prevented using a heavy cut. Owing to the tendency of the work to spring away from the tool, two cuts were necessary to get a flat surface. The complete operation, facing bracket, and finishing of bore, took 55 minutes, this time being considered excessive.

By using the vertical miller, the single point boring tool has been replaced with multi-tooth cutters, and although the amount of metal removed is much greater, the pressure on the work, tending to spring the piece is very much reduced. The pressure of the cutters acts towards the center of the piece in the line of its greatest strength, and one pass of the cutter over the work covers the surface and produces a flat job. Production time has been cut almost in six, for in place of 55 minutes, the time is now only 9½ minutes. The operator never requires to change his position to shift from the cutting feed to rapid traverse, as the feed box is at front of machine. Although shown on this particular operation, the same general scheme of handling can be applied to innumerable heavy profiling jobs such as gear boxes, covers, segments, etc.

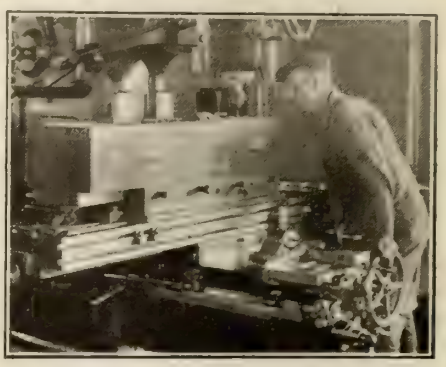


Fig. 3.—Intricate Die-Sinking on Vertical Miller.

Milling Wedge Block

Cutting production time in a piece from 60 to 40 minutes is well worth while, and the work shown at Fig. 2 holds up to this record. Previously the wedge block illustrated was finished on a planer in a railroad shop, and the oper-

Photos 1 to 3 by courtesy of Cincinnati Milling Co. Photos 4 to 7 by courtesy of the Becker Milling Machine Co.



Fig. 1.—Machining electric motor bracket. Fig. 2.—Machining wedge block in two settings.

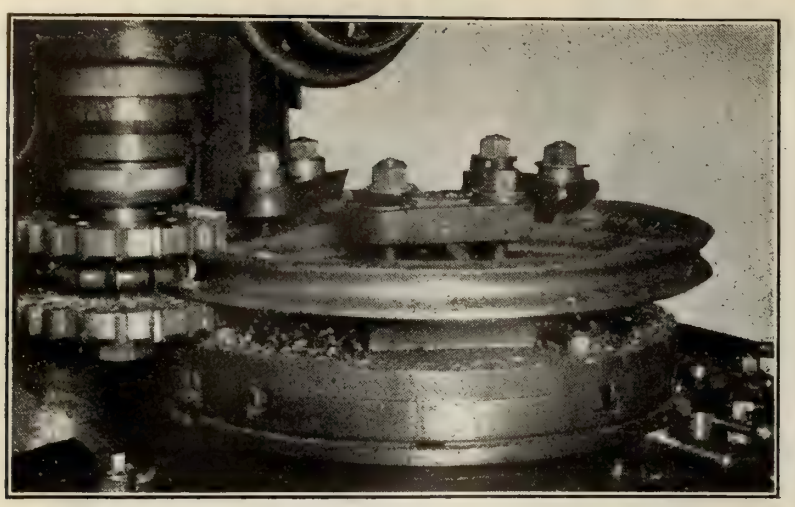


Fig. 4.—Gang milling a sheave wheel.

ations were planing bottom and inside. At present the part is milled in two settings, the bottom surface being finished first. As will be noted two standard steel vises are used to hold the block, and the piece is lined up parallel with the table by means of a surface gauge. The photograph shows all other particulars.

For Die Sinking

To prove the previous statement that vertical milling machines can be used on general work, refer to Fig. 3. This shows an intricate operation of die sinking being performed, and any mechanic who has attempted work of this nature knows the need of accuracy and ease of control. In the illustration shown the machine is so arranged that both the longitudinal and cross feed are handled by the operator without moving. As can be noted, he is at all times in a position to watch the operation carefully. Die sinking, of course, is merely one of the general uses for such machines.

Continuous Milling

There is also that field known as continuous milling, and the remaining illustrations deal with this type of operation. This method is used where high production is desired, and Fig. 4, shows an interesting gang milling operation on a steel sheave wheel. The cutters used are as follows. The outside diameter is form milled, while the two sides are faced. The side cutters are 8 in. diameter, while the form cutter is 6 in. diameter. A feed of 3 in. per minute is used, and the cutter spindle revolves at 28 r.p.m. Usually about ¼ in. stock is removed, and the time on each wheel is 30 minutes. Some might consider this a lathe job, but the milling time has reduced cost considerably.

Another clever arrangement is shown at Fig. 5. In this case the inside faces of universal yokes are being milled, and production is around 160 pieces per hour. Two 7 in. staggered inserted tooth cutters are used, and the fixture shown has 36 stations. When a high rate of production is necessary, value of fixture as depicted is evident. There is nothing elaborate about it, and yet without the aid of quick loading the productive qualities of the machine would be handicapped. Whenever work of the nature illustrated is being contemplated, it pays to spend time and thought on the design of fixture used. A little extra money and thought expended, will often increase production to a surprising extent.

At Fig. 6 is shown the milling of differential gear housings. These castings weigh approximately 40 pounds and are made of malleable iron. Formerly 9 per hour was the production figure, but using the machine and fixture illustrated, 15 per hour can be machined. There is nothing elaborate about the fixture, for it merely consists of support blocks, with quick acting clamps. A slight slackening of the nut, and the clamp slides back by means of the slot shown, and as the clamps are on an angle, they slide back automatically the moment the nut on holding down bolt is released. A large inserted tooth cutter is used, this being the best type for such work.

The remaining illustration Fig. 7, shows how the continuous miller can be made still more productive by the addition of another spindle. On certain classes of work, two surfaces of about the same level, and yet too far apart to be milled by one cutter, must be machined. When quantity warrants the investment, a two spindle machine is a good thing, for it reduces labor cost, and handling time, increasing of course the number of pieces completed per hour.

Usually a simple fixture is all that is necessary to mount on the work table, and the operation shown at Fig. 7, bears this statement out. There is nothing intricate in the fixture illustrated, and yet the rods are quickly and accurately located. Each clamp holds two rods, being worked on the eccentric principle, while at large end of rod, one lug goes up against a tool steel locating block, set into the ordinary steel filler between stations, while another locating medium operated from the screw A, tightens both rods at the same time. Straddle mill cutters are used, these having inserted cutters. The rods milled on this machine vary in length from 11 in. to 14 in., and production likewise ranges between 65 to 75 per hour.

While these illustrations barely scratch the surface of the possibilities of vertical milling, they at least give a few applications which may suggest other operations to readers, who at present may be finishing parts in some other way. For example, the planing time on a trailer spring saddle guide was 40 minutes, yet by simply holding this piece in the vise on a miller table, and using a regular cutter, the operation time was cut down to 28 minutes. Two vises were placed on the table, this allowing the operator to unload and load, while the other piece was being finished. Two cuts were taken in the 28 minutes, as the parts were made from cast steel and

(Continued on Page 46.)

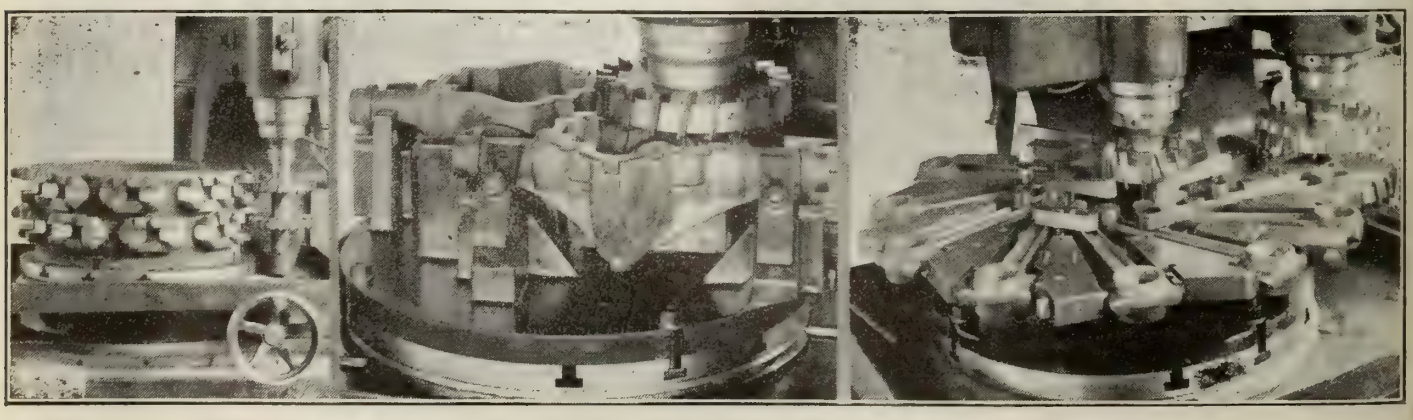


Fig. 5.—Milling inside faces of universal yokes. Fig. 6.—Facing differential gear housings.
Fig. 7.—Double spindle milling on connecting rods.

Planning and Installing Effective Lighting

Proper Distribution of Illumination—Adapting Existing Equipment to Best Advantage—Allowance Made for Ageing of Lamps —Surfaces That Reflect Light.

By JOHN T. SCOTT

THE INTENSITIES of illumination required for different classes of work were outlined in the previous issue of Canadian Machinery. We will now consider the methods for planning an installation.

The requirements of any satisfactory industrial lighting installation are:

1. Sufficient light on all parts of the working area.
2. Moderate light on adjacent areas and on the walls.
3. Freedom from glare or glaring reflection.
4. A system, simple, reliable, easy to maintain, and of low operating cost.

The conditions usually presented are two:

1. Where the building has not been wired before, or where, if wired, the plant manager is willing to rearrange the outlets. Here the greatest freedom is allowed in planning the installation.
2. Where no change or addition is to be made in existing outlets. In this case we have but to decide upon the proper type and size of unit to replace the present fixture.

Factory interiors are usually divided by columns into bays or rectangles of uniform size, as shown in Fig. 1, and such bays afford a convenient starting point in determining the location of the lighting units. It is desirable that the lighting units be symmetrically spaced throughout the whole of an interior and this will result if the units are properly spaced in each bay. Furthermore, a correct lighting design presented in terms of individual bays can be readily extended throughout a plant of only a few or of many bays.

Planning the Installation

In order to determine the requirements of the installation the following procedure is generally adopted.

1. Determine the foot-candle illumination required.
2. Calculate the floor area and number of lighting units required.
3. Determine the spacing of the outlets and mounting height.
4. Ascertain the size of Mazda lamps which will provide the foot candles required.

Let us now figure out the illumination required by a machine shop doing a medium class of work. We will decide upon 10 foot candles for illumination at the working plane. Now make a diagram to scale of the floor area of the room, which is say 60 ft. by 200 ft. The spacing of the outlets will in part be determined by the mounting height. Measure the ceiling height and refer to the following table for permissible spacing distance.

Mounting Height of Unit			
Above Plane of Work	Above Floor	Permissible Distance Between Outlets	Distance Between Outlets and Walls
4	6½	6	3
6	8½	9	4½
8	10½	12	6
10	12½	15	7½
11	13½	16½	8
12	14½	18	9
13	15½	19½	9½
14	16½	21	10½
15	17½	22½	11
16	18½	24	12
18	20½	27	13½
20	22½	30	15

Table of Spacing and Mounting Height

Figures are for feet. Plane of work is assumed to be 2½ feet above flor. When work on a plane higher or lower than 2½ feet, then work from first column.

Let us take a ceiling height of 18 feet and decide to give a drop of 18 inches to the unit. This gives us a mounting height above the floor of 16½ feet and 14 feet above the working plane, with a permissible spacing distance between units of 20 ft. Our plan will enable us to mark out 3 rows of 10 units, 20 ft. apart, with an outside distance of 10 ft. from the walls, providing a total of 30 lighting units.

If the units are mounted as close to the ceiling as possible, a wider spacing is permissible, fewer units are required, and the cost will be less. An allowance of one foot is usually necessary to provide for the drop of the reflector from the ceiling.

Having determined the permissible spacing proceed to locate the outlets on the diagram of the floor area. Locate the units as nearly symmetrically as possible without appreciably exceeding the permissible spacing for uniform illumination. The distance between the walls and outside row of outlets should not exceed one half the spacing distance; or above one third the distance if benches are near the wall. After the outlets have been located on the plan, the lamp size to be used may be ascertained by the following method of calculation:

A. Area in sq. ft. per outlet

$$= \frac{\text{Total floor area in sq. ft.}}{\text{Number of outlets}} = \frac{60 \times 200}{30}$$

$= 400$

B. Lamp lumens required per sq. ft.

$$= \frac{\text{Foot candles x Dep. Factor}}{\text{Coefficient of Utilization}} = \frac{10 \times 1.3}{60}$$

$= 22.$

C. Lamp lumens per outlet

$= A \times B = 400 \times 22 = 8800$ lumens

A 500 watt Mazda gas-filled lamp has a light output of nearly 9,000 lumens, therefore our installation will consist of thirty 500 watt lamps. This lighting will give us an illumination of approximately 10 foot candles.

An arbitrary use was made in the above calculation of two figures which require explanation. The depreciation factor is a safety factor or allowance made for ageing of lamps, dirt, dust and deterioration. For fairly clean conditions use a factor of 1.3; for dirty locations where cleaning is infrequent use a factor of 1.5. With regard to the coefficient of utilization, this ranges from .46 for medium size areas to .69 for large areas, based on using a standard metal dome reflector. Fairly safe calculations may be made for all conditions with a factor between .50 and .60.

Colored Surfaces

A material consideration that should not be overlooked is the matter of painted surfaces, walls and ceilings. These have an important bearing on both natural and artificial lighting. Dark colors will absorb light and so lessen the useful illumination. White, and very light colors like stone, ivory and very light

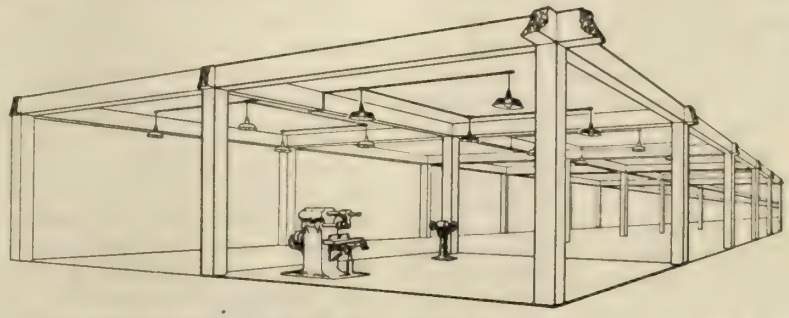


Fig. 1.—An industrial interior can usually be divided into sections, or bays, by which the lighting units can be located in the design of a modern lighting system. Sometimes, where no structural features suggest a natural division into bays, it will be necessary to sketch a floor plan and to draw in imaginary bays of uniform size, the size depending upon the grouping of machines, benches, etc. These bays should be chosen as nearly square as is practicable. In the interior shown, beams divide the interior into 20 x 20 ft. bays; 4 units are symmetrically spaced in each bay.

Author is engineer in charge of standardization work at the Sunbeam Lamp Works.

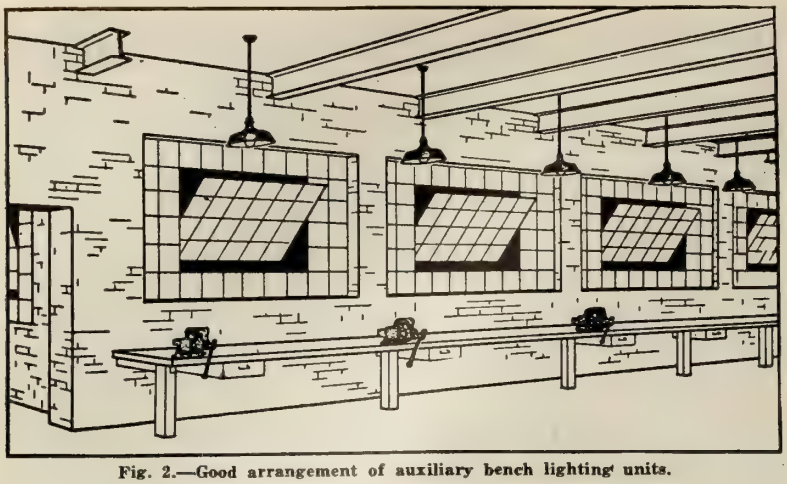


Fig. 2.—Good arrangement of auxiliary bench lighting units.

gray will reflect the light and prove a useful aid in illumination. Matt or dull surfaces will be better than oil or glossy, since there will be no undue brightness or reflection.

Bench Lighting

Where more units are employed than one per bay, bench lighting can be adequately cared for by shifting the outside rows of units nearer to the walls along which the benches are placed. This means, of course, that the spacing distance between the outside row of units and the next is greater than it should be, and the illumination at points between the two rows is correspondingly reduced. However, since this area of low illumination usually covers the aisle between the benches and the first row of machines, the effect is usually not serious. On the other hand, where only one unit is employed in each bay, best practice usually requires auxiliary bench lighting units. A typical good arrangement of auxiliary units is shown in Fig. 2.

The use of 100 watt, bowl-frosted, Mazda C. lamps in R. L. M. standard dome reflectors, spaced 8 ft. apart and mounted 6 to 8 ft. above the bench tops will provide an average illumination on the bench of about 6 foot candles; this is of course in addition to the light received from the general overhead system. The use of 150 watt lamps will increase the intensity of illumination to about 10 foot candles. The distance between the units and the wall will be governed by the width of the bench. The unit should be located so that the lamp is out from the wall about equal to the width of the bench. Where it is possible to mount the units about 2 ft. higher, the spacing may be increased to 10 ft. apart.

Should any reader have any difficulty in using the methods of calculation outlined above, or meet with any special problem, the writer will be glad to cooperate by offering helpful suggestions. The next and concluding article will deal more fully with choice of lamps and equipment, and conditions of use.

Economy of Cork Inserts

By W. F. Schraphorst

Copyright, by W. F. Shraphorst

This is an important topic that has not been written about or discussed to such extent as have other transmission devices. Why this is so is unexplainable. It is a worthy subject because cork insert is to stop all avoidable belt factor as the other devices that stop belt slip. The principal functions of the cork insert is to stop all avoidable belt slip. In doing this considerable coal and money may be saved.

Thus where 2,000 tons of coal are burned per year where coal costs $9 per ton, and where the over-all belt slip is 8 per cent., the cost of the belt slip in terms of the coal pile is $1,440. To compute the cost of belt slip it is first necessary to find the percentage of slip. That is, if a driven pulley rotates only 95 times, whereas it should rotate 100 times, the percentage of belt slip is 5 per cent or,

$$\frac{100-95}{100}=5 \text{ per cent.}$$

Then multiply the determined per cent. of slip by the number of tons of coal burned per year, and then by the cost of the coal per ton. Thus we have

(2,000 x $9 x .08= $1,440.)

the yearly cost of belt slip.

To arrive at the actual and accurate cost of belt slip is not easy, however. It is plainly more than $1,440 in such a plant as above, because coal is not the only thing that is lost. The belts wear out more rapidly where ther is slip than where there is no slip, and the cost of this slip can be approximated.

Let us assume, just for an example that with cork inserts a plant manages to keep its belts a-going for 10 years. The first cost, then, is $500 per year. Without cork inserts the belts wear out in eight years, and the average cost is $625 per year. This would mean a saving of $625—$500, or $1,250 in 10 years. As these figures may not apply to every plant this formula may be used and the reader can substitute his own conditions.

Dollars saved with cork inserts from belt cost standpoint only equal

$$(No.—N)\ K$$

$$N$$

where Nc=life of belt in years with cork inserts;

N=life of belt in years without cork inserts;

K=first cost of belt in dollars.

The cost of lost product must also be considered. The value of cork inserts appears here again, and the problem can be approximated mathematically. Let us take, for example, the above plant where over-all belt slip is 8 per cent. and where the output should be worth, without slip, $2,000 per day. With 8 per cent. slip it is evident that the machines are running 8 per cent. too slow and the product is, therefore, diminished by 8 per cent. Hence the daily output is approximately

$2,000—($2,000 x 8%)=$1,840 instead of $2,000.

To make the formula clearer, and to enforce this cost on the mind of the plant owner, I have thrown it into this form:

Dollars output lost per day=

$$\frac{D}{1—S}—D$$

were D=present daily output in dollars;

S=per cent of belt slip.

Thus, if your present daily output amounts to $1,500, and if your over-all belt slip is 10 per cent, we have, after substituting in the formula

$$\frac{1,500}{1—.10}—\$1,500=\$1,667—\$1,500=\$167.$$

One hundred and sixty-seven dollars lost per day is considerable and may mean the ruin of a small plant, unless discovered and rectified. This "product loss" is often saved by speeding up the driving engines or motors to the extent that after belt slip is deducted the final speed is what it should be anyway. That method is better than none at all, but it is not the best practice. The best practice is to eliminate all belt slip.

Thus comes the cost of defective product. Where belt slip is permitted, the product frequently suffers on that account. The loss cannot be figured mathematically, because it is too uncertain. It may vary from a trifling to a very serious amount. To reduce this loss to the minimum, belt slip must be completely eliminated. By so doing, all machines are driven by steady speeds. There is no bunching here and thinning there. Product is uniform, day in and day out. Such is the ideal state as regards speed, and the value of cork inserts is further emphasized.

R. P. Ross & Co. of Sudbury, have secured contracts on behalf of the Standard Steel Construction Company Limited, for all the construction steel work on the Copper Cliff school and the Salvation Army citadel, Sudbury.

Characteristics of the Different Forms of Gears

Classification—Continuity of Tooth Action—Advantages of Herringbone Form—Moulding Generating Process—Conical Features of Bevel Gears.

By CHESTER B. HAMILTON, Jr., B.A.Sc.

IN THE April 13 issue the author covered the different materials of which gears are constructed and the process of heat treating steel gears. The present article goes still further into the manufacturing of the different types of gears and their various applications.

The whole object of gear work in general is to transmit motion and power from one revolving axis to another revolving axis. There are special cases which appear superficially to contradict the general statement, but on analysis they are all resolvable within its limits. For example, a straight rack is a segment of a gear of infinite radius, and a fixed or stationary gear in a train must at least have relative motion, with regard to the other members of the train. It is evident therefore that a classification of gears according to their axes will be a basic classification.

The separation of the classes is not quite absolute, in that a few gears may be used in two different classes. A spur gear may be matched with a worm of equal normal tooth dimensions by setting the worm askew at a suitable angle. A pair of helical gears, meant to run in mesh on parallel shafts, may if helix angle is high, in the neighborhood of 45 degrees, be each operated as a worm by supplying a suitable mate. It is to be noted that these are both cases of point tooth contact and high sliding action.

The great majority of gears have their shafts parallel and are of cylindrical form. This class includes the spur, the helical and the double helical, each in both external and internal form. The spur has all its teeth parallel to the axis. The helical, and the double helical, have teeth formed along helical curves on the surface of the imaginary pitch cylinder. The double helical is merely two helical gears of right and left hand, but otherwise identical, mounted on the same shaft. The helical gear is frequently miscalled spiral. The error is obvious on considering that the spiral is a curve developed about a centre point in a flat plane, while the helix is a curve wrapped about a cylinder.

The true spiral gear is exemplified in the scroll that operates the jaws of the ordinary universal scroll chuck used on lathes. In this example the scroll meshes with a rack on the back of the jaw. The double helical gear is the modern development of the herringbone gear, and is frequently called by that name. A more remote ancestor is the hook or stepped gear, which is a series of narrow faced spur gears, each set an equal fraction of the pitch ahead of its neighbor, so as to improve the continuity of tooth action, and so give smoother rolling motion. This quality of all the helical family of gears is very important and permits them to be run at enormously higher speeds than is possible with even the best of spur gears. They are used exclusively in the high speed and high ratio reduction sets for reducing the speed of steam turbines, both on steamships and stationary industrial drives.

Double Helical Gear

The double helical will carry considerably more load than the corresponding spur gear, for two reasons. First, its smooth action and freedom from shock permit a smaller apparent factor of safety to be used with the same real safety in result. Second, the helical arrangement of the teeth ensures that there are always some teeth in every stage of coming into and going out of mesh, and some teeth fully meshed and bearing at the pitch line. Therefore there is never a time when all the load is being applied at the tip of the pinion tooth, which is the critical instant with spur gears. The advantage of the double helical over the single helical form is the elimination of end thrust. The double helical gears are usually made with a helix angle of 23 deg., except the very high speed turbine gears which often have high angles, up to 45 deg. The single helical gears are usually made with an angle as high as possible without serious end pressure, which is about the angle of friction. Fifteen deg. is one standard widely recognized.

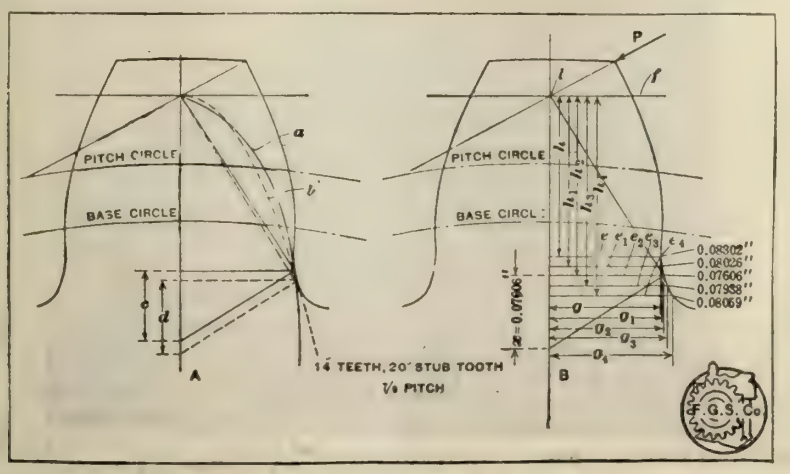
Internal Gears

The internal gear while apparently a spur or helical with its teeth turned inwards, has several wide differences, especially in tooth action. The development of the internal gear has been slow on account of difficulties in producing it accurately. As long as cast gears were in vogue the internal held its own, but to cut it was a serious problem. The rotary cutter or milling process was at a disadvantage on account of necessity of providing a special cutter head with a very awkward drive for the machine, which operated at low efficiency, and also the clearance for the cutter after passing through the tooth hampered the designer. To do a correct job special cutters with convex curves were required, but as the ordinary No. 1 range cutter intended for cutting large gears and racks was commonly used, the results were poor and internals come to be avoided for small and medium work. The Gleason spur gear planing machines which operate on the templet principle, do produce good internals in large sizes. It was not until the invention of the Fellows gear shaper, however, that the internal gear in small and medium sizes could be produced of high quality at low cost. It is now produced in spur, helical and double helical on this machine, which operates on the moulding generating principle.

Distinct Features

The internal gear differs from the external in a number of ways, which influence the tooth action, mostly to its great advantage. The addendum of an internal gear is the distance from the pitch line inward to the tip of the tooth, and the dedendum is the distance from the pitch line outward to the root of the tooth. The base circle of an involute gear is the circle from which the involute

Author is President of the Hamilton Gear and Machine Co., and a member of the American Society Mechanical Engineers; Engineering Institute of Canada; Society of Automotive Engineers; American Gear Manufacturers' Association, Steel Treating Research Society; Standardization Committee of A.G.M.A.; Associate Member of American Institute of Electrical Engineers.



Two methods of determining weakest section of gear tooth. A shows method of constructing a parabola by drawing an irregular curve. B shows method of calculating weakest section of tooth.

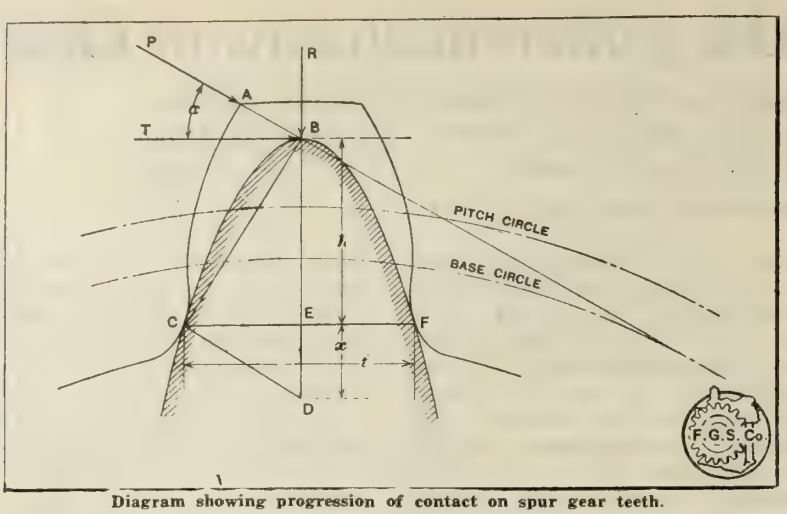


Diagram showing progression of contact on spur gear teeth.

tooth curve is developed by the unwrapping of a tangent which contains a describing point. Therefore the base circle is always of less diameter than the pitch circle. In the case of the internal gear the base circle lies in the addendum, instead of in the dedendum, as with the external gear. On account of the internal gear curving toward the pinion, instead of away from it as an external gear does, the line of action is much longer.

It follows that the engagement of the gear and pinion tooth takes place in a much more gentle fashion, greatly reducing shocks. There are more teeth in mesh at one time so that even with very small pinions the operation is satisfactory. It may be readily demonstrated graphically that the amount of sliding between the surfaces of gear and pinion tooth is much less less with the internal than the external, comparing cases where all other elements are equal. Even with the most perfect generated involute tooth curve the pure rolling motion exists for only an instant as the pitch lines of gear and pinion roll over each other. For all other phases of contact there is an element of slide added which increases with the distance from the pitch line.

Element of Interference

As to the question of interference, there would be more of this in the case of the involute internal if the uncorrected theoretical form were used, not that the involute theory does not work out in practice, but due to the fact that the tips of the gear teeth are the part below the base circle, not above, and theoretically are not curves at all, unless corrected in some way. This is done empirically in the case of the formers of the Gleason planer. In the Fellows system the fact that the cutter works on the moulder generating process saves the situation automatically. The straight flanks of the cutter tooth, below its base circle, roll in mesh with the gear tooth it is forming and shave off that portion of the tooth next the inner tip which would interfere with the flank of the pinion tooth.

Interference between the tip of the pinion tooth and the flank of the gear tooth is prevented just as in external gears by a suitable combination of working depth and pressure angle of tooth. With the 20 deg. stub tooth system the limit is reached when the difference between the number of teeth in the gear and those in the pinion is seven. With the 14½ deg. generated tooth of full Brown & Sharpe standard depth the limit is a difference of twelve teeth. With the 14½ deg. tooth, not generated but formed or planed from templet, fifteen teeth is a safer margin to allow between gear and pinion sizes.

Mitre and Bevel Gears

The second great class of gears is those having their axes in the same plane but at an angle to each other, so that they will intersect if produced. This class covers the bevel gear and all its variations, except the skew bevel gear which is truly not a bevel at all but a hyperboloid.

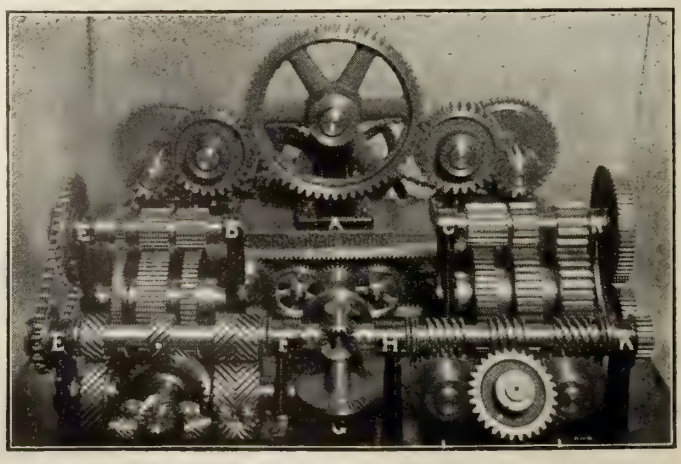
The distinguishing characteristics of all gears of the bevel class is that they are conical in form and conical in action. This is independent of the angle of the axes, which may be greater or less than the usual right angle. It is independent of the pitch angle, which may be, theoretically almost anything, and is limited only by practical ability to machine the teeth of the gear. It is independent of the style of the teeth, which may be straight and converging on the cone centre; or may be spiral curves, about that centre, laid out on the pitch cone surface; or may be arbitrary curves, as a segment of a circle, in the case of the Gleason so-called "spiral" bevel; or may be a combination of two almost straight lines, as in the Citroen gear, so as to produce a herringbone effect. All considerations of bevel gears must be based on a knowledge of the pitch cones of the pair, whose apexes coincide and whose surfaces are tangent.

Angle of Axes

Taking the other features in turn, first consider the angle of axes. Practically all bevel gears have shafts set at right angles. Those at other than the right angle are sometimes called angular bevels. They do not differ in form from any other bevel. Their ratio is determined by the pitch diameters which are proportional to the sines of their respective pitch angles, for the distance from the cone centre to the point of tangency of pitch circles is the common cone line. A crown gear is a bevel which is flat, that is, has a 90 deg. pitch angle. Its pitch cone is then a disc with the point of intersection of axes, or cone centre, at the middle. An internal bevel has a re-entrant pitch angle of less than 90 degrees. The teeth are of different form, having concave curves. There are limits to the size of the mating pinion, just as in the case of the internal spur.

Pitch of Bevel Gears

The pitch of any bevel gear, unless specifically stated otherwise, is the pitch at the large end of the teeth. The blanks are turned with the surface at the big end of the teeth at right angles to the pitch angle, or the pitch line to cone centre. This surface if extended backward or inward to the axis would form the imaginary back cone, and the distance from the pitch line to the apex of the back cone is the back cone radius. This is important in considering tooth forms, though it does not enter into every day gear production. The forms



Showing an interesting assembly of different types of gears.

of the teeth are considered as they would be developed on a plane from their respective back cones, and all the tooth action corresponds to the action of two spur gears of radii equal to the radii of the respective back cones and revolving about their apex points. It is seen then, that the tooth form of a bevel gear is not the same as a spur gear of same pitch and pitch radius, but rather a spur of same pitch and a radius equal the bevel gear's pitch radius divided by the cosine of the pitch angle.

In the case of the crown gear the back cone radius is infinitely long and the tooth curve becomes a straight line. In the case of the internal bevel the back cone centre is in front of the gear, and this negative position is one of the causes for the tooth curves being concave in which they again resemble the spur internal. The internal bevel is of little or no practical value, while the spur internal is a very useful, efficient and highly developed class of gear. The consideration however, of all the different possible cases of the bevel is essential to a full understanding of the interrelation of its different parts. The truly flat crown gear is a practical gear, for angular mounting of course, but is rare. What are commonly called crown gears, such as in the rear axle drive of automobiles, or under boring mill tables, are merely any bevel gear which closely approaches 90 deg. pitch angle.

Origin of Bevel Gear

The history of practical cut bevel gears on this continent would be the story of the efforts of two men who worked independently at the problem. William Gleason, of Rochester, invented and built bevel gear planing machines that worked on the templet principle, the same as his spur machines. In fact, some of them cut either spurs or bevels. Hugo Bilgram of Philadelphia, invented a bevel gear generator which used straight edged tools and worked on the moulding generating principle. The tools traveled in a path, relative to the work, which made them play the part of teeth in an imaginary crown gear meshing with the gear being cut. The work of this machine was very fine, and intrinsically there is no doubt it is superior to the Gleason templet machines.

Hugo Bilgram, however, would not sell these machines, but tried to have all the high class bevel work in the country sent to his shop. This was a mistaken policy even in the days before automobiles were invented. The Gleason Works sold their templet machine over the whole world, and it was and is so satisfactory that, though William Gleason and his sons developed a bevel gear generator aimed to beat the Bilgram generator, it was not found commercially necessary to bring it out for a number of years. Then, to meet the call for better gears for the automobile and finer machine trade, it was put on the market and was found to not only equal the Bilgram quality and theoretical perfection, but to have much greater productive capacity.

Manufacturing Difficulties

The true spiral bevel gear is not a practical form on acount of difficulty of manufacture. Andre Citroen, of Paris, France, developed a method of making herringbone bevels, using an end mill of special profile to form the teeth, along the same general line as his well known spur gear process. A compromise spiral gear was used for several years by the Packard Company, using an altered form of Bilgram machine. The teeth of the gear were planed, not toward the cone centre, but toward a point off to one side. The teeth of the pinion were made in a similar way but on the other hand, the offset being negative. The objects of these and many other attempts along the same lines were two fold,—strength, but quietness—in the case of Citroen, strength, but in the automobile trade mostly quietness. When the automobile had been perfected to the point where all the rest of the machine made less noise than the bevels in the rear axle, it became evident that something radical must be done for that member. In shops turning out good bevels, as much as seven per cent. of otherwise perfect product would be scrapped for noise. One prominent maker of high class cars even went to the extent of using a worm drive in the rear axle of touring cars for several seasons.

(To be continued.)

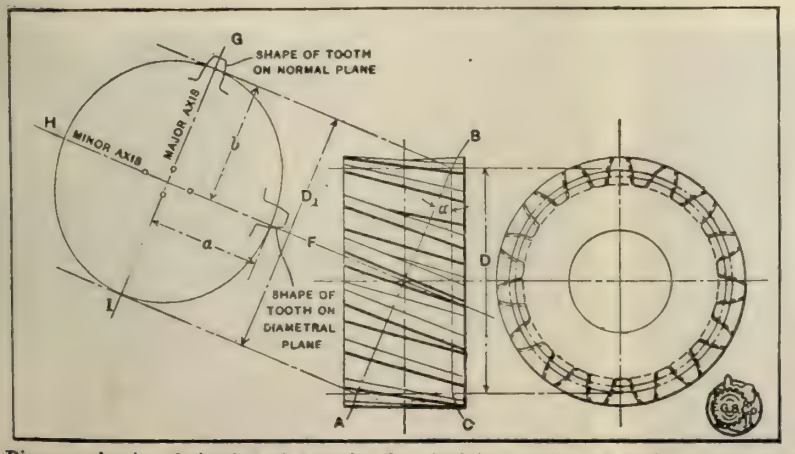


Diagram showing derivation of formulae for obtaining number of teeth on normal plane.

TAPPING SQUARE THREADS IN STEEL

By Jack Homewood

The tapping of square threads in steel is no snap when the diameter of the hole is small in comparison to the pitch of the thread and also when the piece to be tapped is long. Many years ago when the writer was eager for fame, he dropped into a small manufacturing town and landed a job. In this plant they were making small parts and square threaded nuts of the above peculiarities. Being young and enterprising like all the others, it behooved me to scan the field of endeavor to see where I would start first in making a clean up. Not being eager to await my demise before having a monument erected in my honor, I proceeded to lay the foundation of one of my own design and manufacture, embodying all the nice things that suit my taste.

Having just arrived from Cleveland and also having tapped ¼ in. 20 threads in ⅛ in. brass plate years before, my being was horrified when to my chagrin a youth before me was tapping out some nuts as I have already commented upon, using anywhere from fifteen to twenty taps. The apparent inefficiency was evident; such a waste of time and lard oil was too much for me to stand.

Knowing that the cost of the nuts was excessive and knowing that I was new blood in the institution, and that I had come from an enterprising and prosperous city, the works manager granted me an interview which included the mechanical engineer and the shop foreman, Bill. As I unrolled the sketch that I had carefully made up, of a single tap which first started as a V-thread, then to an Acme and finally to a square form, I had the same feeling that overcomes a young lawyer as he is about to make his first appeal in court. The problem of tapping those nuts had been a knotty one for years, and here was I, only a youngster aside from the rest, with an idea that was going to turn the shop upside down.

As I proceeded with my plan the manager leaned back in his chair and sized me up and down greatly to my satisfaction; he was admiring me. The more he looked at me the wider open I turned the valve. Mustard gas wasn't known in those days but whatever the ingredients were, it had the same effect. Bill, who had in past years worried, dreamed, thought, reflected, cogitated, argued, experimented and failed, slowly receded in his towering stature as I grew in power. My argument was concluded very forcibly as I inquired, "Gentlemen, what do you think of my plan?"

The mechanical engineer looked at the manager; he in turn looked at Bill who by now had slipped his hands into his pants pockets and tramped back and forth wearing that smile of doubt, "It can't be done, it can't be done," was all Bill would murmur. One glance at the cost sheet and the manager's reply syn-

(Continued on page 39)

Practical Application of Precision Instruments

Construction of Different Gauges—Improved Designs Increase Efficiency—Reducing Weight of Larger Sizes—Combining Blocks for Checking Dimensions—Testing Micrometers for Wear

By H. ALTON

IN CONTINUING the study of the use of precision measuring instruments, the broad field of such work makes it only practical to discuss the apparatus, methods, and practices which are the most common, or have some outstanding feature of general interest. The science of precision measuring, as we have seen, goes hand in hand with the modern development of shop practice, namely quantity production and interchangeable manufacturing. Standardization of product has been made possible largely through the fact that precision measuring can be accomplished in the manufacturing shop through the medium of special gauges. One cannot separate precision measuring from a system of gauges, because gauges are the commercial evolution of precision measuring instruments, produced for practical use.

Gauges are classified in several general ways. The classification as to uses contains three subdivisions namely, shop gauges, inspection gauges and reference gauges. These applications are self-explanatory. The shop gauges are those that are used by the operators on the machines to verify the work as it is produced. They check an error practically as soon as it occurs and eliminate the continued production of faulty pieces. For this reason time and material are saved on many occasions with resultant monetary savings. Generally speaking, shop gauges are designed with somewhat smaller tolerances than are the other classes of gauges which are used to check the same dimensions. There are two principal reasons for this, first is that shop gauges are subjected to the most severe conditions and often receive abuse, both conditions conducive to wear and possible error. Secondly, if the shop gauges permit a smaller tolerance range it is all the more reason to believe that when the product is subjected to the inspector's gauges that a greater per cent. of it will be acceptable. It is always well to have this slight margin of safety.

The inspection gauges are usually made to have a slightly less range between the high and low limiting dimensions than the reference gauges for practically the same reasons that the shop gauges vary from the inspection gauges.

Other classifications of gauges can be made from the features of their design, quite apart from their various functions. Many simple gauges are made from flat steel. Small snap gauges, profile gauges and such gauges for gauging small parts lend themselves to this method of design and manufacture. Sometimes many slots are cut in one piece of flat steel for gauging several dimensions. As this type of gauge is solid and non-adjustable several developments have been made to overcome wear. Removable inserts have been placed in the slots and also several gauges have been tied together by small plates. Both of these arrangements have been followed to a considerable extent.

Another simple type of gauge is the ring gauge. The name of this gauge indicates its design. It is simply a ring of solid steel for gauging cylindrical work. This type of gauge is not usually made with high and low limits in the one piece. It is practically always either high or low.

Another common type is the snap gauge, and it is made in either the solid, adjustable, or limit designs. For internal work, the three point contact, or star gauge is often used. Several types of gauges have incorporated in their design, indicators, which are capable of registering high and low limits as well as the exact intermediate dimension. A step further is sometimes found in gauges with dial indicators. Apart from these general classifications there are literally thousands of special gauges for use on an equally varied line of product.

Trussed For Snap Gauges

A new form known as the truss snap gauge has recently been devised which has some interesting features. These gauges are adjustable and are of the limit type. They are cast iron and the various portions are in tension and compression similar to the members of a roof truss.

The open design is, of course, much lighter than a solid frame and it is claimed that it is much stiffer and less liable to deflection. The outer rib with its broken line gives a peculiarly reliable and grateful grip to the fingers, even when oily. The anvils have a rather unique adjustment. There are two opposed headless set screws pulling in opposite directions similar to the conditions existing in the screws of an independent lathe chuck. By pulling one screw against the other the finest adjustment, positive in either direction, is easily made. When both are tight the anvil is secure against "shake" in any direction, cannot be jarred loose, and is readily sealed. The holes in which the anvils work are accurately line reamed and the anvils lapped square. The gauge is equipped with anvils having offset heads, and in all sizes over ½ in. it is possible to gauge up to within 1/32 in. of a shoulder. A brass button is provided for marking sizes. This method of attaching the button is simple and can be

Illustrations and information through courtesy of the Brown and Sharpe Co.



Fig. 1.—Built up gauge to test distance between plugs on indicator gauge.

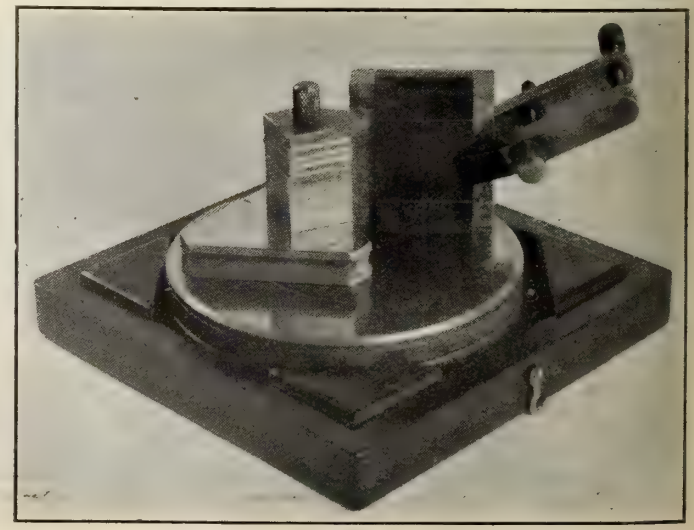


Fig 2.—Scribing layout for holes.

easily removed and the marking filed off, thus preparing for a new marking. Square anvils are also provided for this type of snap gauge, which in some lines of work possess additional advantages.

Plug Gauges

Cylindrical plug gauges are the universally accepted type of gauges used in gauging the diameter of holes. The long plug end is the low limit, and the shorter plug is the high limit end. The gauge pieces can be turned end for end thus giving longer life to the gauging parts. The fact that these gauging plugs, are reversible also makes them renewable. As the handles are standard and sizes marked on the gauging plugs, there is nothing to prevent various gauging pieces being mounted on these handles as may be required from time to time.

The cylindrical plugs are machine lapped by a special method which is a modification of the Hoke process, which, it is claimed, gives a finely finished surface entirely free from circular grooves, which result from grinding or hand lapping, and if present, cause in service rapid initial wear. The process produces gauges that are round and of uniform diameter from end to end. The measuring machine, fluid gauge, and amplifying gauge show no errors in this respect. These features in manufacturing together with the fact that a carefully selected alloy steel is used, assures an exceptionally long life to the gauges.

The "go" ends are held to a very small plus tolerance from the marked size, to allow for wear. The "no go" ends are held to a still smaller minus tolerance, as they are subjected to little wear and must accept work which is exactly up to the allowable limit. The blanks are all seasoned before being lapped. The seasoning process is done with the idea in mind of bringing the steel to a point of molecular rest, as when such a condition prevails expansion and contraction is uniform and at a given normal temperature the size will be always the same.

The handles are of hexagon stock, giving ample space for marking tool and operation numbers. The method of fastening the handles to the gauging plugs is rather novel. Three prongs on the handle, of 90 deg. included angle, engage three grooves of 75 deg. included angle, in the gauging plug. By means of a simple screw through the gauge, the wedge-like prongs are forced into the grooves. This provides a self centering tripod support free from "rock" or "shake" and very sensitive to the "feel." Thus practically the rigidity of a solid gauge is obtained. The screw end projects on the "no go" end and is flush or comes below on the "go" end which necessitates the gauge always being placed with the heavy end down. Handles are made in the single or double end design in all sizes.

The larger sizes of plug gauges are constructed somewhat differently than the smaller ones. Any standard plug

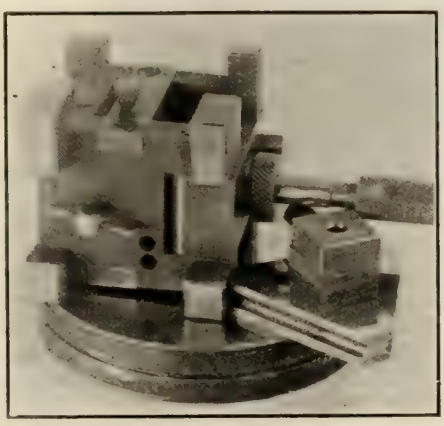


Fig. 4.—Checking a jig.

gauge over 2½ in. becomes a heavy gauge and in order to make the gauge lighter the construction of the "go" end is changed. This hollow construction applies to the "go" plug being lightened by a web-and flange construction. Two discs are forced into the ring on a taper before grinding and grip the central tube, holding the parts securely. The reversible feature provides double the usual wearing surface. Three prongs on the handle are forced into three grooves in the bushing, providing a three point self centering tripod support without "rock" or "shake." The washer at one end, and the handle at the other, bear on both the stay-tube and the discs, binding the assembled gauge-head to the handle. The "no go" ends have solid ends



Fig. 6.—Using a mikecheck for testing micrometers

of the web and-flange construction. The practical application of these gauges is very simple and has no obscure or outstanding features of interest.

Thread Gauges

The gauging of internal threads is a very delicate business as compared with gauging a plain hole with a plug gauge. The diameters of the thread, (root, pitch and outside) the lead of the thread, and form, all have to be gauged for accuracy. Thus the proposition has several variable quantities as opposed to only one, diameter, in the previous problem. Many thread gauges are reversible and renewable as is the cause in the plug gauge construction. The same special alloys are used and in many ways the method of manufacturing is similar. These gauges are interchangeable with the plug gauges on the standard handles, as the trilock method of locking to the handles is used.

The length of a thread gauge is not governed by any definite calculations, and is usually made up to the desire of the user. The finer the pitch the shorter the gauge required is, of course, an obvious conclusion. Reversible or renewable types of thread gauges were not popular in the past, as the methods used to secure them to the handle were far from being rigid. Thus new designs of locking, which do away with the objectionable "rock" and "shake" have done much to duplicate the sensitiveness of a solid gauge, and thus increase the usefulness of the modern reversible design.

Where the limits of the work are fairly large, extreme accuracy is not required in the gauges. "Working" gauges made to the tolerances recommended by the National Screw Thread Commission,



Fig. 3.—Checking a pro'le gauge.



Fig. 5.—Measur'ng a rack type gear cutter.

are manufactured in all forms and sizes. They have the same appearance and wearing qualities as master gauges. They are not lapped, but ground closely to size, perhaps .0005 in. being left to allow for wear.

A valuable feature first introduced in the reversible thread gauges is the ideal chip groove for carrying dirt, and chips, ahead of the guage when entering the hole. The usual form is that in which the blank is chamfered to the angle of the thread. The helix begins at the root diameter and builds up to a full cross-section of thread in one revolution. This form starts easily in the work, but the growing helix wedges any chips or dirt between the gauge and the work. Pilot brushes attached to the gauge have been used to avoid this trouble. Another expedient is the three chip grooves; here the thread reaches its full cross section in about 90 deg. and a chip is often wedged tightly before reaching the space provided and the groove fails to catch it.

A more efficient device is where the first convolution of the thread is removed. The sharp edge cleans the thread effectively, but the gauge is difficult to start and the edge soon becomes nicked. The ideal chip groove starts in its hole as easily as the first mentioned because it retains the growing helix except at a small portion. Just before the full thread is reached a small groove is provided that collects all chips and protects the thread from injury.

In the thread template gauges the locking screw is tightened so that the threads of the taper screw form a perfect dowel in both planes—something which has been lacking in many previous types of adjustable templets. The importance of accurate doweling to maintain a true helix is obvious. Both screws are readily sealed after setting. These gauges are made in all sizes from 1/16 in. to 5 in. or larger. The first thread of the templet is chamfered to the angle of the thread, for ease in starting. The ideal chip groove can be furnished, but is not usually required because a male thread is more readily cleaned than a tapped hole, and the slots in the templet provide chip space.

Gauge Blocks and Attachments

With a set of precision block gauges any dimension from .001 in. to over 10 in. can be obtained in increments of .001 in., while any dimension from .2000 in. to over 10 in. can be obtained in increments of .0001 in. When the desired size is more than .5 in. two or more stacks can be built up to identical dimensions, for checking against each other for use on several jobs simultaneously. The attachments consist of one pair of inside caliper jaws with a radius of .125 in., and one set of inside caliper jaws with a radius of .250 in., one pair of outside caliper jaws, scriber, centre point, base, knurled screws, headless screws, long flat head screws, short flat head screws, slotted nuts, and six assorted tie rods. Each of the blocks is made from square stock and when machined the common dimension of all blocks is .950 in. square. A hole is provided in each block and by means of the different screws provided various combinations of sizes as well as various types of gauges and tools can be assembled.

The inside and outside caliper jaws, scriber and centre point, are finished flat on one side to fit snugly and adhere to the blocks and gauges. The scriber is finished to a knife edge on both sides of the point. These edges permit of sharpening indefinitely, without affecting the accuracy. The centre point is ground to a 60 deg. angle with the point .100 in. from the finished flat surface. The base is finished .500 in. in thickness and is flat and parallel on both sides.

Practical Application

Fig. 1 shows a series of gauge blocks buit up to test the distance between two plugs on an indicating gauge. The knurled screws facilitate the assembling of the blocks and permit handling with a minimum change of temperature due to heat of the hands. Fig. 2 illustrates a simple, rapid and accurate way of scribing a layout for several holes. Work clamped to an angle iron is placed on a tool maker's flat. Precision gauges built up to the desired size are set up on the base, the scriber is "wrung" onto the top of the stack and the first line is drawn. Gauge blocks are added or removed from the stack to give other dimensions. The whole layout can be made in a short time with the positive knowledge that the lines will be drawn with much greater precision than is possible with rule and divider. Fig. 3 illustrates the use of gauge blocks with a sine square set up for testing the angle of a profile or contour gauge. The square has a knife edge and a very small error can be detected when carefully observed.

Fig. 4 shows the use of a plug gauge and gauge blocks testing the accuracy of a jig. Fig. 5 shows the blocks used to test the angle of the teeth on a rack type gear cutter. It will be noticed that the proper angle is obtained by placing gauge blocks under the end of the fixture to which the cutter has been bolted. The gear cutter teeth in question have straight sides at an included angle of 29 deg. between the sides of the teeth in a tooth space. When the fixture is tilted so that the pitch line is inclined at 14½ deg. to the vertical the surface gauge shown should indicate that the side of the tooth is parallel to the surface plate.

The height of blocks required is easily obtained, if the distance between the V slots in the holder is known. Supposing this distance is 10 in. Look up the sine of the angle 14½ deg. in the tables of trigonometrical functions. Multiply the number found, by ten and you will have expressed in inches the height of blocks required.

Mikechecks are designed to check micrometers for errors which occur in manufacture or from wear on screws and anvils, or in relapping and adjusting. Such errors exist to an appreciable degree in most micrometers. By the use of a set of mikechecks they may be checked, not merely at zero and even inches but also at intermediate points. The importance of having a check on the accuracy of a micrometer is shown in the illustration. This micrometer has seen several years of hard service and the screw is worn in places. The anvils have been lapped true and the nut adjusted to show correct at zero. It also shows correct at the 1 in. position. It might be assumed that it would be correct at intermediate points, but the .5 in. mikecheck shows an error of nearly .003 in. at the half-inch point. Some micrometer errors are unimportant if known; a set of mikechecks makes it possible readily to detect such errors and to allow for them in working to close limits.

In relapping the anvil and spindle it is not easy to bring the surfaces exactly square with the axis, nor to tell when they are square. An error here shows periodically as the screw is revolved. The .094 in., .100 in. and .106 in. mikechecks give readings at three points separated by approximately a quarter turn of screw. Since three points not in the same straight line determine a plane, the squareness of the surface is proven if the three readings check. If not, the direction of the error is shown. Mikechecks, made of the special alloy steel as Hoke precision gauges and produced by the same process of lapping and aging for permanence, are accurate to within .000025 in. Neatly and conveniently contained in a knurled screw-top steel case which justs fits the vest pocket, the set consists of six blocks .094 in., .100 in., .106 in., .300., .500 in., and 1.000 in.. The ..094 in.. and .106 in. together make the equivalent of a .200 in. block. They are .7 in. dia., and will wring together as firmly as Hoke precision gauges. There is also furnished a single 2.000 in. mikecheck in a separate steel case. A few of these long mikechecks, with one set of the smaller sizes, may be used to check micrometers up to 12 in., at each tenth-inch from .100 in. up, and a quarter turn each way from these points.

A RECORD CASTING

The largest iron casting ever made in Great Britain and one of the largest ever produced in any country was recently turned out in a British factory. It weighed about 110 tons and the mould was built in a 16 foot pit. Seven hours were occupied in melting the metal, and the casting was poured in just under five minutes. Three weeks were occupied in cooling the casting. Owing to its enormous size and weight the casting had to be delivered by road, six traction engines being used for hauling it.

Remarkable Locomotive Wreck Salvage

Engine and Six Loaded Cars Collide With Others on Trestle and Fall Into Lake—Locomotive Raised by Means of Scows and Hauled Ashore on Submerged Rails.

By ROY A. HUNTER

THE Vancouver Machinery Depot, Ltd., Vancouver, agents in B.C. for Climax Locomotive Co., carried out, some little time ago, a job for which it is hard to find a parallel. A 50-ton Climax geared locomotive, owned by The Rat Portage Lumber Co., at Harrison Lake, B. C., was taken charge of by its train of six loaded cars of logs by reason of the fact that the air line stop cock had been overlooked when switching—with the result that the locomotive started down a 6 per cent, grade with the six loaded cars unconnected to the air brake system. These naturally took charge as the locomotive's own braking effort could not hold the train. After going upwards of 2,000 yards, the train ran out onto a trestle, over the lake, and there met, head-on, two loaded cars of steel rails. The whole mix-up dropped over into 35 ft. of water, and the locomotive came to rest on the bottom of the lake, having two cars of steel underneath her, and six cars of logs on top.

Prospects for salvage were at once reviewed, and divers reported a bad smash-up, and great difficulty in raising the wreck on account of the loaded cars above and below. Salvage was, however, undertaken by the Vancouver Dredging & Salvage Co., who had a hard time getting their gear to the site: Harrison Lake is inland, and the derrick scows had to be navigated up the Fraser river from the coast, and then across dangerously shallow flood water to the lake. After 8 days the wreck was raised by the derrick scows and, partially submerged, was worked gradually towards shallow water (see Fig. 1), where a submerged track had been built out into the lake a considerable distance, to receive the wreck. This footing accomplished, the wreck was very soon on dry land, (as shown in Fig. 2.)

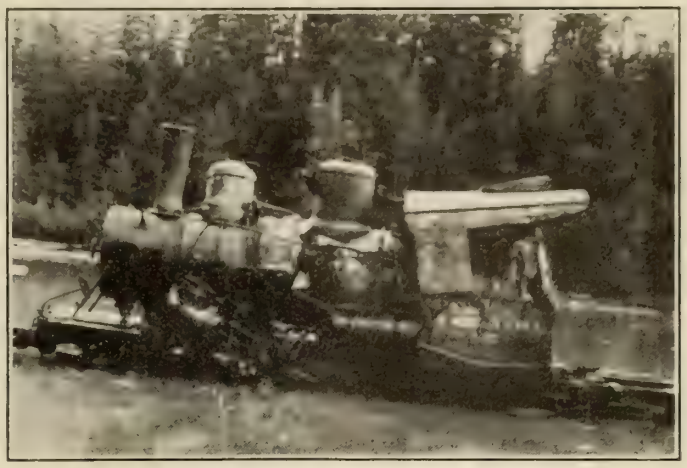


Fig. 1.—Locomotive in shallow water on submerged track.

The water having receded from the shallow flood connection to the Fraser river, it was found impossible to bring the wreck into the town for rebuilding. Accordingly "Mahomet had to go to the mountain" in the shape of the Vancouver Machinery Depot Ltd.'s rebuilding squad, armed with air tools, rivetting tackle and other necessary and suitable equipment. It was in the depth of winter and very cold, and the work was unavoidably outdoors. Every particle of the locomotive had to be dismantled and rebuilt from the ground up. Engine frames, trucks, boiler, and a few other main parts had escaped structural damage, but were full of the material and effects of Harrison lake mud, and required a large amount of very thorough cleaning and scraping and minute inspection; also other parts were irretrievably damaged or destroyed. New cab and fittings and controls were required; all shafts, etc., straightened and reset; tender and tanks rebuilt; all demountable gear stripped down, overhauled, and replaced; new air equipment was required and also new headlight equipment. The work of rebuilding was pressed on with all speed and was completed in 30 days from commencing the job—and this away from shop conveniences of all kinds and even reasonable warmth to work in. The locomotive was placed in commission again on completion and has since performed, in every way, exactly as brand new from the factory.

The Vancouver Machinery Depot, Ltd., who, by the way, do a great deal of the locomotive overhauling and rebuilding work in British Columbia, are to be congratulated on their major portion of the above most notable salvage.

Ten 4-page leaflets under one cover are being circulated by the Fitchburg Grinding Machine Co., Fitchburg, Mass., in which several models and sizes of cylindrical grinding machines are described and illustrated. In addition to a general description of each model, specifications are given. Both hand-operated and automatic types are described.



Fig. 2.—Appearance of wreck when taken from water.

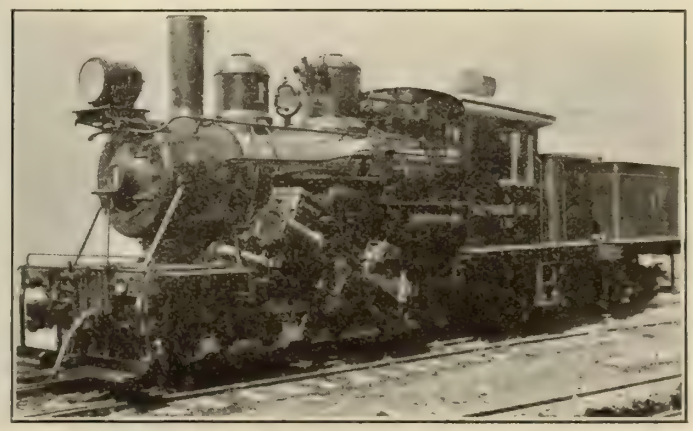


Fig. 3.—As the engine appeared after repairs.

News From the Welding Field

Welders Wage War Against Flood

Repairing Gas Mains Over Night—Domestic Service Hardly Interrupted—Smelting Shutdown Averted—Two Well Known Firms Amalgamate

NEARLY every community has suffered interruption of its public utilities service at one time or another as a result of severe storms. Not very many years ago, if serious breaks occurred in gas mains, regardless of the cause, it was likely to occasion inconvenience to the public for a considerably longer period than is now required for making repairs and restoring service. The expedition with which havoc wrought by the elements can be remedied with modern repair equipment, such as modern welding outfits, for example, was instanced recently in California. The Gas Age (New York) describes the recovery and repair by oxy-acetylene welding of broken gas mains during one of the worst storms and floods experienced in the Pacific Southwest in a generation. The details are fairly typical of what public service corporations the country over are doing from time to time in similar emergencies, and are of special interest as showing the part gas welding and cutting are playing in service maintenance in the gas industry. After pointing out that a certain gas company in Southern California, operating 1,300 miles of transmission pipe lines that cross dozens of dangerous streams in serving five counties and 43 cities, had suffered a number of breaks in its lines during the storm noted, the writer proceeds:—

The first serious break in a company's main occurred when the San Gabriel river tore away the most of the El Monte bridge, then under construction, thereby severing the 4" high pressure transmission line supplying the city of El Monte. The bridge went out at five o'clock on the night of December 20th. The local superintendent of the company was notified at 6 p.m. In less than one half hour he had a construction crew on the job, had turned off the gas in the broken main and had begun the long battle in the river bed to recover the severed main.

The line across the San Gabriel, in addition to supplying the city of El Monte, is part of the Monrovia transmission system. The pressure at Monrovia dropped 50 pounds in less than one hour following the collapse of the bridge. The district superintendent and his construction force worked from 6 p.m. until the following morning at 3 a.m., when the break in the main had been repaired.

When the patrons of their company began their meals on the morning following the storm, they found their gas service as excellent as ever. The superintendent and a construction force had worked most of the night in a drenching rain, much of the time up to their waists in the river, in order to tie in the broken main. The welders had been on the job and had succeeded in welding the broken line, fastened it to the abutment still standing in the river bed, and finished the work in a raging storm.

The writer then recounts how other breaks were handled with such dispatch in other parts of the system that service was scarcely interrupted at all during the hours when required by consumers. It is an interesting commentary no less upon the energy of the present-day management of well-directed public utilities and their emergency crews than a revelation of what an industrial process that has been known only a little more than a decade has come to mean in the lives of the people to day. And after all, such emergency uses for oxy-acetlene are strictly negligible compared to its broad and growing applications in industry.

PROGRESS IN STEEL WELDING

In the early stages of welding steel and even up to recently, the practice consisted too often in filling a steel weld with whatever rod was ready at hand. This aften resulted in poor or weak welds and in a prejudice against the art in general.

Much research has been conducted recently both on the correct mixture of gases and the proper distribution to attain controllable temperatures as well as on the kind and composition of the rod which is to supply the welding metal. Attention has also been paid to the use of proper fluxes as well as to the needs in obtaining a high-grade weld of being certain that the base metal and the welding rod are fused at the proper temperature to insure a thorough mingling of the metals. It has been conclusively demonstrated, says Iron Age, that to obtain a weld as good or better than the original metal it is necessary to use a rod of a composition which will produce a joint better than the original or base metal. To attain this, rods of various compositions, including nickel steel, manganese steel and other alloys, have been developed. Their judicious use in the hands of experts is producing results hitherto unexpected.

It may safely be said that the art of welding has developed to a stage where, by controlling the temperatures, the materials and the fluxes, furnace conditions originally existing in the actual manufacture of the metal are imitated as nearly as possible at the welding point, to the decided improvement of the welded portions.



Large hydraulic car axle press before and after welding.

WELDERS AVERT CLOSING OF SMELTING PLANT

A job that is typical of the work being done by oxy acetylene welders and cutters at mines and smelters is illustrated in the accompanying illustration, which shows a 300-lb. hydraulic car axle press before and after being repaired. Figure 1 clearly indicates the seriousness of the fracture, showing the broken press in two pieces, while Figure 2 depicts the press after it was reclaimed by the welder. The latter view might easily be mistaken for a reproduction of an entirely new press, so well executed is the outer finish of the weld, and that its excellence is more than "skin deep" is attested by the satisfactory service the press is now giving under heavy working pressure.

The press shown is the property of a large refining company in the West. It is a small part of the company's great plant, but it was found to be very necessary to continued operation the moment it got out of "kilter," distinctly emphasizing its importance as a necessary unit in the machinery of production. There was occasion for congratulation, therefore, that the company maintained an oxy-acetylene department and had a welder capable of handling the repair without unnecessary delay. The weld measured from 3½ inches to 6 inches in depth and was about 6 feet 3 inches in length. The job was executed with one blowpipe and required about 200 lbs. of filling material. Oxweld equipment and materials were used.

WELDING FIRMS CONSOLIDATE

ANNOUNCEMENT has been made by the Air Reduction Sales that it has acquired all the assets, including the patents, trade marks and trade names of the Davis Bournonville Co., Jersey City, N. J., and Toronto. Negotiations effecting this move were consummated on March 17, 1922. It is understood that the purchase was accomplished without the need of public financing or bank loans. The consolidation brings together two large companies, whose histories have, to a great extent, been the history of the development of the oxy-acetylene welding and cutting industry.

In addition to its oxygen and acetylene producing facilities, Air Reduction owns a carbide plant, a welding and cutting equipment manufacturing plant, and extensive laboratories for the carrying on of useful research in connection with its various activities.

The merging of the Davis-Bournonville Co. with the Air Reduction Sales Co. brings to the latter organization all of the products that have been developed by "D-B." These products include hand welding and cutting torches in a variety of styles and sizes, suitable for all classes of service; machine torches for welding and cutting; pressure regulators; lead-burning torches; carbon-burning outfits for use on motor car cylinders; acetylene generators; tube-welding machines and tube-fabricating equipment; barrel-welding machines; weldographs for robe rails, milk cans, etc.; the radiagraph for straight line and circle cutting of steel plates and forgings; the oxygraph in two styles for cutting forgings, dies and shapes; the camograph for production cutting of hand-holes in steam-boiler headers, locomotive links and other parts made in quantity; the pyrograph for cutting boiler flanges to height and caulking angle in one operation.

It is the intention of the Air Reduction Sales Co. to continue the manufacture of "D-B" torches, acetylene generators, special machines, etc., under the supervision of the men who developed this famous brand of oxy-acetylene apparatus. The equipment will be marketed under the trade name of "Airco-Davis-Bournonville" through the medium of the Davis-Bournonville service organization in combination with the extensive service system that has been built up for the distribution of Airco oxygen, Airco acetylene, and other Airco products for welding and cutting.

WELDING HEAVY FRAME OF STONE CRUSHER

Aside from the high cost involved in the acquisition of new equipment or replacement of parts when the services of a machine are suspended on account of breaks in some portion, the delay subsequent on the manufacture and delivery often make it an expensive proposition, so that the possibility of adequate repairs, either of a temporary or permanent character is the chief consideration at the moment. In the repairing of heavy machinery that is subjected to excessive strains and stresses the question of repairs is frequently deemed unsatisfactory, as it is essential that the initial strength be maintained after repairing so as not to affect the efficiency.

As a striking example of the value of oxy-acetylene welding to those who employ machinery of any kind, the illustrations given below should prove of interest. It shows a section of a large rock crusher, the piece weighing approximately 3 tons, which was completely broken at both bearings, the area of fracture being approximately 9″ x 14″. on each bearing.

The cost of a new part being very high (in the neighborhood of $1,000.00), it was decided to have the broken parts welded, if practicable. Perfect alignment was absolutely necessary and when welded the section had to be absolutely as strong as new and flawless. The work was undertaken by the Carter Welding Co., of Toronto, four operations being employed for 12 hours, and 2,400 ft. of oxygen and 2,000 feet of acetylene were required to produce the heat necessary for making perfect welds. The necessary preheating was done with charcoal and a gas and air blow torch.

The cost of a new part being $1,000.00 and the cost of welding $100.00, a net saving of $900.00 was effected by the employment of the oxy-acetylene process.

Ruper G. Bruce of the Van Winkle Co., will return to Toronto this week after an extended trip to Great Britain and Europe.



Fig. 1.—Stone crusher frame with preheating furnace in place.

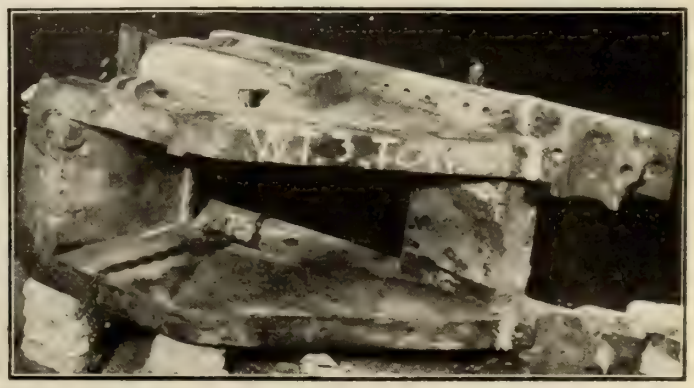


Fig. 2.—Stone crusher frame after welding.

Recent Developments in Mechanical World

Testing of Lubricants

Viscosity is a measure of resistance to shear, but it is no direct measure of the lubricating properties of an oil. Oils of the same viscosity may have widely different degrees of "oiliness," this being a property which cannot yet be defined or measured with any great degree of accuracy. The rapid decrease in viscosity with rising temperature is a factor which must be taken into account where oils are used at high temperatures; but here, again, the oiliness is at least as important as viscosity in determining the maintenance of the essential film. Solid lubricants, states Manchester Guardian Commercial, should be regarded primarily as "fillers" for the minute interstices which exist in even the most highly polished surfaces. Their principal advantage is in reducing static friction by thus improving the surfaces, but they also reduce the internal friction of oils, particularly if used in the colloidal state, and colloidal suspensions of graphite in water form a lubricant which eliminates explosion risks in air compressors, and feed-water contamination where steam engines are concerned.

* * * *

Hardening Steel by Overstrain

The well-known effect of hardening metals produced by straining them beyond the elastic limit was revealed in an interesting way by an experiment conducted recently. The letters comprising the words "Adelaide University" were stamped on the polished side of a rectangular bar of mild steel with a punch. They were then completely filed off, so that all apparent trace of them was removed, and the side was highly polished. The bar was then put in the testing machine and stretched to beyond its elastic limit, when the letters appeared as raised marks, still retaining the original high polish which had become dulled over the rest of the surface. The reason is fairly obvious. Whilst all trace of the letters had been removed by filing, the metal underneath had been overstrained and hardened by the effect of the punch, and this hardened metal under the letters still remained. The result, according to a writer in the Commonwealth Engineer, was that as the bar was stretched in tension, this hardened metal did not flow with the rest of the metal in the bar, but remained standing out in hard raised surfaces showing the original imprint of the punch. A precisely similar effect takes place if the bar is subjected to compression beyond its elastic limit, instead of tension, only in this case the letters are hardened depressions in the surface instead of projection.

* * * *

Shale Oil Being Developed

Wells are now being driven in Australia and Tasmania with the hope of striking oil in some of the shales. Gas has been obtained but oil has been slow to reveal itself, though the deposits are thought to be rich.

The discovery by the Samara University of the edible qualities of "awsan" leads to the belief that the famine of Russia can be greatly reduced. Awsan is a swamp root, containing 70 per cent. of starch, some fats and a good deal of albumen. The university has the sanguine hope that it will have a remarkable effect in minimizing famine.

* * * *

The schooner "Maud," which is now repairing and outfitting at Seattle, will again be driven northward early in the coming Spring in an effort to prove Amundsen's theory. This theory is that by taking advantage of the right current, a vessel frozen in the ice will drift across the Polar Sea in less than five years. He has tried twice without success, a propeller having been broken in the second venture. In the next effort to be made the ship will carry two airplanes which will be furnished with sleds.

Cobalt Magnet Steel

MILLING CUTTERS are in some classes of work far more economical to use than the ordinary machine roughing tools. They carry a number of cutting edges, the pitch of which is governed by the nature of the work, viz., roughing, a coarse pitch of tooth is required; for finishing, only a fine pitch. These work in quick succession on the same surface, and cover a width of some inches at once. The saving in time is consequently considerable, says Practical Engineer. Ordinary machine roughing tools, on the other hand, cut with one edge or point alone, and the width of the material worked is no greater than that of this cutting surface.

* * * *

Clearing Sand From Deep Wells

TWO INTERESTING cases of the application of compressed air to the removal of sand plugs in deep wells is given in the Engineering News-Record. "One well, with an eight inch casing 145 feet deep (from which about 100,000 gal. of water was pumped daily), became clogged with sand to such an extent that it practically stopped the supply. A test developed fourteen feet of sand and small gravel. A three-fourths inch pipe to the sand was inserted and air forced to the bottom, the rising bubbles keeping the water disturbed and the sand in suspension, and it was thrown out very quickly and at little expense. In another case, the well was 236 feet deep with an eight inch casing, and the sand was beginning to shut off the supply and get into the pump. There was available only 150 ft. of one-half-inch pipe which was connected up with a compressor. The rising air created enough suction to lift the sand and the water was clear and running free of sand at the end of 25 minutes. While in the case here cited, the compressed air injected below the sand plug removed the obstruction very successfully, it should be noted the arrangement was not what is properly known as the air lift."

* * * *

A Remarkable One-Tooth Gear

WHEN A GEARING is required to give a large difference between the speed of the driving and the driven wheel, what is called double reduction is adopted. That is to say, the reduction in speed is made in two stages. A British firm, however, has constructed a most ingenious gear in which a ratio of 63 to 1 is effected with a single reduction. The gear is of helical formation and it has been run for some time transmitting 10 horse power at 1,000 revolutions per minute without sign of distress of wear. The pinion has almost been found to work satisfactory as a driver, and the efficiency of the gear is stated to be equal to that of any ordinary double reduction gear. It is expected that this gear will be used for a large variety of applications, especially for the lighter drives in which it is desired mainly to transmit motion. The first pair of gears of this type will be deposited in the South Kensington Museum, London, to form part of a permanent collection of interesting mechanical devices.

* * * *

Recently a patent was issued in Britain to cover the use of nickel wool, which has been activated for the hydrogenation of fats. The nickel wool is treated with nitric acid. The nickel salt then formed is converted into the oxide and this reduced in hydrogen. The activated wool is packed in the reaction chamber through which in counter current the oil and hydrogen pass. By washing it with hot oil to take away the nickel soaps the catalyst is regenerated. Finally the oil is removed by solvents and heating in hydrogen takes place.

Now is The Time to Invest In Machine Tools

Present Conditions Demand Greatest Efficiency if Profit is to be Made—Machine Tool Salesmen Can Help You Plan Cost Reductions—Make Your Improvements to Equipment Now.

IN THE ERA of strong competition now upon the business world, the best way to make profits is to get more and better production at lower costs. You can never attain that with obsolescent and antiquated machine tools. Conditions demand the greatest efficiency you can get from your factory—the use of the best and most modern tools! Right now, when you yourself are not hurried by an excessive demand, is the time to plan your own cost reductions.

The machine tool salesman is a missionary for better production methods. You can never tell which one may offer something that will save you thousands of dollars a year. It is never safe to pass him by. You may waste some time with him, says the Natural Machine Tool Builders' Association, but some day will come a golden hour that will more than repay you for all your trouble. Let the machine tool salesman help you plan your cost reductions—let him show you what the builders have for you today.

There never was a period when the machine tool builder studied his business so closely as he has the last two years. He has improved the quality and accuracy of his work, junked his own obsolete tools—and put his business where he knows he has his costs as low as they can go! The forehanded user can now get the benefit of all this study.

Only Two Policies

Studies of the business cycle show that for investors in permanent equipment, there are only two policies: the few invest carefully when business is slack and prices are low; the many invest hurriedly when business is rushing and prices are high. Those who invest in tools at a high first cost, when money commands boom rates of interest, must compete with the few who invested at the low price, when money brought only low rates. The stock market, the raw material market, the Federal Reserve Bank reports, all say that time is now!

When business swings sharply upward and the prices of labor and materials go with it, machine tools then cost more. A machine tool is a capital investment that stands ten or fifteen years. Such slow "turnover" produces the greatest returns if the investment was made when the user could get the best quality and when, because the builders' costs were lowest, the price was also low. These conditions prevail right now.

Place Orders Now

If you and other machine tool users wait to order additional equipment until you reach the capacity of your present facilities, the machine tool industry must wait until after all other industries are in full swing. Then the machine tool builders must outbid their own customers for high priced labor and materials. Machine tool orders placed now will not only take up slack in labor supply, but also increase consumer demand for general products, and avoid later strain on the labor market. Besides, the investment is made under the most favorable conditions.

Secretary of Commerce Hoover has urged the railroads to invest in equipment now, because the low level of prices makes the equipment a better investment for the long pull, and because current orders stimulate all business and bring us all that much nearer to normal. If that is logic for the railroads, it is logic for any manufacturer that intends to stay in business.

Before you swing into full capacity production again, doubtless there are improvements that should be made in your equipment. Isn't it really better to invest now when good materials and labor are plentiful and cheap, than it is to wait for higher prices, slower and more uncertain deliveries, and have to accept, possibly, more hurried and less perfect workmanship?

War racked or "war baby" tools offered now at low second hand prices may be a liability instead of an asset. They are already more or less obsolete because of important cost reducing improvements made since. In the rush of high pressure production, it may have been impossible for the manufacturer to maintain his usual standard. Before you buy such possible liabilities, find out what the builder has to offer you now in the way of real asset investments.

Much Better Product

Machine tools are a lot better than they were during the war, for many reasons. The current models are greater labor savers, greater cost reducers, than any the industry has ever previously built. The machine tool builders now offer something so much better than any previous product, that, in some cases, the user could not afford to accept the older types of machines as a gift.

When transportation is as cheap as it was in 1914; and wages are as low; and working hours as long; and taxes as moderate—then it may be possible for machine tool prices also to return to the 1914 level. But will the time ever come? Waiting for such a time before investing in equipment you really need, can only result in your sacrificing in production costs far more than the anticipated saving in price of the equipment. You pay more for the machine you do without than you pay for the one you buy.

Machine tool prices now quoted by builders are away down from the peak. These are for tools with the latest labor saving features—many of them perfected since the war. They are for tools that have been made unhurriedly, of the best materials, by the few finest machinists in the industry—the men who were kept on when the others were laid off. The wise user will make his investment now and avoid the rush that always booms prices in every period of prosperity.

THE TWENTY-FOURTH ANNUAL CONVENTION OF THE N. M. T. A.

The twenty-fourth annual convention of the National Metal Trades Association will take place at the Hotel Astor, New York, on April 19th and 20th. The program for the year, it is reported, is in many respects the most attractive which the association has ever been able to offer, subjects having been selected which it is felt everyone is vitally interested in at this time.

Among the subjects of vital importance to the metal trades which will be discussed at the convention is that of training apprentices to be the skilled all-round workmen. There are a great many methods of training apprentices in vogue in factories and shops to-day, and the committee on apprenticeship has examined these systems with great thoroughness. It has sought to incorporate their virtues and eliminate their defects in a training course which it has evolved. This course may be used in every type and size of plant.

A report which will be submitted at the convention will show courses of shop work for the apprentice, suggestions for a standard diploma, for an interchange of apprentices among the smaller or specialty shops, and other aspects of the apprentice situation which have occurred to only a few of the more advanced manufacturers.

Conditions in the coal mining industry and on the railroads will be discussed by speakers of national prominence; finance; the relation of the farmer to industry; the progress which the city of San Francisco and other large cities have made in emancipating themselves from labor union domination; future industrial conditions in the light of the European situation—these are only a few of the subjects which will also be dealt with by able speakers.

Practical Ideas for Shop Executives

TOOL HOLDERS

By Hubert Bentley, A.M.I., Mech. E.

A little careful attention paid to the tool equipment of the ordinary machine tool will generally result in increased output and reduction in costs, and often for a very trifling outlay. There is no doubt that the elaborate systems of toolholders to be found on the automatic capstan and hexagon turret lathes have helped tool designers considerably when the equipment of ordinary lathes has been under consideration.

An interesting planing machine toolholder is shown in Fig. 1. This was designed to provide the necessary relief for the tool when planing down a vertical face from one of the ordinary cross slide toolboxes. It is the usual practice for a toolbox to be pivoted or hinged so that on the return stroke of the table the tool may be lifted or relieved in order to prolong the life of the tool. This is quite satisfactory so far as horizontal planing is concerned but if vertical planing has to be performed from the same toolboxes it is ineffective. Side toolboxes of course surmount this difficulty, being hinged in a similar manner to the cross slide toolboxes. Where no side toolboxes are fitted to the machine, however, it is necessary to utilize the available toolboxes for vertical planing and the toolhandler shown in Fig. 1 is a very useful machine accessory.

The toolbar is of 2 ins. square section material and bolts to the cross-slide tool box by two bolts. A tapered hole in the lower end of the tool bar receives the toolholder itself. This is held securely in position by a hexagon nut and a square peg in the shank which fits a groove in the washer behind the hexagon nut prevents the nut from working loose when the thrust comes on the tool. The tool block holder is planed out to receive the steel tool block which swivels on a suitable bolt in a similar manner to the ordinary toolbox. The thrust due to cutting is effectively taken by the projecting lip shown in the detail at A. Three-eights square section tool steel is employed and this is gripped by two square head screws. In order to ensure the return of the block to its normal position after the idle or return stroke has been made, a flat steel spring is fitted behind the block.

In Fig. 2, a slotting machine toolholder constructed on the same principle is shown. In many slotting machines, no provision is made for relieving the tool on its upward stroke so that the tools require frequent grinding as the cutting edge is quickly worn away, hence the introduction of the example described. The tool bar is of similar section to the one just described and secured by two bolts to the tee slotted ram end. The bar is grooved at the bottom for receiving the steel tool block which is pivoted on a suitable bolt. On the return or upward stroke the toolblock swivels on this bolt and the cutting tool rides on the work. When slotting, the toolblock lip takes the thrust and a flat steel spring returns the block to its normal position after being relieved. In this case ½-in. square tool steel is employed and held in place by a steel pad and grub screw. This arrangement takes up considerably less room than when projecting head screws are employed.

The application of toolholders of this character while increasing very considerably the productivity of a machine also results in a considerable saving in tool steel, due to the longer life given to the cutting edge and to the small pieces of tool steel employed.

CARE REQUIRED IN MOUNTING GRINDING WHEELS

The mounting and maintenance of grinding wheels demands the exercise of special skill and observation. The wheels should be carefully examined before mounting with a view to detecting any damage that may have occurred in transit, storage or otherwise. Except in the case of very small sizes, all wheels should be lightly tapped with a hammer before mounting and should not be used if they fail to ring clear. In applying this test, care should be taken to remove all sawdust and extraneous matter from the wheel. Grinding wheels must never be forced into position on their arbors or spindles. They should slide on easily, but not too loosely. If the clamping nuts are over-tightened, the resulting strain is apt to crack the wheel. Care should be taken to tighten only enough to hold the wheel firmly. Grinding wheels should under no circumstances be used without flanges. The flanges, which may be straight or tapered, should be inspected frequently, and when found out of truth should be straightened or replaced by new ones. Washers of rubber, leather or blotting paper, slightly larger than the diameter of the flanges, should be interposed between the wheel and the flanges.

HARDENING HIGH-SPEED STEEL

Hardening high-speed steel is usually carried out in a gas or electric furnace and the steel quenched in oil, free from water, until the oil ceases to flash on the surface of the piece. Pieces with fine cutting edges are advantageously brought to a quenching temperature by immersing in white-hot lead, after the necessary preliminary heating to a color, or in a bath of barium chloride kept at a proper temperature (from 2275° to 2325° F.) by means of a pyrometer. A little potassium ferro-cyanide added to the bath will prevent decarburisation of cutting edges while heating. Tools should be ground with light pressure on a wet stone to avoid cracks due to sudden expansion of the surface caused by the heat of grinding. The high heats necessary for the successful hardening of high-speed steel have a tendency to deteriorate slightly the outer portion of the metal, and consequently it is advisable that the deteriorated metal should be ground off after hardening and before use. At least 1/32 in. should be ground off the tool and front of the nose of the tool. Grinding should be done on a free-cutting emery wheel under a copious, steady flow of water. An intermittent flow of water, allowing the tool to heat up, after which it would again come into contact with water, would cause surface cracks.

Mill scale and adverse weather conditions promote corrosion of steel. Mill scale and all rust must be removed before any paint is designed to protect the clean steel surface. The second coat of paint protects the first coat from the weather and this second coat must, therefore, be impervious to moisture and frost.

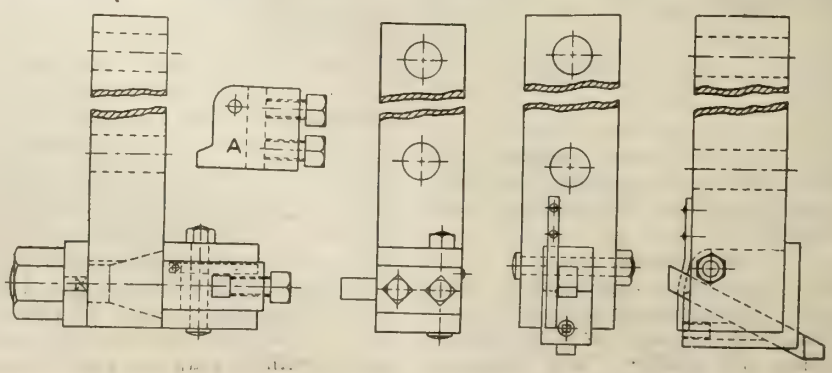


Fig. 1.—Left, relief tool holder for vertical planing. Fig. 2.—Right, relief tool holder for slotting machine

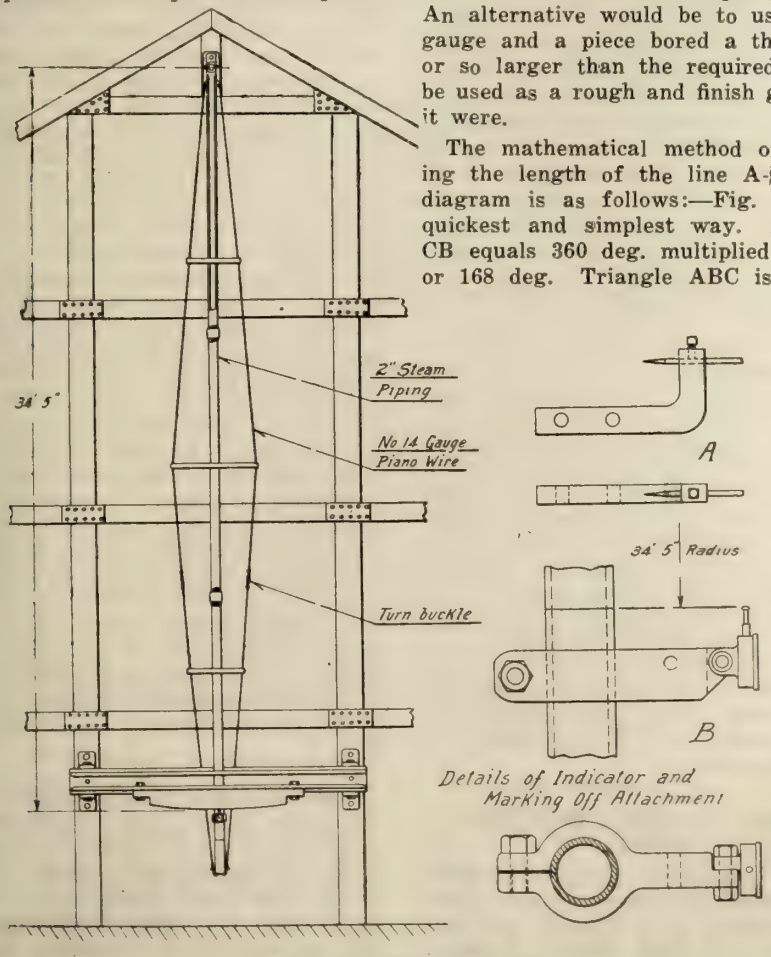
CAMBERED ROLLS

By R. Harrison

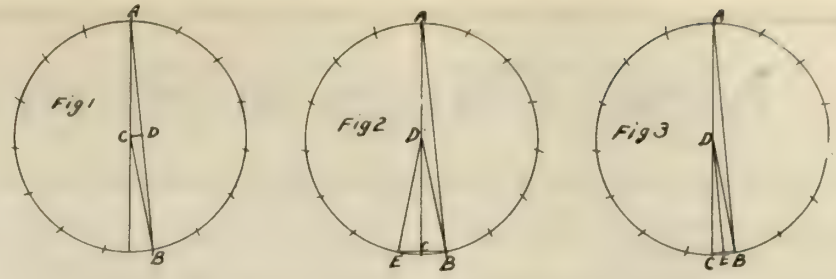
In the production of sheet metal, the chilled iron rolls used in the mills are often supplied with cambered surfaces. This curved or cambered surface is reproduced on the roll body from a camber bar of known curvature fitted to the reciprocating table of the grinding machine on which the roll is ground.

Contact between the camber bar and the wheel head operating mechanism is made through a hardened steel roller, which in turn operates through a series of levers, ultimately imparting the very slight reciprocating motion to the wheel head necessary for the reproduction of the camber. When it is realized that the actual camber on the roll is only a matter of perhaps a few thousandths of an inch, on a roll say thirty inches diameter by forty-eight inches long, it will be readily credited that the generating mechanism to produce it must be both extremely accurate to start with and durable in use. Although all components are important, the camber bar from which the form is generated being the basis, it must necessarily be made to very close limits of accuracy. Several methods are available by which the correct radius on the camber bar can be struck, but the scheme illustrated herewith being the simplest and most direct, the results are naturally more accurate, and what is more important, less costly to attain.

Suspended from a point in the apex of one of the bays under the pitched roof of the erecting shop is a length of 2 inch steam piping, while braced to eliminate side whip with a couple of piano wire struts tensioned by suitable turnbuckles. Varying lengths of radii can be obtained by swinging the pipe from pivotal holes drilled at pre-determined distances. A line to machine is struck across the length of the camber bar by traversing by hand the tool point shown in detail at "A." After profile milling, the bar is again mounted on the wall brackets and checked over by means of a dial indicator mounted as shown at "B." Final correction is obtained by draw filing.



Device for testing camber bars.



Diagrams showing solution of reamer query.

SIZE OF REAMER QUERY

By H. T. Osborn

Reply to query by D. J. as to gauging a reamer having an odd number of teeth, the following solution is submitted. The calculations here given are on the basis that all flutes are equally spaced. An alternative would be to use a ring gauge and a piece bored a thousandth or so larger than the required size, to be used as a rough and finish gauge, as it were.

The mathematical method of obtaining the length of the line A-B in the diagram is as follows:—Fig. 1 is the quickest and simplest way. Angle A CB equals 360 deg. multiplied by 7/15 or 168 deg. Triangle ABC is bisected by radial line CD, thus forming two right triangles.

As ACD equals one-half of 168 deg. or 84 deg. and AC is 1 in. (the radius of the reamer), length AD equals sine of ACD x AC, or .99452 in. AB equals .99452 x 2 equals 1.98904 in.

Fig. 2 gives the same result, thus:—Angle EDB = 360 ÷ 15 = 24 deg. CDB = 24 ÷ 2 = 12 deg. DC equals cos. CDB × DB = .97815.

AD + DC = 1.97815 in. = AC. CB = DB × sine CDB = .20791 in. Having the length of AC and CB, AB can be found by

$\sqrt{AC^2 + CB^2} = \sqrt{3.9563} = 1.9891$ in.

Fig. 3 is based on the principle, that if two straight lines are drawn from the extremities of a semi-circle and meet at any point on the circumference they will form a right angle. Thus, ABC is a right angle. AC being known, CB is found by bisecting at E, forming right triangles as shown. Either one is solved to find CE or EB.

CLEANING OILY MACHINE PARTS

One of the most troublesome of the minor problems in the repair and overhauling of motor cars and other machinery is the perfect cleaning of parts which have been thoroughly soaked in oil. This problem is very ingeniously handled in the new central repair works in connection with London's great motor omnibus service. The parts to be cleaned are placed on wire trays mounted on a conveyor which moves very slowly through a cylindrical casing inside which are mounted on a number of pipes perforated with holes ⅛ of an inch in diameter. Hot caustic solution is forced through the pipes by a pump, and the multitude of jets reach every part of the gear wheels and other portions of machinery passing through. When the parts emerge from the cylinder they are practically free from oil. In this way a process which generally is most prolonged and laborious is perfectly carried out in a minute or two.

WATER WHEEL CORROSION

In the water wheel work the blades of the wheels travel at very high speeds. The combined effect of the evacuation resulting from this high speed and the corrosive action caused pitting in bronze, this pitting being sufficiently deep to bring about failure. Monel metal replacing such bronze has shown more than 9 years' service without a sign of pitting.

New Things in Shop Equipment

CONSOLIDATED TAP AND TOOL HOLDER

A very useful tap and tool holder has recently been placed on the market. The chuck is constructed along the lines of a drill chuck. It has a rather wide range, the maximum capacity is for taps up to ⅝ in. in dia., and other tools in proportion. The jaws are provided with V grooves extending parallel to the axis of the holder. These jaws are serrated throughout their whole length, in order to provide a secure grip. The opening of the jaws may be easily adjusted by turning the sleeve, which is knurled and has a maximum di. of 1⅜ in. The length of the handle is 7½ in. and the length of the tool itself is 4 in. The tool is manufactured by the Consolidated Tool Works of New York City.

PRECISION ANGLE AND MEASURING IRONS

There has been recently placed on the market a precision angle iron built in three sizes. The device is made of cast iron and is intended for holding work on a machine table. Two slots are provided for clamping one leg to the table, while the slot in the other leg can be used to secure work to the angle iron. Two ribs brace the legs to keep the device from distorting. The iron is made in the following sizes: 4 x 5 x 5 in., 6 x 6 x 8 in. and 8 x 10 x 12 in.

The same firm also is marketing a precision measuring iron. The device is especially intended for use in setting and aligning work for accurate boring operations. It is provided with a bolt hole and keyway, so that it can be easily secured to the table of the machine. If it is so desired it can be used for clamping work that is to be machined. This tool is made in two sizes: 2½ x 6 x 12 in. and 4 x 8 x 21 in. These tools are manufactured by the Simplex Tool Co., of Woonsocket, R. I.

BENCH GRINDER WITH SELF-CONTAINED EXHAUST FAN

There has recently appeared on the market, a bench grinder, which has as a component part, fan provision for removing the dust caused by grinding. Outside the bearings are located centrifugal fans which blow the dust directly back through the exhaust pipe connected at the rear of the grinder. A separate fan and motor are not required. This design is best adapted for use in the case of single machines where it is possible to conduct the dust directly outside. In a measure, it does not attempt to replace large and powerful exhaust systems as the fan has not capacity to convey the dust through a long pipe, particularly if many bends are encountered. The self contained motor is of the induction type, fully enclosed, designed, for single, two, or three phase alternating current, and built in half and three-quarter h. p. sizes. Hess-Bright ball bearings, fully enclosed, are used. The fans and the two grinding wheels, are located outside the bearings. The grinding wheels are well guarded. Adjustable tool rests are provided for both ends of the machine. The grinder is made by the Forbes and Myers Co., of Worcester, Mass.

LARGE PLANER

A large planer that has a distance of 15 ft. 2 in., between the uprights and can take work under the cross rail that has a height of 10 ft. 2 in., and has a table 38 ft. long by 12 ft. wide, has recently been built for specially large work. The machine is driven by a 75 h.p. motor of the planer reversing type. A large range of cutting and return speeds, which can be instantly changed, are provided. The planer is also provided with a device for "air" or spot planing. This device automatically increases the speed of the table on its cutting stroke when a long stretch of air is to be cut, and automatically slows down the table just previous to the entry of the tool into metal. The return speed remains constant. Five tool heads are provided. Two heads are carried on the cross rail, one extension-slide side head on each upright, and one head on a separate column. The independent feed and power rapid transverse in all directions for the two cross-rail heads, and the two extension-slide side heads, are so arranged that each can be engaged for power rapid traverse in any direction, at the same time the other head, or heads, are feeding. A 15 h. p. motor located at the top of the girt, furnishes power for raising and lowering the cross-rail and for the power rapid traverse to the heads. Automatic tool lifters are provided for the cross rail heads. Forced lubrication of the table ways, as well as of the driving gears, rack and shaft bearings, is furnished by means of pumps and an oil filter system. A separate tool head, or column, fastened to the bed some distance ahead of the right hand upright, carries a saddle which is provided with vertical feed and power rapid traverse in both directions. This power is furnished by a separate electric feed motor. The planer was manufactured by the Betts Machine Co., of Rochester, N. Y.

SMALL PORTABLE ELECTRIC DRILL

A very small and compact portable electric drill has recently been placed on the market. It is intended for general work of a light nature. It has a capacity that will permit it to drive with ease a one quarter inch drill. It is equipped with a Universal, high-speed motor, which will operate on either direct or alternating current, and in the case of alternating current it will operate on either direct or alternating current, and in the case of alternating current it will operate on anything from 25 to 60 cycles. The housing of the motor is made of aluminum and is finished in black. The diameter of the motor is 3 in. All shafts are ground to size and the gears are made of heat-treated tool steel and all gears have helical teeth. The spindle carries a No. 1 Jacobs chuck. A ball bearing takes the end thrust of the drill spindle. Ten feet of cord is furnished as regular equipment, as well as the plug and switch. The drill is ten inches in length, overall, and weighs four pounds. The drill was designed by Joseph W. Jones and is manufacteured by the Consolidated Instrument Co., of America, New York City.

HIGH SPEED METAL CUTTING HACK SAW

There has recently been placed on the market a small hack saw that is designed to use very thin blades and to operate at a very high speed. The number of strokes per minute ranges from 60 to 100, the length of the strokes being 6 in. Twenty-one gauge blades from 10 to 12 in. long are used. It is claimed that the high speed is made possible by the positive mechanical lift on the non-cutting stroke. This action gives clearance to the teeth on the back stroke which prevents dulling from the dragging action. The cut is taken on the draw stroke, and gravity pressure only is applied to the saw blades. An automatic knock-out is provided to stop the saw when the cut is completed. It is stated that the saw is very economical in blades, time, and material. The saw frame guide holds itself at any height, automatically. The saw frame slides on V ways which are provided with adjustments for wear. The normal capacity of the machine is 4x4 in., but an adjustment is provided whereby it can be increased to 6 x 6 in. for large work. The height to the top of the table from the floor, is twenty inches. The floor space required is 38 in. by 12 in. The weight of the machine is 150 pounds. The machine is manufactured by the Racine Tool and Machine Co. of Racine, Wis.

PORTABLE WINCH HOIST

A rather novel type of portable winch hoist, which is very useful in machine shops, has recently been placed on the market. The frame of the hoist is similar to that of a large "horse," having four legs, each pair converging at the

top and supporting a central beam. Steel angles, well braced and riveted, are used to provide a rigid unit. The feet are provided with large castors. When not in use the two pairs of legs are arranged so that they can be folded together and the hoist left up against a wall, where it would occupy but little floor space. The interesting feature of the hoist is the arrangement of the lifting chains. Two chains are provided, which can be operated independently. The chains are mounted on drums which are carried on the horizontal hexagon shaft supported by the top beam. These drums may be easily slid along the hexagon shaft to any position desired. The shaft operating the drums is revolved by means of a crank, which, through the medium of a chain and sprockets, applies power to the final drive of a train of gears mounted on the top of one end of the frame. Owing to the fact that one end of each chain can be uncoupled, two speed ratios are provided. The leverage with the direct lift is 200 to 1 and with the double lift, the leverage is 400 to 1. A pawl engages the teeth of one of the large gears, so that the load may be held in any position desired. This pawl provides points separated by 1-16 of an inch at which the load can be held. A friction brake is supplied for lowering the load. This brake acts on the chain pinion shaft, where the advantage of the purchase, is made use of to assist the braking operation. Two sizes of hoist are made. The smaller has a capacity of 4,000 pounds, has a width inside the legs of 8 ft. and a height of 7 ft. 9 in. The weight of the hoist is about 450 pounds. This smaller hoist can be furnished to special order with a height of 9 ft. Two sling chains are regularly furnished with each hoist. The larger size has a capacity of 8,000 pounds. In this hoist the lifting chains are carried on trolleys which automatically position themselves over the centre of the load. The chain is wound on a winch at one end of the frame. Two speeds are also provided. The rapid speed is gear driven, and the other is actuated through worm gears for the lifting of heavy loads. Either method may be engaged without the use of wrenches. The brake and locking device are very rugged. The hoist has a width of 9 ft. between the legs, a height of 9 ft., and weighs 1,000 pounds. These hoists are made by the Manley Manufacturing Co., of York, Pa.

PORTABLE WOOD-WORKING MACHINE

A machine has recently been placed on the market, which is portable and designed for general wood-working use. The mechanism is mounted on a bench or stand, which can be easily moved about. It carries an 8 in. cross cut saw and an 8-in. rip saw, a jointer, boring and mortising attachments, a miter board and other attachments. A motor of one-half h. p. operates the machine. Current can be supplied from an ordinary light socket. The motor is mounted on a slide that can be swiveled so as to bring the pulley into proper position for driving that part of the machine that it is desired to operate. When connected to the cross cut saw it swings and slides with it. Hardwood up to 2 in. in thickness can be handled by the machine. In the pattern room it is especially useful for grooving out core boxes, for cutting accurate joints for segment work, for small planing and ripping and making mitres at any angle. The advantage is that a great many jobs can be done on the spot at a greatly increased rate of speed over the hand method. At the same time it saves time, and is more economical, than the method of taking the work to a large stationary machine, and tying up that machine from time to time. When the cross cut saw is used, the motion is straight and not in an arc as with a swing saw. The mitre box can be set at any angle, and the dadoing machine is in full view of the operator. The saw runs at a speed of 4,200 r. p. m. and the jointer at a speed of 4,800 r. p. m. Both the rip saw and the jointer operate at the same time, so that two men can work simultaneously. The table tilts for ripping bevels. The machine requires a bench space of 18 x 24 in. The weight of the machine is about 240 pounds. The machine is manufactured by the Hutchinson Manufacturing Co. of Norristown, Pa.

ARMATURE PRESS

An armature press that is intended for the use of electrical repair men has recently been placed on the market. The construction and capacity of the press enable it to be employed for assembling operations such as putting in place piston rings, spindle bushings, gears and similar work. The frame is of cast steel and is capable of withstanding a pressure of 3,000 pounds. It is 17 in. in height overall, and an opening provided in the base is 5 in. in dia. A hardened steel plate, made in two pieces, having three different sizes of openings is furnished to accommodate small work. The plate is held together by two bolts. The two halves can be slipped under the bearings of an armature shaft so that the shaft can be pressed out of the bearing. The working height between the plate and the bottom end of the arbor, in the raised position, is 9¾ in. The press is manufactured by the Napier Machine Co., Inc., of Napier, Ill.

STRIP METAL FILING MACHINE

A machine has recently been built for the purpose of filing the edges of strip metal. It will be of special use in cold rolling mills, where metal is rolled wider than necessary, then cut in narrow strips and wound in coils. Such strips of metal are used to make springs, hack saw blades, and similar articles, and before such articles are made it is desirable to remove the sharp edges. Thus different classes of work call for edges of different kinds such as round, oval, bevelled, or special shape. The coil of metal to be filed is placed on a spool on the spindle. The end of the strip is passed between the two clamps at each end of the table, and then gripped and wound on a power driven spool that draws the metal strip through the machine. The design of the machine is such that power must be applied by a unit seperate from the filing machine. The machine is equipped with fifteen pairs of semi circular heads carrying the files. Each head is mounted on two rods placed one above the other and transversely with the centre line of the machine. The rear head of each pair is secured to the rods by set screws, while the front head is a sliding fit and is held in place by the tension of a spring. Each of the heads carries a file holder, in which is mounted a file 1¼ in. wide by 2¼ in. long by ¼ in. thick. The positions of the files are adjustable by swinging them around on the semi-circular heads and locking them in position. An adjustment of 180 deg. is provided, and it is possible to so group the files as to give the desired shape on the edges of the work. As the files operate in pairs, the pressure of a file on the work is counterbalanced by the pressure of the file on the opposite side. All the heads which are at the front of the machine, can be operated by a lever which pulls them forward, thus opening the filing space. In this way the inserting of a new coil of strip metal is simple. The metal passes in a straight line from one end of the machine to another. Strip metal of any gauge, and up to 3 in. in width, can be handled. The machine itself is rather simple but is very sturdy. It is capable of quick adjustment, and weighs about 1000 lbs. The machine is manufactured by the Duston & Clark Engineering Co. of Cleveland, Ohio. This firm are the successors to the D. & C. Engineering Co. of the same city.

MOTOR DRIVEN BENCH LATHE

There has recently been placed on the market a small bench lathe, which carries its countershaft mounted on an upright steel bar, which bar is supported from the headstock of the machine. The motor which drives the lathe is carried in a bracket at the back of the headstock. The swing over the bed is 10 in. and the distance between the centres is 24 in. The spindle is provided with a ⅝ in. hole throughout its entire length. The carriage is gibbed to the bed and is traversed by a screw. Instead of an apron, a bracket is carried down from the carriage, in which a nut is located. This nut engages the carriage-travel screw in the front of the bed. At the right hand end of the machine a crank handle is fitted to the screw. Thus all feeds are operated by hand. There are no back gears only the open belt drive is used. The motor is supplied with current from an ordinary lamp socket. The equipment includes motor, cord, plug, face-plate centres, centre rest and wrenches. Thus the lathe comes complete and ready to run. The manufacturers are the A. V. Carroll Machine Tool C. of Norwood, Cincinnati, Ohio.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Engage Only The Best

DURING the joint safety convention held in Toronto recently, the question of proper medical attention for injured employees was freely discussed. Several prominent industrial doctors including Dr. Starr, professor of surgery, University of Toronto; Dr. Baker, of the Massey Harris Co.; Dr. Scarlet, of the International Harvester Co.; Dr. Addison, of the Wm. Davies Co.; Dr. Gaby, Dr. Doolin and others, expressed their views on this most important subject, and without exception, they emphasized that cheap, inefficient doctors were a menace to industry.

Selfish motives did not prompt this unanimous opinion, for these are well up in their profession, have a splendid reputation, and do not require to use conventions as a plea ground for higher salaries. They were speaking from experience, and any one of these physicians could, if requested, tell of permanent disabilities caused through careless and inefficient medical treatment.

When a worker is injured, he deserves the best attention possible. Only doctors with a reputation should be engaged, and where a surgical operation is necessary, the best surgeon obtainable is none too good. How many plant managers would allow the doctor attending their injured workmen, to handle their case were they suddenly injured? Ask yourself this question, then if you do not consider the doctor handling your compensation cases good enough to look after you, it is time to change to a more capable physician.

During the discussion, Dr. Starr, who has had very wide experience during the war on surgical work of all kinds, brought out a splendid point. He suggested that some arrangement should be made whereby a specialist could be available as consultive head. That is, if a serious accident occurred, this man could look the injured workman over, diagnose the case, then instruct some other doctor what to do. As Dr. Starr said, "A man such as I have in mind would command a high salary, but the saving of life and money which would result, would soon offset the cost. Not only would it help the employee, but the employer as well, because, through careful treatment, the injured workman would be able to get back on the job all the quicker."

This is an important point for there is nothing lowers the morale of a worker quicker than long convalescence. Even if you cannot place an employee back on his regular task at once, start him on some lighter work which will take up his attention until he is able to return to his former duties.

During the war, Dr. Starr discovered that several soldiers could not use their hand owing to a shattered tendon. He performed an operation unthought of before, took a tendon from the arm where it was not called upon to function much and placed it where it would do the most good. The result was that the soldier was able to use his hand, and get back to the lines. A surgeon less capable would have hesitated to perform such an uncommon operation, which simply proves the need of selecting only the best doctors and surgeons to look after our injured employees.

Phenomenal Development of Repairs

THE DEVELOPMENT which has taken place in wireless telephony during the past few years is nothing short of marvellous. From an experimental stage the art has developed by leaps and bounds, until today even boys and girls from 15 years and upwards are able to receive messages intelligently.

Its popularity is almost beyond belief, and now that Canadian newspapers are taking up the task of distributing concerts and general news service, we can expect a wave of enthusiasm to spread from coast to coast.

A notable farm journal in Western Canada has announced the installation of a powerful radiophone broadcasting apparatus, and has promised its readers within a radius of 1,000 miles that they will be supplied with the latest world's news, concerts by artists of international reputation, etc, all by simply installing a receiving set at a small outlay.

Very little technical knowledge is required to operate such a set, and for the price of a good gramaphone, a home can be connected up to listen in on the different messages passing through the air, provided of course, the instrument is tuned up to the proper wave length.

But what of the future? Will the art of radio telephony develop to such an extent that every home will be equipped to listen in? If so, what type of instruments will be used? Will some standard method of transmitting messages be adopted, or will the arrangements be hap-hazard, every broadcasting station working independently.

It seems to us, before long, a standard type of instrument will be developed, more powerful than the cheaper style now in use, and that it will be leased at so much per month, just the same as we lease our telephones at present. Broadcasting stations will work to a standard plan, and perhaps pay certain theatres for the privilege of sending broadcast their performances. "Why should great singers to whom we pay fabulous salaries, sing for nothing to the general public?" may be the cry of the theatre manager of the future, so that we may soon reach the period where programmes are arranged in a manner somewhat like the large phonograph companies follow out.

Whatever transpires, we are sure of one thing, that radiophones will be of higher quality than used at present, and be almost in universal use. Every newspaper and trade journal of importance will have at least a receiving set, and until the last form is fastened to the bed of the press, readers will be supplied with the very latest news.

Strength Developing in Iron and Steel Market

Orders Well Distributed But Small in Volume—Bars, Plates and Shapes Stiffen—Likely to Advance—Machine Tool Sales Quiet With Small Supply Demand Fairly Steady.

DEALERS ARE NOW BUYING FOR STOCK

PRACTICALLY no change has taken place on Canadian markets during the week. The iron and steel section remains strongest of all, and there is quite a bit of talk to the effect that a slight advance will take place within the next ten days. At present, bars are selling at $2.75, but $2.90 may be the new figure. Some time ago, an increase was made in the United States, but so far Canadian dealers have not moved up in sympathy, competition being so keen, that they were afraid, and preferred to work on a closer margin.

Non-ferrous metals are weak, but scrap metals show signs of strength, although prices remain unchanged in both lines. Pig iron is decidedly stronger, and several users are coming into the market, asking for speedy delivery. It is known that the material ordered is not for immediate use, but fear is expressed by some that non-union miners may go out, thus tying up the pig iron business. Prices are firm, and shading is practically non-existent. Montreal reports that Buffalo producers have withdrawn all quotations.

Machine tools are in fair demand, and the same holds firm for small tools and supplies. Oils, greases, waste, and other miscellaneous lines remain in fairly active demand, prices in all cases being the same.

The coal strike is beginning to make itself felt in the United States, especially in the iron and steel industry. The striking in non-union fields is responsible for the trouble, and several firms have had to bank or blow out a few furnaces. However the situation is not serious, and after the Easter holidays the non-union men are expected back to some extent at least. The United Mine Workers are said to have no funds to speak of, so that severe opposition is not anticipated.

Pig iron demand in the States improves, and several users are sending in contracts to the mill with the price space left blank. No market is quotable, but prices are around $21 for bessemer, $20 for basic, and $21 for foundry. This is $1.50, $2, and $2 advance respectively, over the market two weeks ago.

Wire mills, which so far have stayed out of the wire nail and staple advance, have entered the fold, and quote similar advances. This makes everybody quoting on the same level. Bars and small structural shapes are up $2.50 a ton, but on attractive orders, prices have not advanced quite so much. Business generally is improved.

Toronto

April 19, 1922

WHILE no decided improvement can be reported in any branch of the local market, there is a much better tone in the trade. Dealers feel more confident, and are beginning to realize that the process of improvement is going to be a gradual one. Some were unfortunately looking for big things in April, but the movement so far this month has shown them conclusively, that they were over optimistic.

Iron and Steel—The strongest movement is in iron and steel, although the business being closed is purely seasonal. A few good sized contracts in street car track material, etc., have been secured, but this has not occurred during the week, it being a gradual development which is being closed as the work proceeds. In the general market, orders are for small amounts, but the total is not discouraging under the circumstances. The recent wet weather has hindered operations to some extent, and the Easter holidays coming in have also spoiled the week's business.

There is no feature, all lines being in fair demand. Boiler tubes are down a little in price, the changes being shown in the list below. These prices represent about a 10 per cent. drop. Recently business has been so poor in tubes and competition so keen, that nine out of ten firms here were quoting the present listed prices, sometimes as they thought, on the quiet. However, the figures now quoted represent the low level.

There is still considerable talk of an advance in the price of bar and shape material, and the consensus of opinion seems that it will occur either this week or the next. Competition remains so keen however, that everyone seems to be afraid to make the first move, although the spread is not so great locally, as it is in the States. If dealers get their way, the price will go up to $2.90 in place of $2.75. Following are present prices on iron and steel bars, also pipe:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

BOILER TUBES—	Seamless	Lapweld.
1 inch	$21 00	$.....
1¼ inch	21 50	.....
1½ inch	22 00	.....
1¾ inch	23 00	.....
2 inch	22 00	17 00
2¼ inch	26 00	18 00
2½ inch	30 00	20 00
3 inch	34 00	25 00
3¼ inch	43 00	27 00
3½ inch	47 00	28 00
4 inch	58 00	35 50

Pig Iron—The demand for pig iron is much better, and the coal strike is largely responsible for this activity. Several users are getting panicky and feel that non-union miners may decide to walk out en masse thus tying up activities. So, in order to play safe, they are ordering material, where a week ago they declared they were out of the market entirely. This has had a stiffening tendency, and price cutting is not so much in evidence. One firm stated that they secured more orders last week than any other week during this year. The price is firm at $27.15.

Non-Ferrous Metals—This market remains stationary, though weak. The consumer shows no interest, and the following are present quotations:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	8 00
Aluminum	26 00

Scrap Metals—This market shows improvement although prices have not advanced. There is a more optimistic tone throughout this section, and dealers expect further improvement shortly. Red brass is stronger but yellow metals are still weak with practically no demand. White metal also remains quiet. Steel scrap is much stronger, and the mills are now in the market, but only for a limited tonnage. However, dealers believe that the mills will soon find they are short, and feel that once this takes place, prices will advance. Cast iron remains quite firm, and dealers refuse to take orders at less than prevailing prices. Following are present quotations:

Copper, light ..... per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition ..... 6...	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools—Several dealers report a fair amount of business, but nothing of importance. The tools sold cover a large field, and while in the total they are not too bad, there is still room for decided improvement. Enquir-

ies are numerous, and several dealers are expecting some good things to break very shortly. Competition is keen and everyone watches the other closely. This is decidedly a buyer's market, with every advantage his way.

Small Tools and Supplies—Things remain much the same. No price changes have taken place, and although this has been a poor week for some, others say they find no difference. Whether April will be any improvement over March is questionable, but the rest of the month may show up to better advantage. If not, the total will be about the same as last month if not a little lower.

Oils and Grease—The demand for oils, greases, waste, steel pipe, and other general lines, remains the same. Prices in steel pipe have stiffened still further and only extended delivery can be secured. Quotations on the above mentioned lines follow:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal.	1 35
Linseed oil, raw, single bbls.	1 00

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bls.	1 00

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

Montreal

April 19

THE GENERAL business situation has improved somewhat during the week, but aside from this, few changes can be reported. Looking ahead there appears to be many matters in the air that may directly affect local conditions in the near future. The opening of navigation has led to a second increase. Sheets, wire and several steel commodities have been rather active. Contractors are making excellent headway in their building operations, these consisting largely of apartment buildings and structures to be used for the dual purpose of business and residence. Manufacturing has not improved to any marked extent, except in a few specialties. Contract shops are fairly busy with spring repair work but the army of unemployed has not yet been entirely absorbed although the number is growing somewhat smaller.

Local longshormen are objecting to the new scale of wages offered by the harbor commission, and what the outcome will be, is uncertain. Few price changes have occurred, but several upward revisions are forecast.

Iron and Steel—Structural shapes and bars for merchant use have been moving fairly well, but there is still plenty of room for improvement. The present small volume of business being handled is considerably better than for some time past. Plates are the most sluggish of all steel items on the local market, but sheets are in good demand, especially galvanized wire, bars, etc., are moving better than last week and prices and quotations in all lines are firm, increased quotations being looked for shortly. Galvanized sheets are much firmer in British markets and locally, in importing these sheets with river navigation in full swing, the inland freight will be saved.

American quotations to local houses are also very firm. American mills in the middle west are reported to be working from 70 to 75 per cent. capacity. Eastern mills are not so busy, as they have largely confined their efforts to producing lines that are not in as great demand as the products of mills farther west. This has a tendency to create a very firm tone locally, and to eliminate all quotations for future delivery. No changes in prices have been made, and local quotations are as follows:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron—There appears to be a firm conviction that local quotations on pig iron will be advanced shortly. Some firms have already withdrawn their prices and are accepting orders only when they have been submitted to the various head offices. No. 1 iron is still quoted at $29.80 but orders are only accepted by the producers. No iron will be sold for delivery beyond the end of June, and when these new features were announced the latter part of the week, many firms placed orders for advance. These orders do not represent increased consumption as foundries are still very quiet but it looks as if the rumoured advance will result in increased business. Stocks are very low in all quarters and more or less business will undoubtedly be booked in the next few weeks. It is stated that several Buffalo producers have withdrawn quotations, and that others have advanced the price one dollar per ton.

Machine Tools and Supplies—Little or no improvement is noticed in iron working tools. There does not appear to be any immediate prospect of increased sales, the demand for some time past has been for small sizes, and for single machines. Prospects for large machines, or for batteries of tools are not in evidence, and every order is very aggressively sought, the tendency being to shade prices. Wood working tools are in somewhat better demand, and supplies continue to move fairly well, although most purchasers are still operating on the hand-to-mouth principle.

NonFerrous Metals—Quotations on practically all metals have been advanced during the week in sympathy with British and Foreign Markets. Still, there is no improvement in business locally. Lead and zinc are very strong. Tin is firmer, but it is not thought that this condition will hold. The tone is better, however, increased business is anticipated. Following are the local quotations:

Lake Copper	16 75
Electric Copper	16 50
Castings, Copper	16 25
Tin	35 00
Lead	6 75
Spelter	7 25
Antimony	6
Aluminum	23 50

Scrap Metals—No improvement has occurred in the scrap metal field. The fact that ingot metals have strengthened may create a better demand, business locally has not shown any very marked improvement as yet, and some even doubt whether the strengthening tendency of ingots will influence scrap until business picks up in the foundries.

Copper, light per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	7 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	18 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	8 00

Pittsburg

April 19

SPECIAL to Canadian Machinery—The coal strike is affecting the iron and steel industry more than was expected, because there has been a considerable amount of striking in non-union fields, particularly in Western Pennsylvania. Something of this sort was expected, but not nearly as much as has occurred. The union coal strike was expected to last several months, and what was thought to be sufficient provision was made against it. In particular, the strikes in the lower Connellsville region affect iron and steel, because normally, coke as made in the Connellsville region just as the coal is mined, is shipped as fast as drawn from ovens, and used by blast furnaces practically as received there being no stocks.

There have not been many strikes in the Connellsville region, or "old basin," but the lower Connellsville or Masontown field is nearly all down. Normally, the Connellsville region has more coke production than lower Connellsville but the former is largely a Steel Corporation affair, the merchant ovens be-

ing located largely in the latter mentioned territory. The Steel Corporation has partly made up for its loss in production in the lower section by starting additional ovens in the Connellsville but even the corporation has had to bank or blow out a few blast furnaces, perhaps half a dozen or more.

Pig Iron Demand:—Not many merchant furnaces have had to bank thus far, but there is danger that many will have to do so, and as they have pig iron obligations already, they have been withdrawing as sellers. Consumers on the other hand, appear to have discovered suddenly that they need iron and are not particular as to the price. Foundrymen who a month ago could not be coaxed to buy pig iron are now sending in orders, with the price space left blank.

No regular pig iron market is quotable, but prices would be not under $21 for Bessemer, $20 for basic and $21 for foundry, f. o. b. valley furnaces, or $1.50 higher on Bessemer, $2 higher on basic, and $2 higher on foundry, than the market ruling a fortnight ago. A small part of the advance in basic and foundry was reported a week ago, but the $21.50 figure given for Bessemer was an error, as the market had been $19.50 for quite a while.

Steel Supplies:—The turnover in steel products is considerably decreased. Part of the decrease is due to the reserve of sellers, exemplified chiefly by their stiffening up in prices, while part is due to buyers, who had undoubtedly been buying more freely in February and March than would have been the case if no coal strike had been expected. Undoubtedly consumption of steel has been increasing, but it is inconceivable that consumption should increase in three months in the way production has increased. In the last week of December steel ingots were being produced at less than 18,000,000 tons a year, while on March 31 the rate of production was in the neighborhood of 36,000,000 tons.

On the other hand, some buyers of steel seem to have been drawn into the market by the coal strike, but this disposition to buy on account of the coal strike is not noticed in steel to anything like the extent it is seen in pig iron.

The remaining independent wire mills have advanced nails, staples and barb wire $2 a ton, while the American Steel and Wire Co., has not yet taken action. It is expected that it will eventually advance. The advance that seems to be in progress does not involve plain wire or wire fence. The market is quotable as follows: Plain wire, 2.25c; cement coated nails, $1.90 to $2; wire nails, $2.40; to $2.50; polished staples, 1.55c to 1.65c; galvanized barb wire, $3.05 to $3.15; wire fence, 68 per cent off list, in carloads.

Bars, and structural small shapes are up $2.50 a ton, but attractive orders might still go at almost the old figure. There is no buying in sheets, as buyers have ample opportunity to cover before the $3 a ton advance that occurred early this month. It is said that the advanced prices are being firmly held, $2.40 for blue annealed, $3.15 for black, $4.15 for galvanized and $4.50 for automobile sheets.

Tubular goods are going fairly well at regular list prices, there now being little shading. Hoops are firm at $1.90 and it is said bands are commanding practically the same base price. Strip mills have advanced price, $2 a ton on hot rolled to $2 and $3 a ton on cold rolled to $3.65. The mills have a considerable tonnage of business on books at old prices.

Coal Strike Prospects:—The Connellsville and lower Connellsville regions were supplying coke to make between 20 and 25 per cent of the country's pig iron, and a large part of this supply has been shut off, possibly between one-third and one-half, while coke supplies elsewhere are menaced to a slight extent. Some of the by-product coke plants are well stocked with coal, but those that were depending chiefly on non-union coal are not so well stocked.

Up to writing there has been no recession in the striking in non-union fields, but the strikes have made little if any gains in the past few days. The Connellsville coke workers have always been strong for observing religious holidays, and there have been times when the Easter group of holidays made coke scarce for a short time. The operators have thus far made no effort to get their plants into operation again, but are now beginning, and it is possible that within a week or two strikes will be less prevalent.

The strike as a whole is divided into two parts. The trouble at the union mines was expected all along to last two or three months, some observers expecting it to be late in the Autumn before it was entirely settled. Then there are the non-union strikes, which are quite unlikely to last long. The union miners are quite accustomed to striking, having had one pretty regularly every two years for a long time as the biennial scale came up for adjustment.

Since the war they have thrown in two extra strikes. The non-union workers, on the other hand, are not accustomed to striking, and their trouble will probably be over long before the union strike begins to come to a head. While the United Mine Workers are back of the non-union strikes, they have no funds to pay benefits even to their regular members, let alone to new members whom they have taken in at $2 apiece, it being reported that in some cases they cut the price to $1. It seems that they have spent very large sums of money in the past year or two in their efforts to unionize certain fields in West Virginia.

TAPPING SQUARE THREADS

(Continued from Page 23.)

chronised with a slap on the desk, "Let's try."

With all ceremony the drawing was forwarded to a well known tap maker for criticisms and prices. They compromised with the suggestion that we use four taps embodying the same idea that I suggested using on the single tap. While they had been making taps for years and knew what they were talking about, I had some experience in the world and didn't see why they did not agree with my idea 100 per cent; finally I agreed to the change.

After several weeks elapsed, the taps were delivered to the manager's office for inspection. They looked beautiful; Bill picks up one and squints doubtfully down the flutes; I didn't need to look at them, I knew that they were going to work, all that I did was to stand with folded arms and await. The map of Missouri was spread on Bill's face as he asked, "Will they do the trick?" Being the father of a great idea that was going to plant me upon a pedestal, I awaited the comments from the manager. Sizing me up and down, then looking at the cost sheet again he then swung his feet up onto the desk and drew the Derby down over his forehead and replied, "I'm on the fence." At that Bill gathered up the taps and calling to the others to follow, went down the steps to the shop. He handed over the taps to the straw boss of the drill presses with instructions to tap some nuts. I felt that he gave the strawboss a wicked wink as he told him to use plenty of lard oil and to handle the job with all care at his command.

The machine was set in motion, tap after tap oozed its way through that nut until finally the last one produced a perfect nut. Bill grabbed the nut; the mechanical engineer looked in one end at the same time the manager was squinting in the other. Glowing in my victory I did not wait to see it, I wandered among the other machines nearby until Bill aroused me from my jubilant dream by calling "Hey Jack, we have several nuts to tap yet; stick around." By the time I had reached the machine the second tap was squeaking its way through the other nut; the third tap was started in the hole; half way through it clicked. If that story about the heart being up in the throat is all bosh, take it from me that my throat was down around my heart. Finally the fourth tap was started upon its sad journey. Alas! a grind, then a creak, then the inevitable usual scatter to the four winds of that shop. The main supporting pillar of that memorable castle being erected in my behalf had maliciously been withdrawn thereby tumbling the dominoes and dice of the superstructure to the mercies of gravity as the manager looked at me and smiled in that way known to know one but him and myself.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 2 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 00
Castings, copper	16 25	17 00
Tin	35 00	34 50
Spelter	7 25	7 25
Lead	6 75	6 75
Antimony	6 50	6 75
Aluminum	23 50	26 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 00	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 50	3 50
Medium brass	4 50	4 50
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00
	Per Ton	Gross
Boiler plate	$7 00	$7 00
Heavy melting steel	9 00	10 00
Axles (wrought iron)	17 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	18 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	18 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 25	...
Galvanized sheets, No. 28		5 55
Queen's Head, 28 B.W.G.	7 00	....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B. ⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 30
Linseed oil, raw, single bbls.	1 05

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 5 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ⅛ in. to 1 in. rod	24
Brass sheets, 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored.13

Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 8 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

INDUSTRIAL NEWS

The Red Wing Quarry Co., dealers in stone, granite, stucco, etc., are considering locating in North Bay.

The new library building for Queen's University at Kingston will be started this fall. The approximate cost will be $350,000.

A report comes from Sydney that work on the Imperial Oil plant station at Baily Point, Cape Breton, is to be started shortly.

An addition to the factory of the Hamilton Cotton Co., costing $18,000 has been planned for. Stuart and Sinclair have the contract.

A salt refining plant is to be built at Courtright, Ont., by the Diamond Crystal Salt Co. of St. Clair, Mich., at an estimated cost of $50,000.

Construction work has been started on the new buildings being erected by the Fisher Motor Co. and the Canada Electric Castings Co. of Orillia, Ont.

Harry G. Dalton, of Pickands-Mather Co., ore refiners of Cleveland, Ohio, will succeed the late Senator John Milne as a director of the Steel Co. of Canada.

The Cosmos Cotton Co., at Yarmouth, N. S., has purchased several lots of land north of their large brick warehouse on Water Street, North Yarmouth.

The contract for the construction of a cooling plant for Swift Canadian Packing Co. of Ottawa, has been awarded to Joseph Robert at an approximate cost of $10,000.

Construction work on the new extension to the Port Arthur plant of the Provincial Paper Mills has been started. The cost of this addition will be in the neighborhood of $1,500,000.

The annual meeting of the Nova Scotia Mining Society is to be held at Sydney, N. S. May 16th and 17th and will be the first annual meeting to be held at Sydney for four years.

The schooner Kaduskak is loading lumber for Barbadoes. The timber industry of Nova Scotia was very dull this season. The number of men in the woods was smaller than for years.

At Carleton, Yarmouth County, E. F. Beeler has erected a lath and shingle mill, and contemplating possibilities of extension when the mill has gotten well into operation, an adjoining property has been purchased.

The E. B. Eddy Company sawmill at the Chaudiere opened Monday morning for the season's operations. Seventy-five men were put to work with the understanding that the number will be increased in a few days.

G. A. Owens has been appointed to supercede H. O. Shepard (transferred) as roadmaster of the Shore Line subdivision of the C. P. R. and the St. John terminals, with headquarters at St. John. Appointment is effective from April 1.

The contract for the erection of a new convent at Almonte has been let to A. C. Gilmour of Almonte, the work to be commenced as soon as possible. Completion is expected by Sept. 1. Messrs. Brodeur & Pilon of Ottawa are the architects.

The Westboro-Nepan High School Board has four sites under consideration for the erection of a new high school. Plans for the new building are practically complete and once the site is definitely decided upon tenders for the work will be called.

It is interesting to note, in connection with Canada's export trade developments that the Indian Government in the East, in calling tenders for a year's supply of lumber for packing cases, has specified Canadian spruce as the material required.

A. G. Milton, Ontario representative for the George Ellison firm in Birmingham, England, reported this week that business in their line is fairly brisk and that even better business is in sight. Their line includes electrical appliances and accessories.

Mr. Lennard of the Lennard Machine and Tool Co., 99 King St. W., Toronto, reported to Canadian Machinery, that until quite recently his plant has been closed down, but now reports a revival of business in their line, that of tooling parts for automobiles.

William Esmond, of Cardinal, Ont., has been instructed to proceed to France in the interests of the Corn Products Co., of New York. He will have charge of the installation of machinery in the new starch factory the company is erecting in the outskirts of Paris.

Building of two normal schools for girls, one at Beauceville and the other at St. Jerome, in the county of Terrebonne, has been ordered by the Quebec government. The estimated cost of these buildings is $100,000 each. Tenders will be called for almost at once.

At Amherst, N. S., industrial conditions are reported improved. The Canadian Car Co. have about 275 men at work on railway freight-car reconstruction and the Maritime Coal and Railway Co. are working full time, though the Woollen Mills have reduced their staff.

Toronto University is planning the erection of four new buildings and a requisition has been forwarded to the Provincial Government. The plans include a new Forestry building, botany and Administration buildings, a Woman's building, and additions to the heating plants.

A sliding scale rate which will run from sixty-five to eighty cents per hour instead of a flat rate basis which is now in effect, will probably be offered to members of the electricians' union of the city. Under the present agreement which expires May 1 the men received 80 cents an hour.

Forty-five cents an hour, as from May 1, was the unanimous award of the board of arbitration in connection with the building laborers' dispute. In addition the board recommended that a nine-hour day shall be worked and all time over this be paid for at the rate of time and a half.

At a meeting of the Civic Hospital Board held last week it was decided to call for tenders for masonry, brick and carpentry work in connection with construction of the new main buildings of the new hospital. It is expected that more tenders will be called for within two or three weeks.

The Avon Power Co. has received authority to proceed with development of hydro electric power at Avon Falls. Engineers and contractors have gone over the site for the dam. The first contract will be for the dam and a canal of 1,750 feet across a point of land to increase the head of water.

Word comes from Newfoundland of a silver find at Vernon's Island, Placentia Bay and W. H. McKay, mining expert, who has arrived at St. John's with samples of ore, showing not only silver but iron and lead, thinks there are evidences of another Cobalt in the district. A contract has been entered into for shaft sinking and other preliminaries to mining.

The Minister of Finance recently received a delegation from the Dominion Retail Merchants Association and the Automobile Merchants of Canada. The refund of luxury taxes upon automobiles to the amount of the loss not borne by the manufacturers was urged. Hon. W. S. Fielding promised the government would give careful consideration to the representations made.

Toronto Furnace Co., formerly the Toronto Furnace and Crematory Co., 111 King St. East, have dropped the crematory department of their business and are moving their head office to 35 Golden



What Can We Do For You?

If you are, at any time, confronted with troubles in your machine shop, do not hesitate to consult us. Both our inside and outside men are fully qualified to tackle any problem that may arise, and, while none of them pretend to "know it all," the breadth of their experience and our cumulate knowledge gained by intimate connection with manufacturers in Canada, United States and Great Britain places us in a position to render service second to none. What can we do for you?

The A. R. Williams Machinery Co., Ltd.

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If its Machinery—Write "Williams"

Ave., where they have a strictly up-to-date foundry. In addition to manufacturing a full line of hot and warm air furnaces they will do general jobbing in heavy and light machinery castings for which they are fully equipped.

The Great Manitou Park Co., and the French River Navigation Co. have amalgamated under the name of The French River Park and Navigation Co. Provisional directors are Messrs. M. J. Wallace, F. A. York, E. A. Doan, L. Banner and T. H. Noble. The company will give a better service to the island which it is hoped will become a popular summer resort. Already a number of persons have signified their intention of building summer cottages there.

Industrial and constructional activity in the district of Sudbury is showing great improvement. Unemployment has been quite pronounced during the winter months but this condition is changing with the advent of warmer weather and men are being placed at work in many lines.

The patents and good will of the "Jack Frost" Electric Refrigerating business, formerly carried on by the Toronto Laundry Machine Company, of which the late John O'Neill was president, have been purchased by the "Jack Frost" Ice Machine Company, Limited, Toronto, with an authorized capital of $1,000,000.

The Sun Life Insurance Co., will soon commence to demolish the old Knox church in Montreal, in preparation for the construction of a large addition to their present headquarter's building. The aquisition of this property was included in the original plans, but until recently ample room was available in the existing structure.

It was announced recently that a built-up Barrett specification bonded roof will be installed on the new Mount Royal Hotel by the Carmichael Waterproofing Company, of Toronto, which has been given the contract for the roofing and sheet metal work to be used on the building. The roof will be approximately 70,000 square feet in size.

The International Nickel Co. has announced a new price list on nickel, monel metal and nickel specialties, effective April 1, showing a marked reduction from previous quotations. Nickel shot, ingots and electrolytic are reduced 5 cents a pound and hot rolled rods 10 cents a pound. Cold drawn rods are 12 cents a pound lower at 60 cents a pound.

Within the coming year it is expected that another imposing edifice will be added to the already fine collection of buildings in Kingston, Ont. A nurses' home will be erected in connection with St. Joseph's training school for nurses of the Hotel Dieu Hospital. It will be of stone, five stories in height, and dimensions 100 ft. x by 40 ft., and will include class rooms, demonstration rooms, and a large assembly hall in addition to accommodations for the nurses.

Negotiations have been successfully concluded whereby the city of Belleville, Ont., will secure another American industry. The new firm, The American Optical Co., will commence operations with 300 men, but ultimately will increase this number to nearly 700. The Canadian branch at Belleville will supply the Canadian trade, and also the large export business of the company, which has been handicapped of late by the friction caused by the high American tariff.

According to a statement made to Canadian Machinery by Louis H. Bean, vice-president of Dwight P. Robinson & Co., the volume of industrial construction has been showing gradual improvement. He states that:—"An increasing demand for goods is gradually taking up the slack in available manufacturing space and many industrial companies are now proceeding with new plants and extensions, as indicated by new contracts we received during the month of March."

The following are the names of companies recently incorporated under Dominion charters, with head office, capitalization, and name of one director:

Grant Brothers Construction Co., Ltd., Ottawa, $200,000, Alan G. McDougall; Manganese and Steel Foundry, Ltd., Sherbrooke, $25,000, Frederick S. Pugg; Northern Architectural Iron Works, (Montreal) Ltd., Montreal, $40,000, John G. Frost; La Compagnie Electrique de Rockland, Ltd., Rockland, $100,000, Andrew T. Thompson.

A bill to extend the accident-prevention effect of the Workmen's Compensation Act is now before the legislature and has received its first reading. The object of the bill is to recognize manufacturers who were trying to protect their workmen and to penalize those who were careless and this could best be done by a rating that would give a lower rate to the employer with the most modern protective equipment and the lowest accident ratio, and imposing a penalty rate on others.

In a statement recently made by Hon. W. C. Kennedy, Minister of Railways, it was shown that less than one-third of the work on the Welland Canal had so far been completed, and that the cost to date had been upwards of twenty-six million dollars. It was pointed out that if ample funds were available for the completion of the work, the canal would be ready for traffic during the year 1927. Work to be done this year includes the construction of locks on Section 1, 2 and 3, and excavation upon Sections 1, 2, 3, 4 and 5.

The annual statement of the Pressed Metals Co. of Canada, showed the concern to be in a healthy condition. The past two months of this year was reported to have been the best in the history of the company and considerable new business was anticipated. Up until lately the automobile activities of the company have been devoted exclusively to turning out bushings for the Ford interests only, but other car manufacturers are interesting themselves in these products and large orders are expected. The production capacity now exceeds one million bushings a month.

Operations in heavier navigation circles commenced at Kingston April 11, with the clearing of the steamer "Keyport" from her winter berth. This steamer is the first of the "Key" line boats to finish overhauling and outfitting. The four other "Key" boats are being put into shape by gangs of mechanics from the Collingwood Shipbuilding Co.'s shops, who are working under the direction of mechanical superintendent Waller, of Montreal. Some of these vessels will carry coal for the Montreal Light, Heat and Power Company, their owners, while others will be busy in the grain trade.

Industrial consumers of coal in Ontario have shown no sign yet that they fear a shortage of bituminous coal, as a result of the strike that has been in progress since April 1. The situation has been remarkably quiet, as regards operators, miners and consumers. The Canadian situation is causing little comment. The general view is that the long notice given to consumers gave them an opportunity to secure adequate stocks, and that there is no occasion for worry for some time yet. The large industrial users of coal in particular have protected themselves against almost any contingency.

Great interest is being shown in the discovery of a new metal, non-ferrous in character, and known as "Virtu." The new material dispenses with electroplating, does not tarnish, and is considerably less than half the cost of stainless steel ware. Experiments are now proceeding in the steel works to decide whether the discovery can be applied for engineering purposes. Exhaustive tests have proved that the material can be rolled or cast. The inventors are hoping to prove that it can also be forged or hot rolled like steel, in which case it could be applied to a hundred-and-one uses in constructional trades, as, for instance, turbine blades, agricultural machinery parts, and motor-car fittings, which are particularly liable to corrosion through exposure.

Wettlaufer Brothers, Limited, head office 178-180 Spadina Ave., Toronto, with plants in different parts of Canada, are building a new and strictly modern foundry at Mitchell, Ont., to replace the one which they had outgrown. They manufacture a full line of builders' and contractors' machinery and equipment, specializing in concrete mixers and equipment for the production of concrete bricks, blocks, drain tile and sewer pipe. They find business exceptionally good, and report that they are planning some of the largest contracts in their history during the present season. The new building will add 12,000 square feet of floor space to their plant. They are contemplating additional machinery but have not decided as yet just what it will be.

J. E. Ray, trade commissioner at Manchester, Eng., stated, in a recent report that during the years 1919 and 1920, Canadian wire rods became better known and more fully appreciated than was the case formerly. The purchases from Canadian manufacturers rose from 13,342 tons in the former year to 25,962 in the latter. No statistics are available for the year 1921. Although the demand is not brisk to-day, Canadian makers should keep their prices before customers. It is hard to battle against European competition, but the writer is assured that the quality of two countries producing on the Continent is far from satisfactory. One firm in Manchester would like to receive prices from a first-class Canadian manufacturer. (Address can be obtained from the Commercial Intelligence Branch, Ottawa, quoting file T. C. 3-113.) Statistics covering importations of wire rods, iron and steel wire and wire nails into the United Kingdom in 1919 and 1920, together with the countries of origin, are on file at the Department of Trade and Commerce, Ottawa, copies of which may be obtained by interested Canadian firms on application to the Director, Commercial Intelligence Service.

OBITUARY

Albert Melish Wickens

After a brief illness of three weeks, A. M. "Dad" Wickens, passed away at his home in Toronto a week ago. Born in Brantford, he lived in Guelph for several years and on removing to Toronto in 1883 became chief engineer on the Globe, a position which he resigned on appointment as the chief engineer at the Parliament buildings. He was afterwards connected with the Casualty Fire Insurance Co., and for the past five years he has lived in retirement. As a member of the first technical school board he took an active interest in the establishment of the technical school, at which time he lived on Berkeley street. He was one of the founders of the Canadian association of stationary engineers, by the members of which he was familiarly known as "Dad." He was 80 years of age.

Charles Simpson Boone

Charles Simpson Boone, president of the C. S. Boone Dredging and Construction Company, Limited, died yesterday at his home, 142 Crescent Road, following a stroke. Ill-health had compelled Mr. Boone, who was in his 68th year, to give up active business life five years ago. Born at Oakville, Ont., on August 27th, 1854, he was educated in Rockwood Academy and embarked early on a commercial career. For many years the firm has carried out dredging and harbor improvement work, largely for the Dominion Government, on the Great Lakes, the most important undertakings having been at Collingwood, Little Current, in Manitoulin, the Canadian Soo and Port Arthur. At present the firm is engaged in work at the Chippawa Canal for the Hydro-Electric Commission. The late Mr. Boone, who was an extensive holder of downtown real estate, was a member of St. Paul's Church, Bloor Street, and a 32nd degree Scottish Rite Mason. His hobby was pictures, of which he was an excellent judge.

T. H. Rieder

Following an illness of about ten days, T. H. Rieder, president of the Ames-Holden and McCready Co., died last week at his home in Montreal. Mr. Rieder was born in New Hamburg, Ont., August 10, 1878.

He was educated in the public and high schools of Kitchener. He engaged in general store business with his father, 1892-1897; became stenographer for Kitchener Gas Company and L. Breithaupt estate, 1898, and gas and electric meter reader and collector, 1898-1900. He was bookkeeper and director of the Kitchener Rubber Manufacturing Company, 1900-1903. He or-

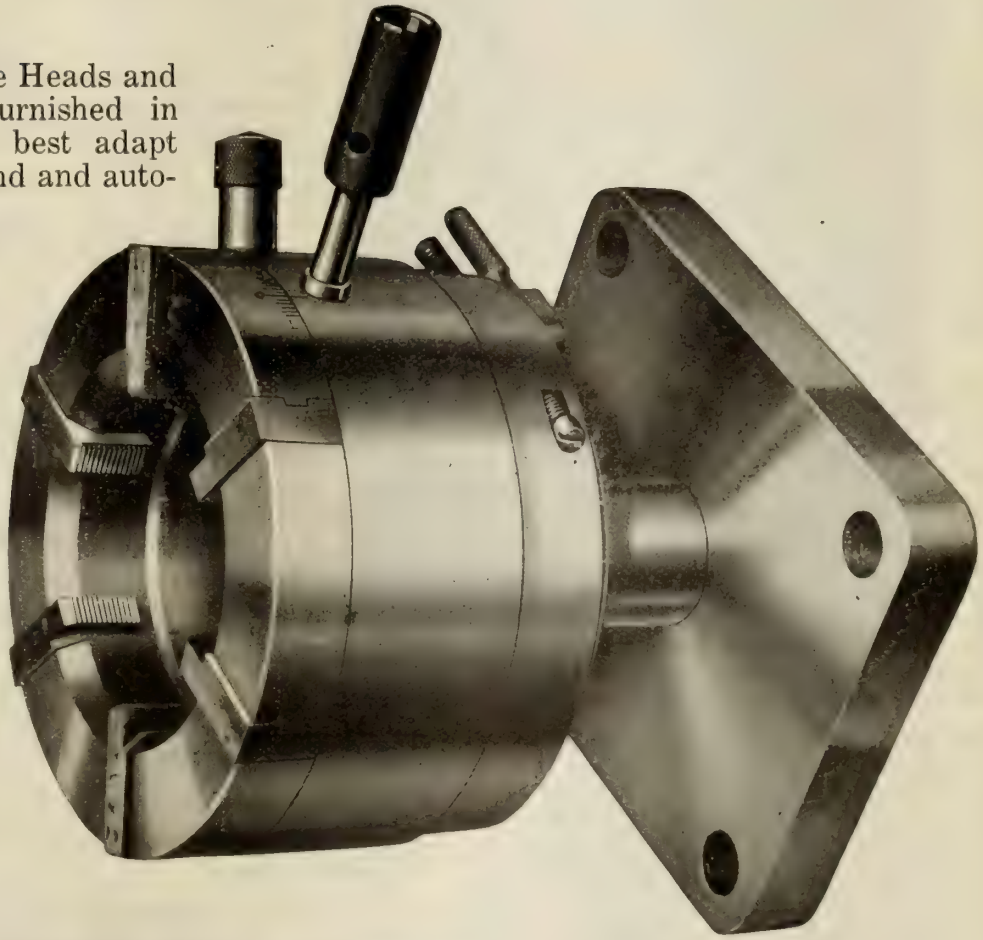
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GEOMETRIC

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Geometric Automatic Die Heads and Collapsing Taps are furnished in several types so as to best adapt them to the turrets of hand and automatic screw machines.



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ganized and built and was managing director of the Merchants Rubber Company Limited, 1903-1906.

The Kitchener Rubber Manufacturing Company and the Merchants Rubber Company, Limited, were absorbed in 1907 by the Canadian Consolidated Rubber Company, Limited, at which time Mr. Rieder became vice-president and manager of both Kitchener companies. He was elected vice-pres. of the Canadian Rubber Company, Limited, 1908, directing all operations of the company. In 1915 he was made vice-president and general manager, and president and general manager in 1917. In the year 1919 he resigned from the rubber and felt companies to accept the presidency of the Ames-Holden-McCready, Limited, and its subsidiaries.

The contract to build the new St. Michaels Church in Leamington, Ont., has been let to B. Bondy of Chatham. The cost will be approximately $20,000.

The passenger and freight steamer Britannic of the Cornwall and Montreal Navigation Co. will go into commission on her old run between Montreal and Kingston on April 24.

The Canadian Government steamer "Scout" left Prescott Wednesday on the first trip of the season to place gas and spar buoys along the channel and attend to permanent lights.

The steamer Lakeport of the Peterson Steamship Lines, of Cleveland, which wintered at Ogdensburg cleared last Saturday for Thorold to load newsprint paper for the Chicago Tribune.

The four local lodges of the Independent Order of Oddfellows in Ottawa are uniting in the purchase of a site and the building of an Oddfellows' Hall. Plans have been left in the hands of a committee. The hall to be erected will be centrally located and will cost in th vicinity of $35.000.

The plant of the Ogdensburg Pulp Mills is **closed** temporarily on account of a lack of pulpwood. Several orders are on hand for the highest grade but the pulpwood necessary must be secured from a distance. The mill will resume operations as soon as the raw material is available.

The city council of Windsor, Ont., has asked the Ontario Power Commission to build an auxiliary plant in the Border Cities to furnish electric power when the line from Niagara Falls is down. The request was prompted by the three lightless and powerless days suffered by this section between March 30 and April 3.

The early days of April brought a gloom to Kingston industrial circles occasioned by the death of William Cook, for many years superintendent of the large plant of the Dominion Textile Co. Although Mr. Cook had been in failing health for some time, the end came as a shock to a large circle of friends in every walk of life. Besides his activities in the business and industrial world, the late Mr. Cook was a prominent figure in sporting organizations and a great booster for hockey.

The freight rate on soft coal from Detroit to Windsor will continue indefinitely at 80 cents a ton according to the reply of the Canadian Freight Association to the Border Chamber of Commerce. In 1915 this charge was 30 cents and the Border manufacturers have been seeking relief from what they consider an exorbitant charge. They will ask the co-operation of the industries in Niagara Falls, Sarnia and other border points in a further effort to have the "cross the river" rate reduced.

J. J. C. Bradfield, chief engineer for New South Wales, Australia, is in Western Canada and United States visiting firms who expect to bid on the Sydney Harbor cantilever bridge. He is scheduled to be in Walkerville, Ont., about April 28 from where he will go to Toronto, Ottawa and New York. He will sail for England in June. The Sydney bridge, while it has only a 1,600 foot clear span to 1,800 on the Quebec bridge will probably have a greater total tonnage of steel due to the fact that it will carry highways as well as railways.

Tenders will be asked within the next two weeks on three building contracts in the Border Cities, Ont., aggregating $180,000. The Windsor Council, Knights of Columbus, are to build a $70,000 club house behind their present quarters at 541 Ouellette avenue. The Separate School Board has sold debentures amounting to $80,000 to finance the construction of a new school on Drouillard road, Ford City, Ont. Tenders will be asked for about April 25. The school is to be ready for the fall term. The Beach Grove Country Club in St. Clair, Ont. is going to build a club house that will cost about $30,000. The contract will be let before May 1. Pennington and Boyd of Windsor are the architects on all three of these structures.

CANADIAN SCIENTISTS WILL TAKE PART

A number of Canadian representatives are to attend the International Science Conference to be held in Rome next month and at the conference a special effort is to be made to arrive at a uniform system of arriving at tidal data throughout the world. Dr. W. Bell Dawson, of the Tidal and Current Survey Branch, Naval Department, who will be one of the Canadian representatives, is known the world over as an eminent authority on tidal and current questions. Canada's investigations of tides and currents under his direction is stated to be in advance of most other countries. He will leave Ottawa for Rome to-morrow, it was announced to-night by the Naval Department.

TORONTO FIRM FILLING FRENCH ORDER

The R. Anderson Co., Toronto, have recently shipped to J. Herrburger, Paris, France, an 1,800 lb. Keyboard boring machine. This order was secured about three weeks ago.

CANADIAN FIRMS MAY SECURE CREDIT IN BRITAIN

Through a plan recently inaugurated by the British Government, Canadian municipalities or industrial corporations may obtain advances for undertakings to the extent of the value of British machinery or other materials purchased in this country for such undertakings. Thus, a Canadian city or town contemplating Hydro Electric developments may finance the purchase of the necessary plant in Britain through the medium of the British Government credit, or a responsible company may do the same in installing or enlarging its plant facilities. Guarantees to the extent of about $70,000,000 have been approved by the British Treasury for this purpose.

The Philip Gies Foundry, Kitchener, are placing on the market a line of machinists' vises, solid and swivel bases, in five sizes, 4-inch, 4½-inch, 5-inch, 5½-inch and 6-inch. The vises are nicely proportioned, yet have the weight to stand the rough usage that a vise is generally subjected to. The body is of semi-steel and the jaws and screw of tool steel. Beaver vises are the result of observation as to heavy-duty requirements in everyday shop practice.

EXAMPLE OF VERTICAL MILLING

(Continued from page 18)

unusually tough. This operation was performed in a locomotive shop.

The Cincinnati Milling Machine Co., practice what they preach, for in making their milling machine vises, they machine the bottoms of the vise bases on their own millers. They use their own all steel vises to hold the work, and two are placed on the work table. Thus, the operator loads and unloads during the time the cutter is machining the other base. Two cuts are taken, a roughing and finishing, and a base is completed every 4.3 minutes, against a former planing time of eight minutes.

Because a part has been machined in some standard manner for years, is no reason why it should always be completed the same way. The successful foreman is continually on the lookout for better production methods, and while vertical milling is not by any means always the solution, it has in many cases increased production, and reduced operating time in an astonishing manner.

The city engineer of Chatham has been appointed to the position of city manager. He will continue also to discharge the duties of engineer.

ATKINS METAL CUTTING SAWS

Present Conditions

Don't let present-day conditions worry you; everything is fundamentally sound. More economy is being called for, use

Atkins Metal Cutting Saws

Conditions are such that quality and quantity production is essential. The use of Atkins AAA Non-Breakable Hack Saw Blade and Frames, Circular Metal and Slitting Saws, Hot Saws, Cold Saws, Kwick-Kut Hack Saw Machines and Blades and Metal Band Saw Machines, will assure you of efficient, economical operation and give you quality and quantity production.

Write for descriptive literature and prices on any of the above

"A Better Saw for Every Use"

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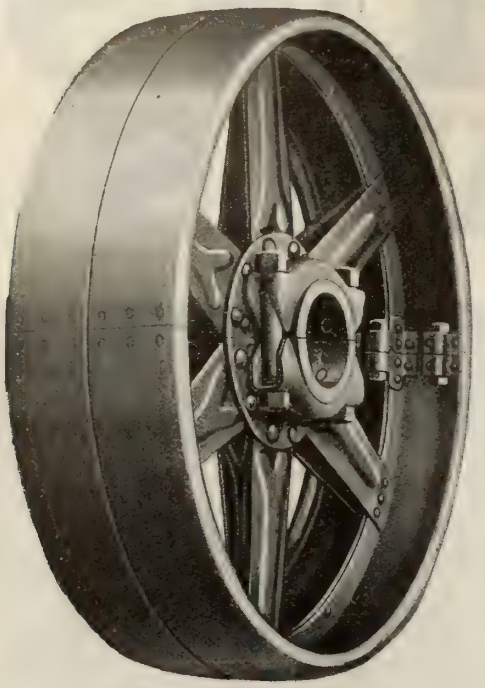
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THE successful manufacturer is always interested—from an experience view-point—in what other successful manufacturers are doing. Write us for a partial list of prominent leaders in industry who are large and consistent users of "American" Pulleys.

Why these leaders chose "American" Pulleys is best explained, perhaps, in a book entitled "Getting Maximum Pulley Efficiency." We'll mail you a free copy at once.

The American Pulley Co.
Philadelphia, Pa.

Manufacturers of Steel Split Transmission Pulleys, Steel Sash Pulleys and Pressed Steel Shapes



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Showing clearance and rake angles for cutting tools. 17 x 27½ inches, printed in two colors on heavy manilla stock.

A splendid thing for any tool room. One large engineering firm, in acknowledging this chart, stated that they would like two additional copies as they intended adopting it as standard in their tool room.

We would like these charts placed in every shop in the Dominion and if there is not one in YOUR tool room, write for your copy at once. IT'S FREE.

CANADIAN MACHINERY,
153 University Avenue, Toronto.

Please send me / us free, one of your tool grinding charts.

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Prov. .....

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for grinding high tensile material

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for grinding low tensile material

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CLEVELAND "FOUNDRY" CHIPPERS

Are Dust-Proof *Easy To Hold* *Easy To Control*

A Remarkable Tool for Fast Chipping

Made in "Seventeen" sizes with "Open" or "Enclosed" handles—
Outside or Inside Latch.

CLEVELAND SAND RAMMERS

For Floor, Flask, Bench and Core

Size No. 4F, for heavy floor and pit work.
Size No. 1HF, for light floor work.
Size No. 1H, for bench and core work.

They have high speed, no recoil and are dust proof. They increase output.

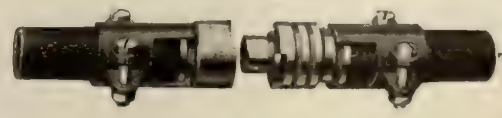


PORTABLE AIR GRINDERS



The size G, illustrated, is a "one man grinder," has 3,300 r.p.m. Weight, 19 lbs. Adapted for grinding castings, etc.

BOWES AIR HOSE COUPLINGS

AIR  TIGHT

The Bowes is instantly connected or disconnected. Always air tight. Write for special Bulletins Nos. 50 and 51.

CLEVELAND PNEUMATIC TOOL CO., OF CANADA, LIMITED

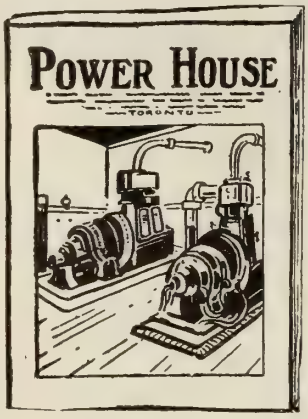
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Machine Shops
Metal-working Plants
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Foundries
Industrial Shops

You can establish a contact with prospective buyers by cultivating their business in these papers—each exclusive in its field—



CANADIAN MACHINERY AND MANUFACTURING NEWS—published weekly, serves the Machinery, Iron and Steel and General Metal-working industries, reaching proprietors, purchasing agents, business men, works managers, superintendents and foremen. All Canada's important manufacturing and metal-working shops are covered, machine shops, engineering plants, railway shops, iron and steel mills, farm implement manufacturers and, in fact, all kinds of shops where metal-working is carried on.

POWER HOUSE—published semi-monthly. It serves steam, electrical, water and gas power plants and refrigeration plants throughout the Dominion. It reaches plant owners, their purchasing agents and stationary engineers and firemen. It goes into the power houses of all general manufacturing plants, pumping stations, mining industries and railroads.



CANADIAN FOUNDRYMAN AND METAL INDUSTRY NEWS—published monthly. Serves all the grey iron, steel and non-ferrous foundries in Canada. Reaches owners, superintendents and foremen.

Good distribution of your product is desirable—good salesmanship is essential. Our proposition possesses possibilities that will be sure to interest you. Full information on request.

MacLean Technical Newspapers

153 University Avenue,
TORONTO
Montreal Winnipeg Vancouver



Why it costs less to clean Metal Parts with Oakite

LOOK at the drop of oil in the lower left corner. The central portion shows how a drop of oil emulsified by Oakite looks under a microscope that magnifies it 1,000 times.

Notice how the oil is broken up into minute globules. In an emulsion the particles of oil are constantly in violent motion. The adhesive nature of the oil has been destroyed. This explains why the oil so readily passes from the metal surface into the Oakite solution.

Emulsification is a physical action, and does not use up the Oakite. Hence a small quantity of Oakite will do a great deal of cleaning.

A plant that formerly used lye to strip enamel from metal parts now does as much work with Oakite in 15 minutes as it formerly did in 3 hours with lye.

Another concern that used soda ash adopted Oakite materials and is saving $83.52 a week.

Is speed a factor with you? Or are you particularly interested in cutting cleaning costs? We can help you, because Oakite cleans faster and better—and cleans most economically.

It incurs no obligation to haveafrien d-ly talk with one of our experienced Service Men. Find out what he can do. Out of his broad experience and ability you are sure to get some helpful ideas that are worth while.

Write us To-day.

Resident Canadian Representatives:
Mr. C. P. Murphy, Toronto
Mr. C. Burgin, Montreal

OAKITE MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES STREET · NEW YORK

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Two cents a word, including "Canadian Machinery' box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

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FETHERSTONHAUGH & CO.

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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IF YOU ARE LOOKING FOR A HIGH-GRADE firm to handle through the hardware jobbers and consuming trade throughout the Dominion, write us. It will be worth your while to investigate the special features of our marketing proposition. We know what co-operation means. Write to Box 860T., Canadian Machinery.

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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue
THE STEEL TROUGH & MACHINE CO. LTD.
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WELDING
and
CUTTING
APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

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Phones: Adelaide 2841 and 1521
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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern Work. Our advice and estimates will save you money. Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

SITUATIONS WANTED

MANUFACTURERS' AGENT OPEN TO TAKE on one or two more lines. I call on the Wholesale Jobbers, Wholesale Accessory houses and the large manufacturers. Apply Box 809 Canadian Machinery. (C.15.M.)

MECHANICAL ENGINEER IS OPEN TO consider partnership or interest with manufacturer with a view to producing new high grade lines of engineering equipment. Must have good reputation and manufacturing facilities. Box 808, Canadian Machinery. (C.16M.)

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PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium and heavy work, green and dry sand. Bench, floor and machine molding, melt by analysis, and thoroughly competent on cupola practice. Good reference. Box 804. Canadian Machinery. (C11M.)

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ONE J. & J. TAYLOR SAFE, INSIDE DIMENsions 15 inches deep, 2 feet 6 inches wide, three feet 11½ inches high and fitted with a built in compartment. Price $250.00.

ONE J. & J. TAYLOR SAFE, 18 INCHES deep, two feet 9 inches wide, four feet five inches high, fitted with a steel compartment. Both safes are in good condition and can be bought at a price that will save considerable money to the purchaser. Price $200.00. Box 806L Canadian Machinery.

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.



"It Pays to Advertise"

"One of the most persistent advertisers in the history of success was Robinson Crusoe. He knew what he wanted—a ship—and he put up an ad for one. He flung a shirt on a pole, at the top of his island; that, in the language of the sea, was plain to every sea-faring man.

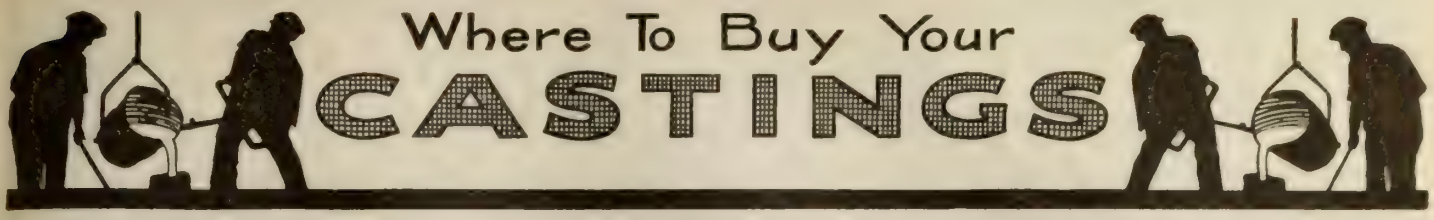
"The circulation was small—there was no other medium—but Crusoe kept at it, despite the fact that he got no inquiries for a long time. He changed his copy—as one garment after another was frayed out—and in the end got what he wanted.

"Suppose Crusoe had taken down that signal after a time and declared 'Advertising doesn't pay,'—where would he and his story be now?

"Put up your signal and keep it there. Crusoe advertised under very discouraging circumstances. You've got a sure thing—it is only necessary to have the patience, persistence, and pluck of Robinson Crusoe—and the good ship 'Better Business' will tie up 'longside your pier."

CANADIAN MACHINERY
149 University Ave., Toronto, Ont.

Everything comes to him who waits, but he who does not advertise waits longest



The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.,
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
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Grey Iron and Semi-Steel Castings up to 10 Tons.

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LIMITED
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Monel, Aluminum, Brass, Bronze, Grey Iron.

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HAMILTON, CANADA
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Contract Repetition Work. Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron Castings.

W. W. Wells
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Nickel and Monel Metal.

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64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
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Maxwells, Limited
ST. MARYS, ONT.
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The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
We make a specialty of Light Grey Iron Castings.

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Stock shipments
Sizes 3-16″ O.D. to 4″ O.D.
Seamless Welded Brazed

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If you use Steel Tubing it will pay you to write for our list of material for

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Purchase now for future requirements and gain the benefit of our

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Side Knob and Lock Cap Screws



Let us quote you our prices on your next order. Our quality and service are sure to please you.



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UPPER BEDFORD, QUEBEC



Built to Give Satisfaction

BLOUNT Grinders are built to stand up under the hard service which is the usual lot of a grinder. They are just as good in every detail as we can make them. They are fast, accurate, strong and rigid —dependable in every sense. Let us send you full particulars.

"We will accept Canadian funds at par."

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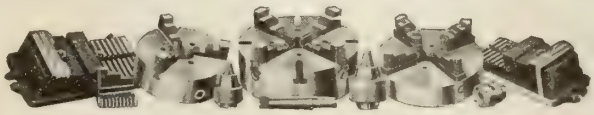
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Send for complete catalogue showing 50 styles 10 to 100 tons capacity.
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Safety Tapping Attachment

The only device on the market having a balanced reversing mechanism, thus eliminating all side pull. Reverse speed is twice that of the forward speed.

It has other features too we would like to bring to your attention—write for details.

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Gear Cutting Machines
Hand Feed
Semi-Automatic, Fully Automatic
Also Lathe Chucks and Centering Machines
THE D. E. WHITON MACHINE CO.
NEW LONDON, CONN., U. S. A.

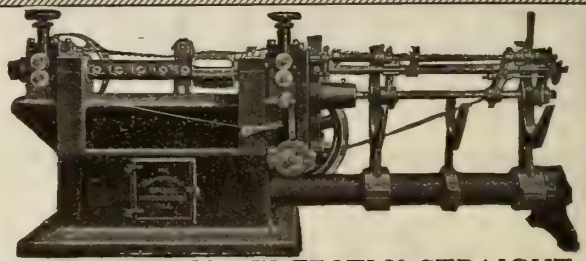
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HYDRAULIC SCREW AND FILTER

Hydraulic Wheel Press



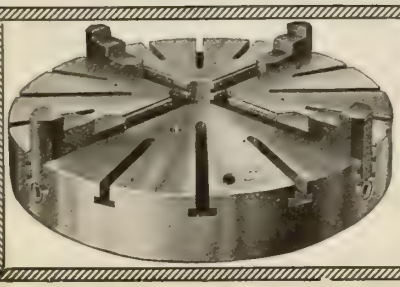
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THE WIRE IS PERFECTLY STRAIGHT
and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?

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Formerly John Adt & Son. Established 1866.
Also makers of Riveting Machines, Sprue Cutters, Cotter Pin Machines, etc.



***IRON BODY* INDEPENDENT CHUCKS**

They represent strength and economy with high-speed cutting tools. Accurate and dependable always.

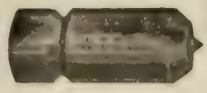
Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.

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Goods Submitted on Memorandum if Desired
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HORIZONTAL BORING MACHINE
Unexcelled for continuous Service
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ACCURATE RIGID DEPENDABLE
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Flexible Shafts and Equipments
Flexible shaft equipments for grinding, polishing, drilling, reaming, scraping, scratch brushing, power screw driving and nut setting.
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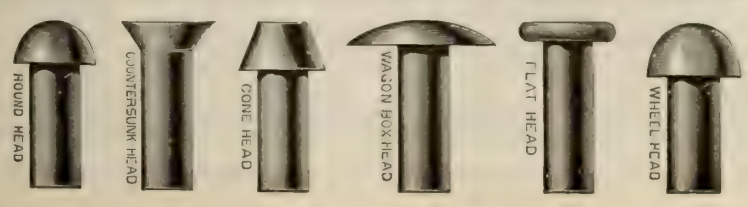
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WE MANUFACTURE RIVETS of every description, 5/8 inch dia. and smaller
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APPROVED PORTABLE
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Universally adopted; direct reading; inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification.

BOOKLET FREE.

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by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem.



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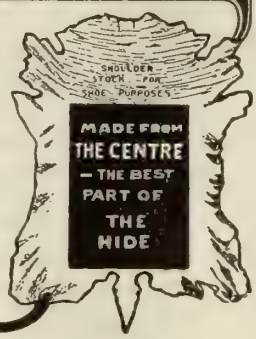
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Will Save You Money In Every Day of Service

Modern plant and thorough knowledge of requirements of belting guarantees perfect satisfaction to all buyers. Our belts are the result of using best leather, and our 57 year's experience.

Ask for Quotations.

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MORTON 30-INCH
DRAW-CUT SHAPER

Investigate this machine to-day. The most powerful shaper. Wide range of work. Ask for bulletin 3A.

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Rapid Production Lathes
Multi-cut Lathes

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Brantford, Canada

BLACK DIAMOND OVENS

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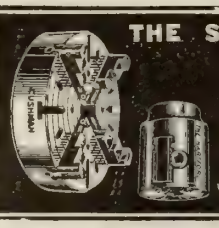
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MALLEABLES

OF QUALITY SINCE 1878.

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SMITH'S FALLS, ONTARIO.

THE STANDARD FOR EXCELLENCE



"CUSHMAN" CHUCKS 1862

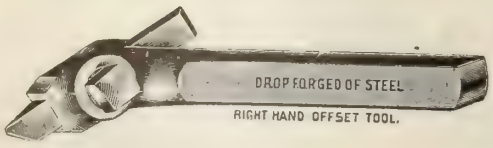
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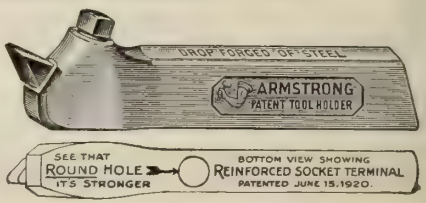
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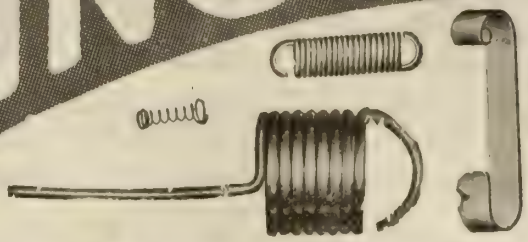
ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

306 N. Francisco Ave., : : CHICAGO, U.S.A.

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WIRE
BARNES CANADIAN SPRINGS
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HAMILTON, ONTARIO

SPRINGS



ALL STYLES and SIZES

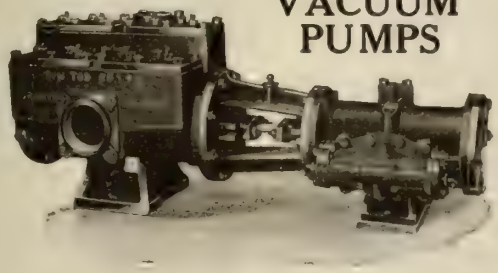
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Self-Draining—Efficient

Hepburn Patent Vacuum Pumps are the only Self-Draining Pumps made in Canada. Note the simple, sturdy construction of the Pump above. There are no levers, no tappets and the long strokes produce an efficiency not attainable with pumps of shorter strokes. Let us give you fuller particulars.

We have other lines — Vertical Engines, Winches, Cut Gears, Power Presses, Derricks, Cranes, Brick Machinery, Blacksmith Work, Acetylene Welding and General Machine Work.

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Engineers and Iron Founders
18-60 Van Horne St., Toronto, Ontario

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Canadian Machinery BUYERS DIRECTORY

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Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E. Eng.

Acetylene, Dissolved
National Electro Products Co., Ltd., Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I.
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.

Band Saws,
Oliver Machinery Co.
Preston Woodworking Machinery Co., Ltd., Galt, Ont.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.
Torrington Co., Ltd., Upper Bedford, Que.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd, Montreal, Que.

Belting, Fabric
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Belting, Rubber
Can. Consolidated Rubber Co., Ltd., Montreal, Que.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Aluminum, Brass, Bronze, Copper, Die-Molded, Ferro-Alloy, Iron, Semi-Steel, Steel.
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Brantford Brass Foundry Co., Brantford, Ont.
Brown-Boggs & Co., Ltd., Hamilton, Ont.
Canada Metal Co., Toronto, Ont.
Can. Hanson & Van Winkle Co., Ltd., Toronto, Ont.
Can. Rumley Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Ltd., Toronto, Ont.
Dominion Engineering Works, Ltd., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Eureka Planter Co., Woodstock, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Fittings, Limited, Oshawa, Ont.
Galt Malleable Iron Co., Ltd., Galt, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn, Limited, John T.
Hull Iron & Steel Foundries, Hull, Que.
International Malleable Iron Co., Galt,
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Langley & Austin, Galt, Ont.
Maxwells, Limited, St. Marys, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Miller Bros. & Sons, Ltd., Montreal, Que.
Mitchell Co., Robt., Montreal, Que.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Sully Brass Foundry Co., Toronto, Ont. Ont.
Tallman Brass & Metal, Ltd.
Vessot & Company, S. Joliette, Que.
Wells, W. W., Toronto, Ont.

Chains (See Sprockets and Chains)
Falls, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn. Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

For list of Dealers see the last page of This Buyers' Directory

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E. Eng.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.
Goldie & McCulloch Co., Ltd., Galt, Ont.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N.Y.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

BUYERS' DIRECTORY

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks,
Chicago Watchman's Clock Co., Chicago, Ill.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Limited, Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Petrie, Ltd., H. W., Toronto, Ont.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Can. Desmond-Stephan Co., Hamilton
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Die Filing Machines
Oliver Machinery Co., Grand Rapids, Mich.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drilling Machines, Bench
Burke Machine Tool Co., Conneau Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Can. Fairbanks-Morse Co., Ltd., Montreal
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Northern Electric Co., Montreal, Que.
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Equipment, Elevator Safety
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan
Goldie & McCulloch Co., Ltd., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Northern Electric Co., Montreal, Que.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Roclofson Elevator Co., Galt, Ont.

BUYERS' DIRECTORY

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings, Limited, Oshawa, Ont.

Flexible Shafts
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cunningham Co., R. H., Walkerville, Ont.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cunningham Co., R. H. Walkerville, Ont.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Cunningham Co., R. H. Walkerville, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Volta Mfg. Co., Welland, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Johansson Inc., C. E., Windsor, Ont
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Thread
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Limited, Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited. Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John. Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited. Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto. Ont.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que
Can. Link-Belt Co., Ltd., Toronto, Can
Hans Renold of Canada, Ltd., Montreal. Quebec.

Gears, Worm
Dom Steel Products Co., Brantford, Ont
Hamilton Gear & Machine Co., Toronto. Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont
Cleveland Twist Drill Co., Cleveland, O.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati O
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ont.

Grinding Machines, Drill
Bellevue Industrial Furnace Co Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont
Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Surface
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Wheels
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co. of Can., Ltd., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis

Hack Saws, Power
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John Dundas, Ont.
Dominion Engineering Works, Limited. Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Mauri Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Ill.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mechanics' Fine Tools
Lufkin Rule Co., Windsor, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence,
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Vertical
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto. Ont.
Wisconsin Electric Co., Racine, Wis.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts, Machine Screw
Torrington Company, Ltd., Upper Bedford, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Packing, Steam
Can. Consolidated Rubber Co., Ltd., Montreal, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Pattern Shop Equipment
Oliver Machinery Co., Grand Rapids, Mich.

Patterns, Wood and Metal
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Limited, Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
J. R. Baxter & Co., Ltd., Montreal, Que.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont
Petrie, Ltd., H. W., Toronto, Ont
Stoll Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

BUYERS' DIRECTORY

Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.
Torrington Company, Ltd., Upper Bedford, Que.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Limited, Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Can. Fairbanks-Morse Co., Ltd., Montreal

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.
Preston Woodworking Machinery Co.,

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I
Simonds Canada Saw Co., Montreal, Que

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I
Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

Screens
Can. Wire & Iron Goods Co., Hamilton
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.
Torrington Co., Ltd., Upper Bedford, Que.

Screw Machine Work
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R.I.
National Acme Co., Cleveland, Ohio

Screw Machines, Plain or Hand
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
Torrington Company, Ltd., Upper Bedford, Que.
National Acme Co., Montreal, Que.

Screw Plates
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Lock Cap
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Machine
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Screws, Side Knob
Torrington Company, Ltd., Upper Bedford, Que.

Screws, Thumb
Torrington Company, Ltd., Upper Bedford, Que.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Oliver Machinery Co.
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stoll Co., Inc., D. H., Buffalo, N.Y.

Sheets,
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Specialties, Swaged and Headed Work
Torrington Company, Ltd., Upper Bedford, Que.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.

Steel Co. of Canada, Ltd., Hamilton, Ont.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steam Specialties
Crane Ltd., Montreal, Que.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

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Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Tachometers
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co., Windsor, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Cunningham Co., R. H., Walkerville, Ont.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa

Threaded Wires
Torrington Company, Ltd., Upper Bedford, Que.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill
Bertrams Ltd., Edinburgh, Scotland
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Tool Work
Brown Engineering Corp., Ltd., Toronto.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

Trolley Wheels,
Langley & Austin, Galt, Ont.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Mon

Unions, Pipe
Fittings, Limited, Oshawa, Ont.

Valves
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque Ont.

Voltmeters
Bristol Co., Waterbury, Conn.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers
Torrington Company, Ltd., Upper Bedford, Que.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Welding Machines, Oxy-Acetylene
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que
Steel Co. of Canada, Ltd., Hamilton, Ont.

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Supplies
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont.

Wire
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Shuster Co., F. B., New Haven, Conn.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont.
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co Montreal, Que.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

A. R. Williams Machinery Co., Montreal, Que.

Yeates Machinery Co., London, Ont.

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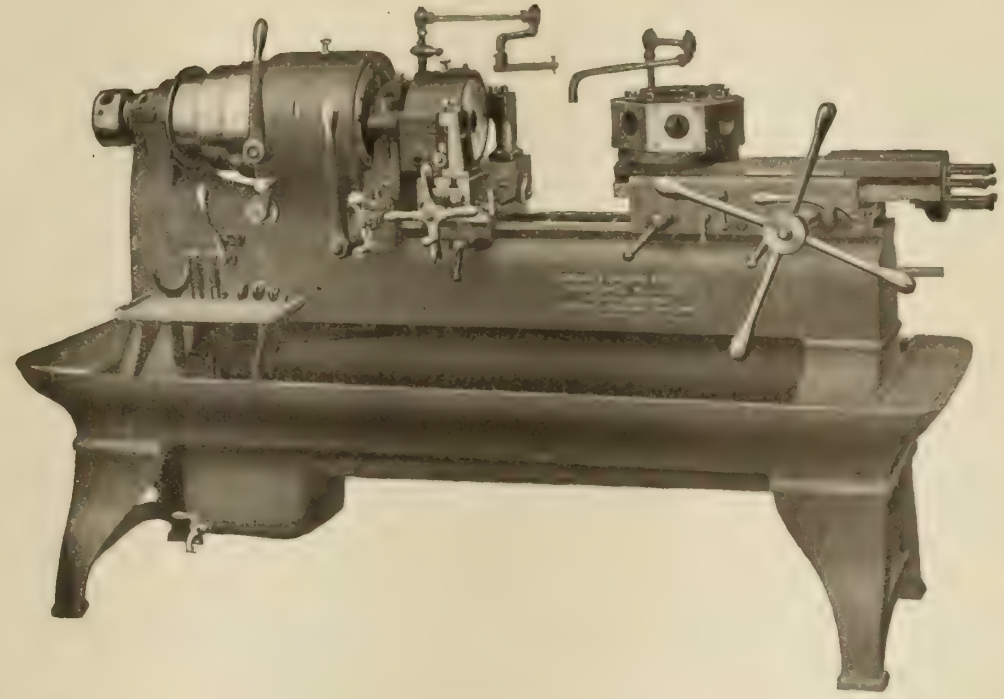
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CANONSBURG GAS COAL CO.
COUNTRY CLUB COAL CO.
WEST PENN. BY-PRODUCTS CO.

HIGH GRADE
COAL AND COKE
BRITISH-AMERICAN FUEL & METALS LIMITED
McKINNON BUILDING TEL. MAIN 7815 TORONTO

Mines and Coke Ovens
WASHINGTON, PA.
MEADOWLANDS, PA.
CANONSBURG, PA.
CONNELLSVILLE, PA.

BROWN & SHARPE

Nos. 4 & 6 WIRE FEED SCREW MACHINES



A Money Saver---even on Short Runs

We grow so accustomed to thinking of a Wire Feed Screw Machine as a good money saver on long run jobs that we often forget the economies it offers on shorter runs.

Suppose a dozen bolts are wanted in a hurry. Two factors must be considered—speed and expense. As it's a question of rapid, uniform production at low cost, consider the economies of running off this small lot on a wire feed screw machine.

In the first place, instead of cutting the stock into lengths, the uncut bar is placed in the rear end of the spindle. A turn of the wrist with a wrench adjusts the roller feed and automatic chuck to grip the proper size. One pair of chuck jaws to hold all shapes of stock, round, square or hex., is a great convenience.

Of course, there are no centre holes to drill. The chuck grips the bar securely; a centreing guide at the rear end of the spindle holds the stock in line with the spindle, relieving the chuck of unnecessary stress, and insuring firm support.

In operation the machine is speed and simplicity itself. One turret tool roughs out the piece. Then the finishing tool is swung quickly into position and turns the piece to size. And every piece will be the same size without bothering about tool adjustment.

Dies do the threading rapidly, accurately and uniformly, saving an extra handling.

When each piece is cut off by the cross slide tool it is finished, ready for use.

Have we suggested possible uses for a wire feed screw machine in your shop?

Our representative will be glad to show you how a Brown & Sharpe Wire Feed Screw Machine can help you save money on short or long jobs.

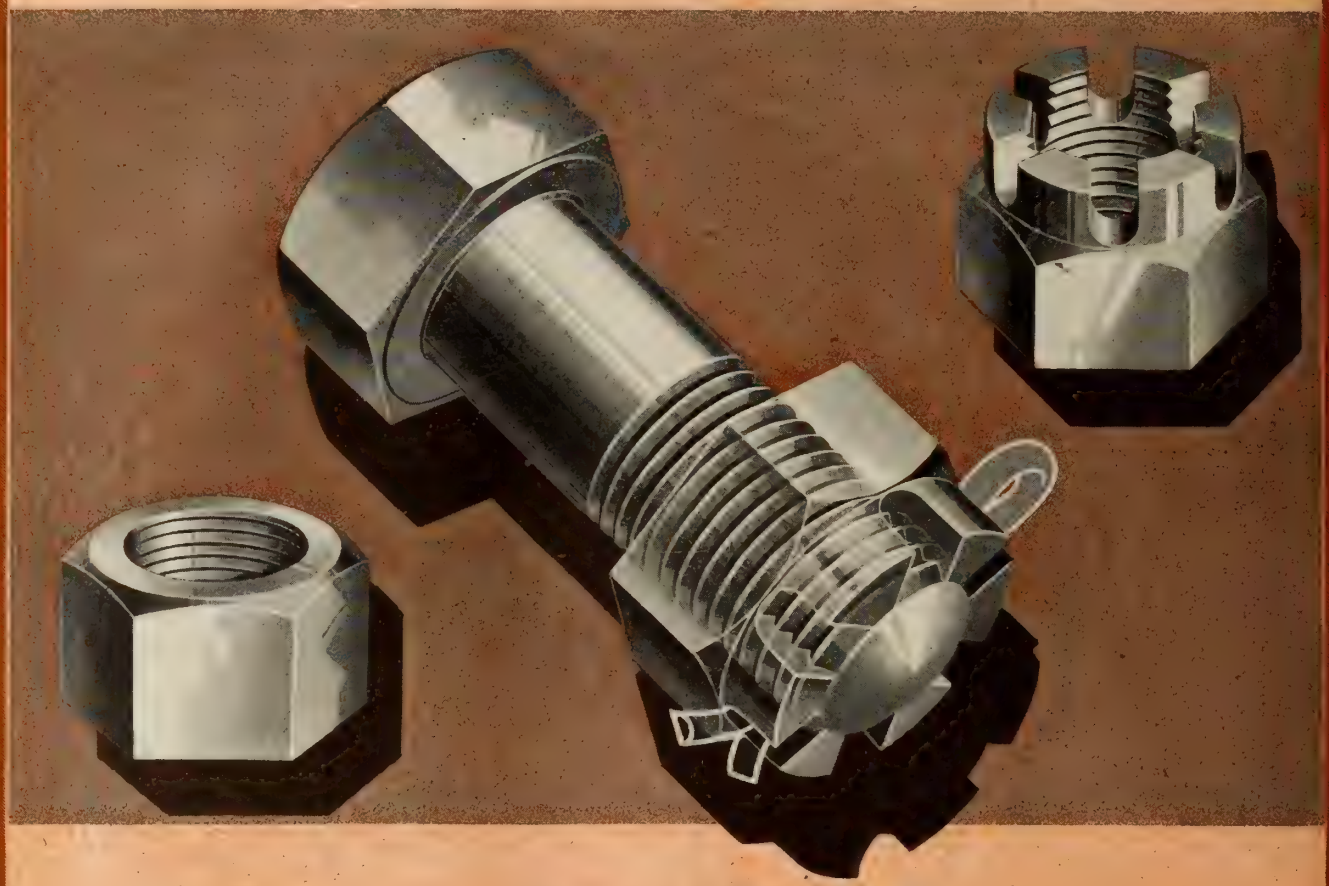
Write to-day for Catalog No. 22-G.

Brown & Sharpe Mfg. Co. Providence, R.I., U.S.A.

Canadian Representative: *Canadian Fairbanks-Morse Co., Ltd.*

Namco Nuts

Plain and Castellated



STANDARD

"V", U.S.S., S.A.E. Cap Screws
"V", U.S.S. Set Screws
Plain and Castellated S.A.E. Nuts
Semi-Finished "V", U.S.S. Nuts

SPECIAL

Screw Machine Product up to 2¼" diam. to specifications
Special Product Hardened and Ground to specifications

THE NATIONAL ACME COMPANY
MONTREAL, P. Q.

CANADIAN MACHINERY AND MANUFACTURING NEWS

Vol. XXVII. No. 17 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | April 27, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

YOU pay your workmen well for their time and effort: don't waste this labor-element by keeping dull files in use.

A file ceases to be fully efficient as soon as it has *begun* to lose its keen-cutting edge.

Replacing it costs only a trifle, but means much in increased efficiency.

These brands, the standard for over 50 years, do not dull quickly:

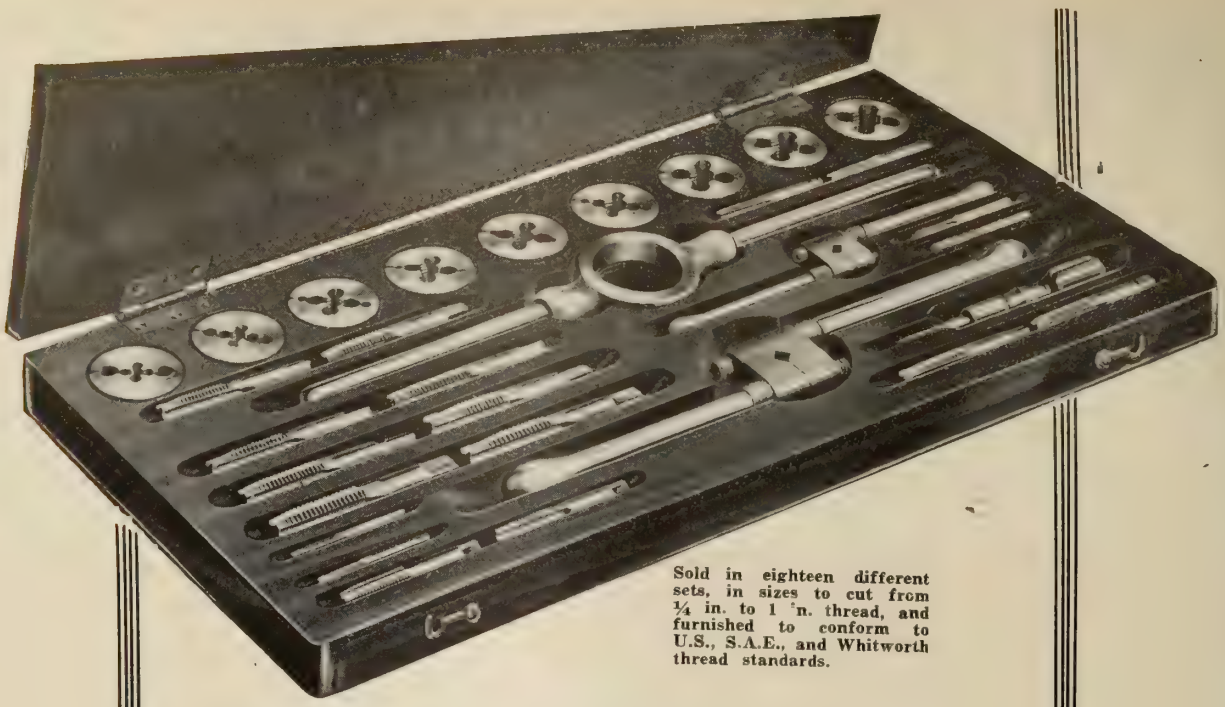
Kearney & Foot - Great Western

American - Arcade - Globe

Made in Canada by:

NICHOLSON FILE COMPANY

Port Hope - Ontario



Sold in eighteen different sets, in sizes to cut from ¼ in. to 1 in. thread, and furnished to conform to U.S., S.A.E., and Whitworth thread standards.

PRATT & WHITNEY

Screw Plate Sets

These reasonably-priced sets of standard P & W taps and dies, consist of our regular product made up in various combinations to meet the requirements of the small shop, garage, service station and general tool-room.
They are unequaled for fast, accurate threading of all metals and will be found invaluable whether used occasionally or for every-day work.

The taps and dies that go into P & W Screw Plate Sets are of a high quality unusual in such general purpose outfits. The taps are all made with the famous "con-eccentric" land—an exclusive Pratt & Whitney feature—that permits their resharpening on the face of the cutting edge without change in size.

PRATT & WHITNEY COMPANY of CANADA, LIMITED

Works: Dundas, Ontario

MONTREAL 723 Drummond Bldg.	TORONTO 32 Front St. West	WALKERVILLE 103½ Sandwich St.
HALIFAX Roy Building	WINNIPEG 1205 McArthur Bldg.	VANCOUVER B. C. Equipment Co.



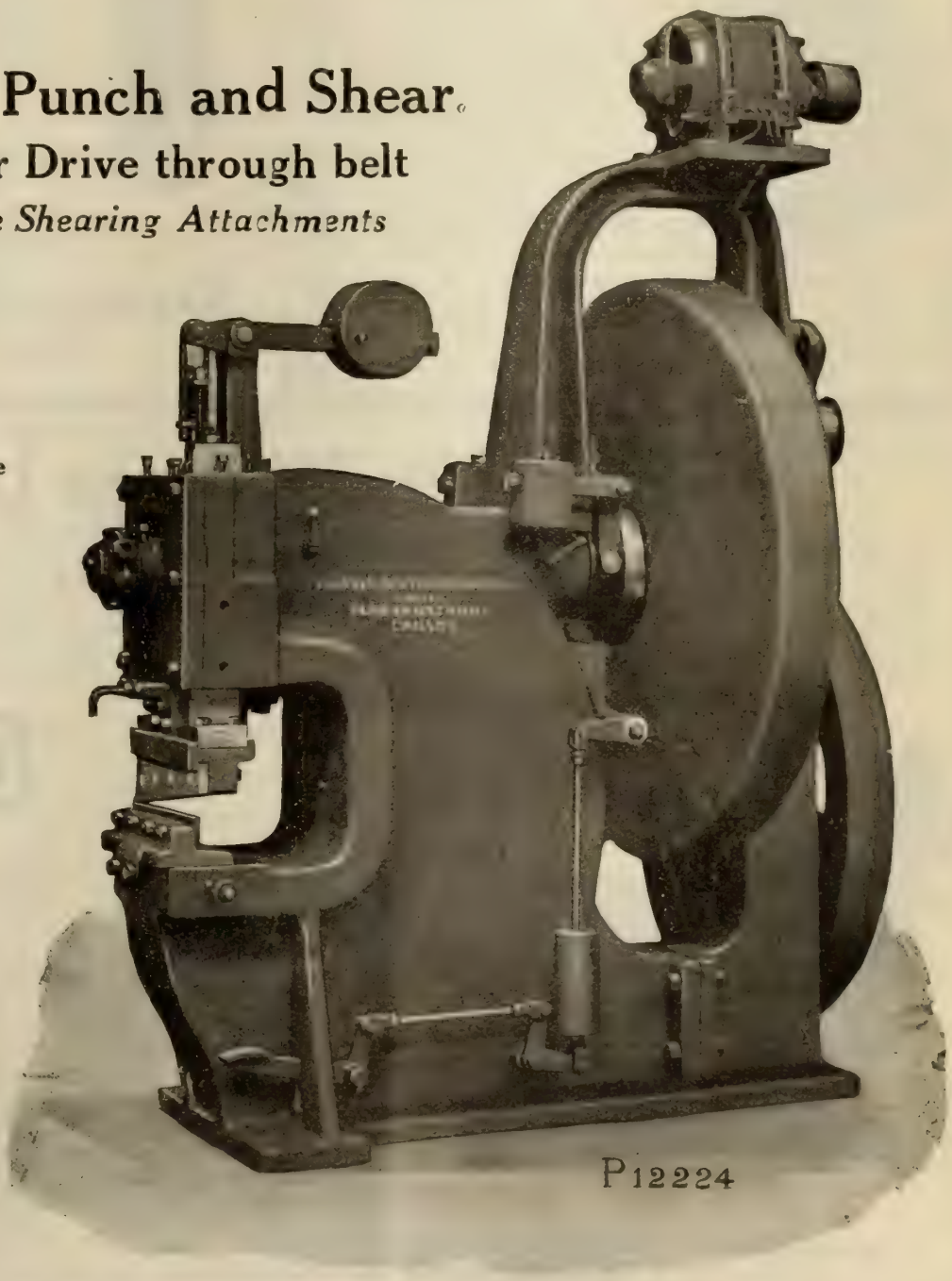
The BERTRAM Page

MACHINE TOOLS

No. 4 Single Punch and Shear.

12" Throat Motor Drive through belt

Fitted with Plate Shearing Attachments

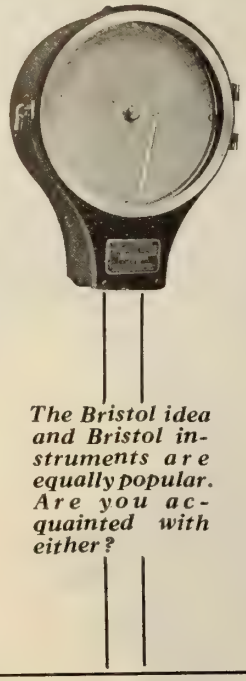


CAPACITY

To punch 1" hole through 1" Plate
To shear 1" Plates
To " 6"x1" Flat Bars
To " 1¾" Round Bars
To " 4x4x⅜" Angles

The John Bertram & Sons Co., Ltd.
DUNDAS, ONTARIO

MONTREAL
723 Dominion Bldg.
TORONTO
32 Front Street, West
VANCOUVER
609 Bank of Ottawa Bldg.
WALKERVILLE
103½ Sandwich St.
WINNIPEG
1205 McArthur Bldg
HALIFAX
Roy Building



The Bristol idea and Bristol instruments are equally popular. Are you acquainted with either?

If a Little Knowledge Is a Dangerous Thing— What About None?

The pressure record traced on a Bristol dial takes you out of both these classes, and puts you with that group of successful executives who know.

TRADE MARK
BRISTOL'S
REG.U.S.PAT.OFFICE
INSTRUMENTS

are to-day writing the operation records in plants all over the world —records that are invaluable statistical evidence of process or operation.

Ask for Bulletin T-1005

"Bristol user—Bristol booster"

THE BRISTOL CO., Waterbury, Conn.
Canadian Distributor
A. H. WINTER JOYNER
Toronto - Montreal

In Buying Springs—



The Name "RAYMOND" Protects You

By always insisting on RAYMOND better-built Springs you get the long service that comes from expert heat treating facilities and modern testing and laboratory equipment. All shapes and sizes of Springs in Carbon Steel, Vanadium Steel Brass and Phosphor Bronze.



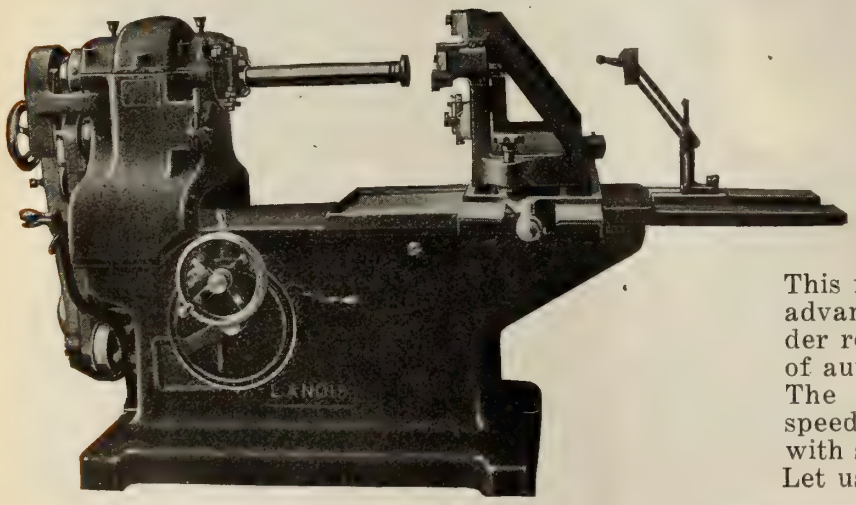
Catalogue on request

Raymond Mfg. Co., Ltd.
Corry, Pa., U.S.A.

Peak Profits With the Landis

There will be thousands of new automobiles, trucks and tractors purchased this spring, and every one of them represents a future business prospect for the repair shop man.
There are added thousands of vehicles, now registered, that will require repairs before starting on the new season's runs. These represent **immediate** prospects.

Are you going to go after some of this present business and gain a reputation that will assure your future? You can do so by installing a



LANDIS

No. 5 Cylinder Grinding Machine

This machine possesses a number of distinct advantages that made it unexcelled for cylinder regrinding. Its range covers every type of auto cylinder bloc.
The Landis Centering Fixture permits of speedy and accurate location of cylinder bores with spindle and thus reduces set-up time.
Let us tell you why the Landis is the choice.

Landis Tool Company, Waynesboro, Pa.
New York Office:
51 Chambers St.

Canadian Agents: F. F. Barber Machinery Co., Ltd., Toronto.
Williams & Wilson, Ltd., Montreal.
A. R. Williams Machinery Co., Ltd., Nova Scotia, New Brunswick, Manitoba and British Columbia.



For Making
Perfect
Screw-Thread Joints

SMOOTH-ON

ELASTIC CEMENT NO. 3

A screw-thread joint made with Smooth-On Elastic Cement No. 3 will not leak, because the Smooth-On expands in metallizing and so closes up any defective places which otherwise would cause leaks; yet the joint may be taken apart when desired.

Smooth-On Elastic Cement is sold ready for use in paste form. It is applied to the screw-threads with a brush. Especially useful for high pressure steam or water joints, for ammonia joints, for coating flanged joint faces and for coating gaskets.

Send for our new Smooth-On Instruction Book No. 18. It illustrates and describes how to make perfect screw-thread joints and hundreds of other repairs. You will marvel at its contents. The book is **FREE.** Smooth-On Iron Cements are sold in 5-lb., 10 lb. and 25 lb. tins. Also larger sizes.

SMOOTH-ON MFG. CO.

ESTABLISHED 1895

Dept. 9-E. Jersey City, N.J., U.S.A.

Sole Agents in Canada: Canadian Asbestos Co., Montreal, Que.



I made **Harris Heavy Pressure** Bearing Metal before you were born. It will wear out two, three or four other so-called just as good Babbitt Metals, and we only ask a reasonable price—a very cheap one—considering the care, responsibility and service we guarantee.

Send for a box. Its Copper Coat, High Tin and Clean Close Grain will appeal to you. You want advice. Please take this. There is no better all round Babbitt Metal in the world. You would trust us for anything we wanted to buy from you.



Trust us in this

THE CANADA METAL CO., LIMITED

TORONTO WINNIPEG HAMILTON VANCOUVER MONTREAL

Dunlop Belts Respond With Efficiency, Economy and Long Life to All Uses.

They are built with an eye to long service.

They save machinery by their ability to run smoothly and easily, yet they transmit the required power.

The special frictioned-surface of "Gibraltar RedSpecial," and the great flexibility of this Belt ensure close pulley contact. It masters straining drives and off-and-on loads.

Heat and cold, wet and dryness, do not affect it.

The Dunlop process eliminates stretch. This saves constant adjustments and undue waste of time.

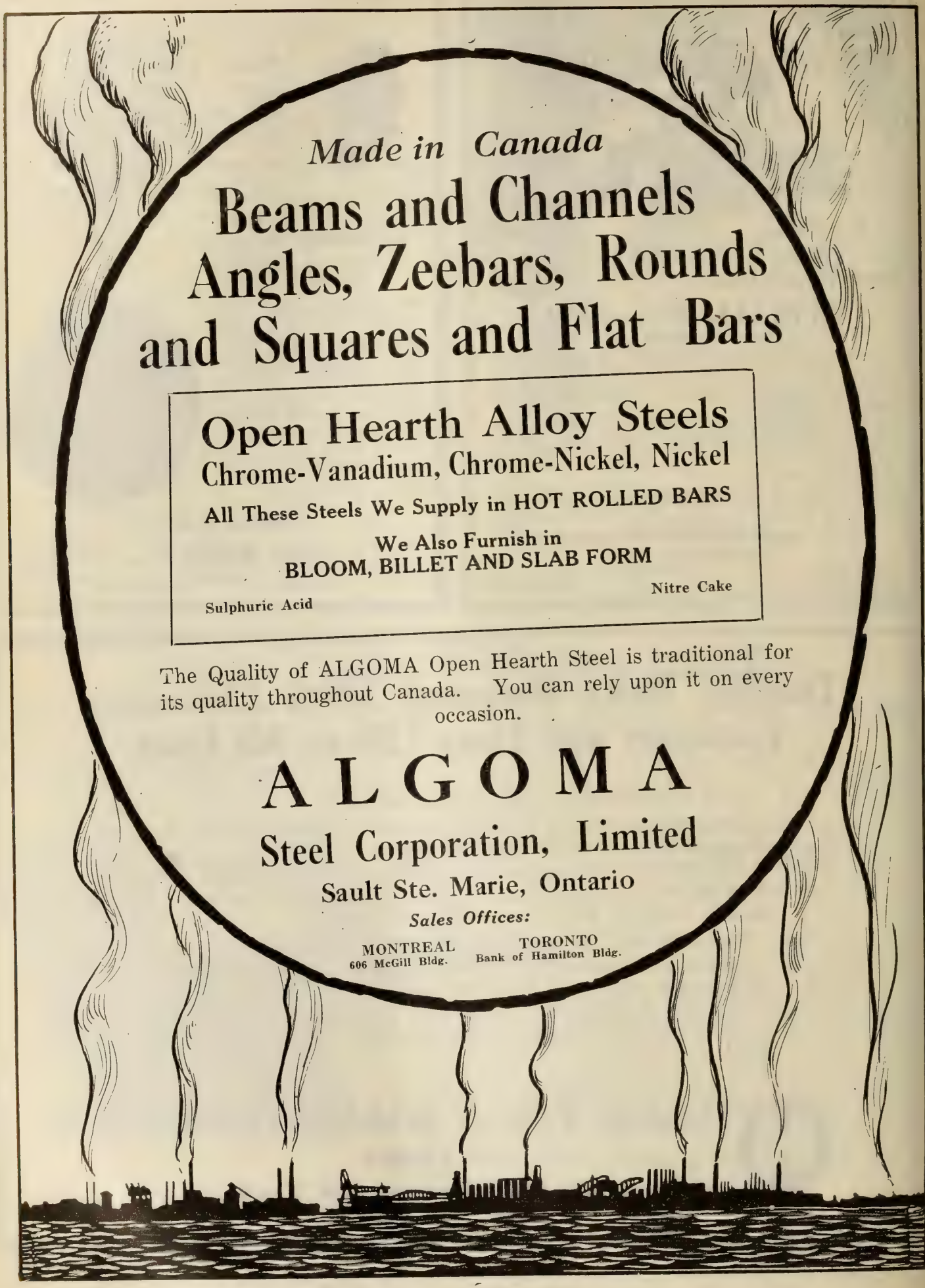
For Belt Economy and Belt Efficiency use "Gibraltar RedSpecial" frictioned-surface. This Belt will adapt itself to any drive.



Dunlop Tire & Rubber Goods Co., Limited

Head Office and Factories: Toronto

Branches in the Leading Cities



Made in Canada

Beams and Channels Angles, Zeebars, Rounds and Squares and Flat Bars

Open Hearth Alloy Steels

Chrome-Vanadium, Chrome-Nickel, Nickel

All These Steels We Supply in HOT ROLLED BARS

We Also Furnish in BLOOM, BILLET AND SLAB FORM

Sulphuric Acid **Nitre Cake**

The Quality of ALGOMA Open Hearth Steel is traditional for its quality throughout Canada. You can rely upon it on every occasion.

ALGOMA

Steel Corporation, Limited

Sault Ste. Marie, Ontario

Sales Offices:

MONTREAL
606 McGill Bldg.

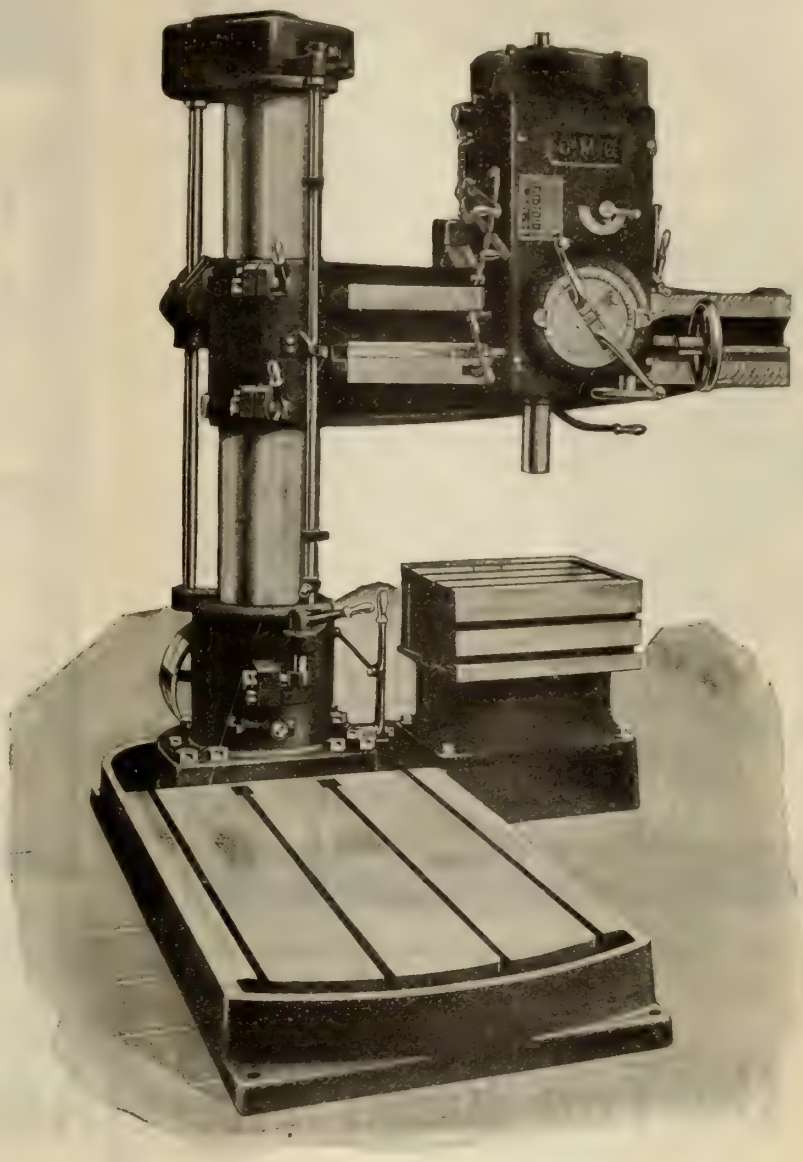
TORONTO
Bank of Hamilton Bldg.

Announcing the

C.M.C.

4' Radial Drill

New design



The new C. M. C. 4 ft. Plain Radial Drill embodies the most modern features of Radial Drill construction.

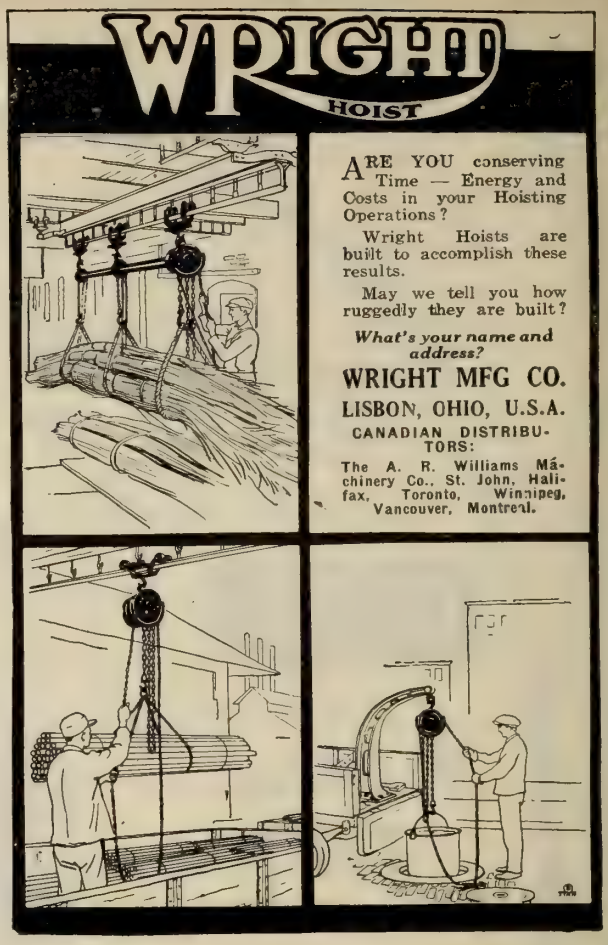
Note that the controls are centralized. All thirty-six spindle speeds are controlled by levers mounted on the carriage, and the operator will have no occasion to leave his position to make adjustments. They are all under his hand.

Built for single pulley drive or constant speed motor drive. The speed of the initial transmission shaft is constant until after passing the frictions, giving as much power on the low speeds as on the higher, greatly increasing the efficiency of the machine.

CANADA MACHINERY CORPORATION, GALT, ONTARIO

Toronto Sales Office: 721 Bank of Hamilton Building





Do You Read These Advertisements?

Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force can not replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every week will keep you posted on the latest developments for machinery equipment.

GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING and DRILLING MACHINES
CYLINDER GRINDERS
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO.
1207 E. Washington Avenue
Madison, Wisconsin, U. S. A.

CANADA FOUNDRIES & FORGINGS LIMITED

DROP FORGINGS

Automotive Industrial Railway
General and Special Forgings
Journal Car Box Wedges
Turnbuckles

Send Blueprints for Prices

Canada Foundries & Forgings Ltd.
Welland, Ont.



STEEL TANKS

Designed and built for every conceivable purpose

OIL STORAGE
GASOLINE TANKS
AIR RECEIVERS
PNEUMATIC WATER SUPPLY TANKS
SMOKE STACKS
BOILER BREECHING
RIVETED STEEL PIPE
BINS AND HOPPERS

Heavy and Light Steel Plate Construction erected anywhere

Acetylene and Electric Welding

T.I.W. STEEL PLATE CONSTRUCTION

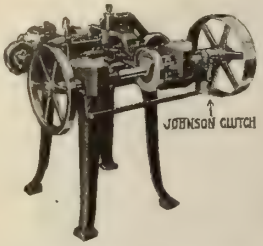
THE
TORONTO IRON WORKS
LIMITED
HEAD OFFICE: ROYAL BANK BLDG. TORONTO WORKS: CHERRY STREET

THE JOHNSON FRICTION CLUTCH

As used on the Manville 4-slide wire forming machine

Replacing Tight and Loose Pulleys

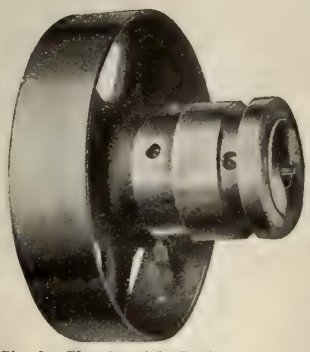
For several years the Johnson Friction Clutch has been used on this machine.



Courtesy The E. J. Manville Mach. Co., Waterbury, Ct.

This proves the efficiency of a clutch drive and the durability of the Johnson Friction Clutch in particular. Machine builders who aim at quality, have learned to place their confidence in Johnson clutches.

Both single and double clutches are incorporated in all kinds of machinery. Let our engineers figure on your requirements. This service is free.



Single Clutch with Pulley

Write for our stock list and yellow catalog

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER, CONN.

STEEL CASTINGS

QUICK DELIVERIES

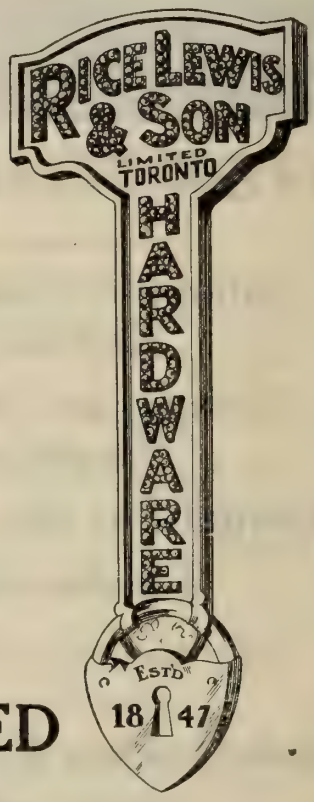
High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

Iron and Steel



We carry heavy stocks of Bar Iron, Sheet Iron (black and galvanized), Machine Steel, Cast Steel, High Speed Steel, Cold Rolled Steel, etc.

The Rice Lewis line also includes Pipe Vises and Pipe Wrenches, Micrometers, Torches, Set Screws, Cap Screws, Machine Screws, High Speed and Carbon Drills, Files and Machinists' Tools and Construction Supplies of every description.

Prices and delivery dates upon request.

RICE LEWIS & SONS, LIMITED

19 Victoria St., Toronto, Ont.



HENRY BERRY & Company Limited.

LEEDS, England

Codes: A. I., A. B. C. (5th Edition) Engineering, Everybody's Pocket Code, Marconi International

CANADIAN AGENTS:

Messrs. Fairbanks-Morse Company, Limited

***Head Office*—Montreal**

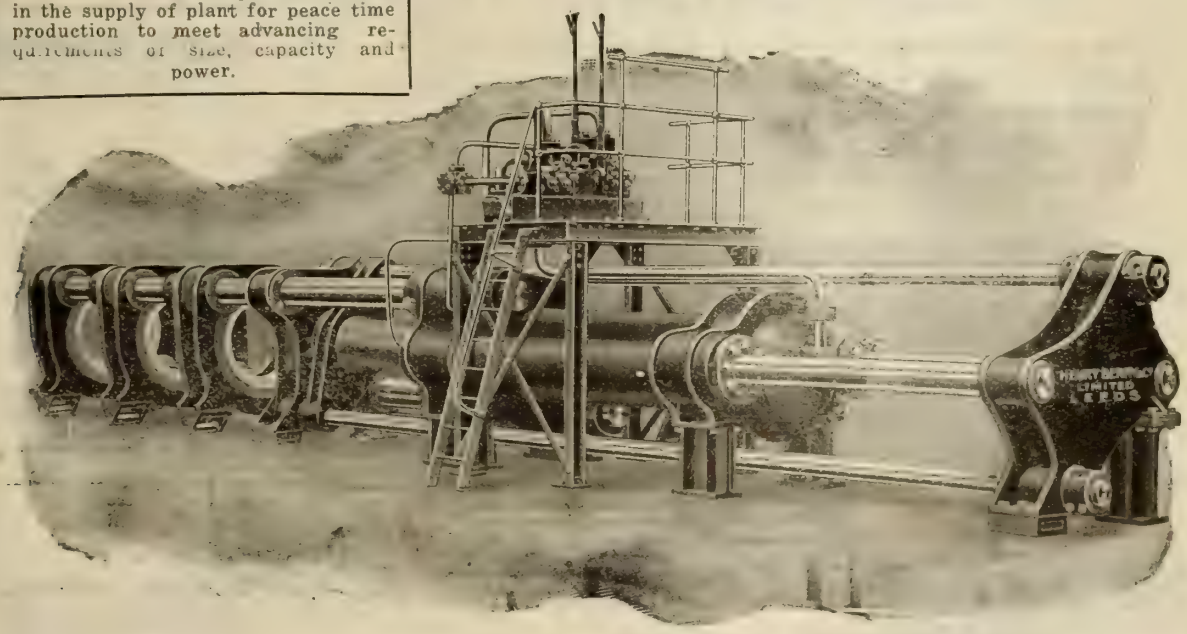
A Cradle of Imperial Industry

Concerned for many years with the design and the manufacture of some of the largest types of machinery for the British Government, the Colonies and the Indian Empire, the firm of Henry Berry & Co. possesses some of the most extensive resources in the country for the production of the biggest, most powerful and most practical types of hydraulic machinery for Shipyards and Industrial Enterprises. These include all kinds of Shipyard Tools, Plate and Armour Bending Rolls, Rivetters, and Punching and Shearing Machines, Presses and Cranes.

Designs and estimates will be submitted to all requirements without charge. Prompt deliveries with full guarantee of Quality and Power.

750 TON PUNCHING & DRAWING PRESS

Pioneer manufacturers of hydraulic shell forging presses for the largest shells in use during the Great War, we are likewise always to the fore in the supply of plant for peace time production to meet advancing requirements of size, capacity and power.





Effective Cooperation

THE three newspapers you see illustrated here belong to the MacLean Technical Group.

If you are a manufacturer of equipment that can be used in machine shops, metalworking plants, power plants, or foundries, one or all of these papers can give you effective cooperation in increasing sales.

Tell the consumer about your products in the columns of these publications. The men who buy industrial equipment read them. Your products may have advantages over other products of their kind.

Tell the consumer what they are. Create a desire in his mind to buy your lines when ordering from the dealer.

An effective message in MacLean Technical Newspapers will prove effective cooperation for the promotion of sales, and the group you can use to greatest advantage includes:

CANADIAN MACHINERY
AND MANUFACTURING NEWS

POWER HOUSE

CANADIAN FOUNDRYMAN
AND METAL INDUSTRY NEWS

Canadian Machinery serves the iron and steel and general metal working industries.

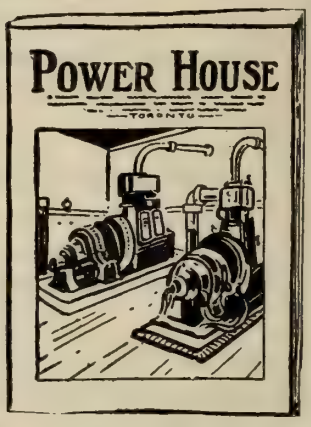
Power House serves steam, electrical, water and gas power plants.

Canadian Foundryman serves the grey iron, steel and non-ferrous foundries.

Each of these papers covers their respective fields almost exclusively. They are "Canadian National" in scope and are read by the men you are anxious to reach—proprietors, managers, superintendents, purchasing agents and foremen. Attract the attention of these men with a strong appeal in their favorite technical newspaper—the MacLean service staff will assist you.



Weekly



Semi-Monthly



Monthly

MacLean Technical Newspapers

153 University Avenue

TORONTO

Montreal Winnipeg Vancouver

Complete information respecting circulation, advertising rates and other data promptly furnished.

Have You Seen These Tools?





FIRM JOINT DIVIDERS No. 139

A new line of high grade Starrett dividers at a moderate price. These dividers are fitted with an improved firm joint and will be found very rigid. The joints are hardened and the dividers are well finished throughout. Described and illustrated on page 277 of the new Starrett Catalog No. 223. Copy of this catalog sent free on request.

THE L. S. STARRETT COMPANY

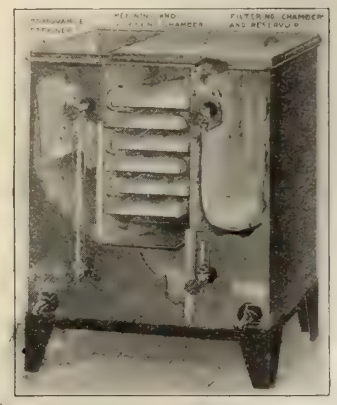
The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled
ATHOL, MASS.

Every man interested in fine tools should have a copy of the Supplement to the Starrett Catalog. Send for this Supplement showing the latest additions to the Starrett line.

42-320

Use Starrett Tools

BOWSER
ESTABLISHED 1885



BY INVITATION MEMBER OF

Friction is the Thief of Power

Friction is a consistent liability. Then why keep it on your payroll? That is exactly what you do when you do not handle and filter your lubricating oil properly.

Bowser Oil Filtering Systems reduce friction to a minimum and obtain the highest economy in operation, and in the use of lubricating oil. The patented Filter takes all water and sediment from the oil and makes it clean and ready for use again.

Consult Bowser Engineers—they can solve *your* lubrication problem.

Write for Illustrated Booklet ***C-13***

Bowser Equipment is MADE IN CANADA by

S. F. Bowser Co., Ltd.
1368 Fraser Ave., Toronto, Ont.



ARMSTRONG
TRADE MARK REG. IN U.S. PAT. OFFICE
DOGS DROP FORGED CLAMPS

GIVE LONG SERVICE

—because they are built for it. In all sizes and styles to meet every need. Have extra long hubs and oversize screws of chrome nickel steel. For complete satisfaction insist on Armstrong Tools.

Write for free catalogue.

Armstrong Bros. Tool Co.
"The Tool Holder People"
335 N. Francisco Ave. Chicago, U.S.A.



It Handles *Every* Job

THE man who chooses a Hepburn 42" x 42" x 10'0" High Speed Planer does so with the assurance that he is getting the power, rigidity and accuracy required to handle the heaviest work rapidly. As to materials and workmanship—the Hepburn name means the best obtainable. We are also makers of Engines, Steam Pumps, Cranes, Spinning Lathes, Castings, etc.

JOHN T. HEPBURN, LIMITED

ENGINEERS and IRON FOUNDERS

18-60 VAN HORNE STREET, TORONTO, CANADA

HEPBURN PLANERS

BOLTS

THE STEEL COMPANY OF CANADA LIMITED

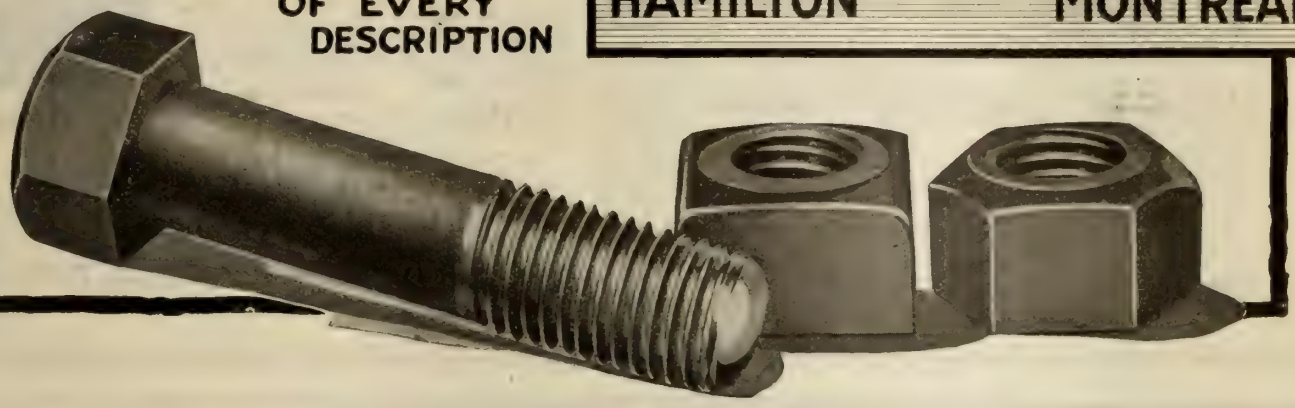
HAMILTON MONTREAL

Machine Bolts Blank Bolts End Spring Bolts
Carriage Bolts Stud Bolts Cant Dog Bolts
Plow Bolts Bridge Bolts Coupling Bolts

ALSO

NUTS, WASHERS AND RIVETS

OF EVERY DESCRIPTION





Keep Your Factory Safe
For Your Men and For Yourself

The factory that has Dennisteel Individual Lockers for the personal belongings of the employees has removed the cloakroom evil. No more gathering of smokers in an unsupervised place, no more danger from the lighted pipes left in pockets. If a pipe is left lit it harms no one's property but its owner's, for each locker is an individual cloakroom. The feeling of privacy the locker gives your employee promotes contentment.

Then, too, there is the space saving angle to look at. Dennisteel Lockers occupy but little space, and keep the workshop or corridor where they are placed, always tidy and neat in appearance.

More Dennisteel Lockers are being installed today than ever before.

DENNISTEEL
Made in Canada

Individual Lockers
For Schools, Factories, Offices

Write for Folders to

THE DENNIS WIRE AND IRON WORKS CO. LIMITED
LONDON
CANADA

Halifax Toronto Winnipeg
Montreal Hamilton Calgary
Ottawa Windsor Vancouver

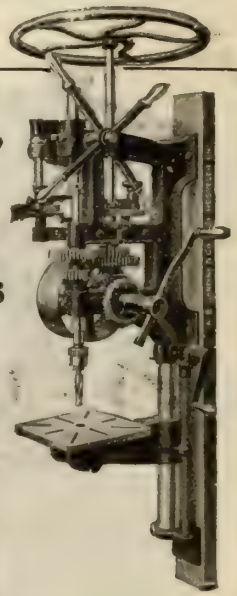
REGISTERED J TRADE MARK

"JARDINE"

Hand and Power

Drilling Machines

MADE IN CANADA



The exacting requirements of an unusually wide range of drilling are effectively served by "Jardine" Hand and Power Drilling Machines.

The sizes in these machines range from the Ratchet Hand Drilling machine to the big No. 6 Power Machine. The Ratchet Hand Drilling Machine is portable, may be applied to the job in any part of the shop and is particularly valuable for repair work, being universal in its adaptation to angles of different positions.

The Large No. 6 Power Machine is especially designed for Blacksmith's use. Get particulars of these tools.

Speed Up Your Drilling — With "Jardine" Tools

A. B. JARDINE & CO. Ltd.

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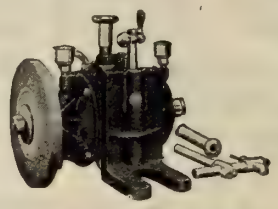
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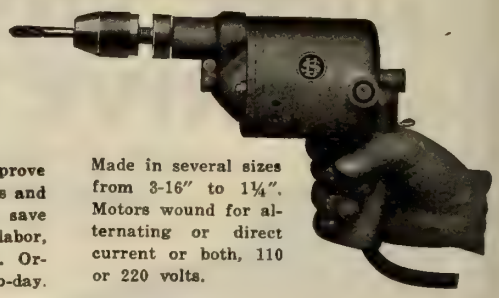
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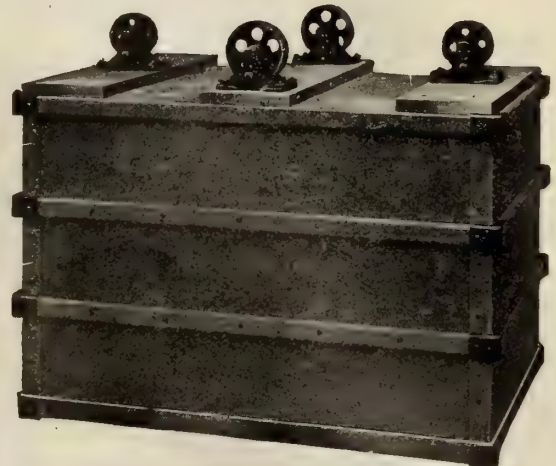


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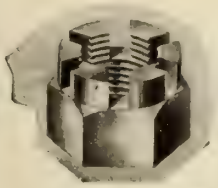
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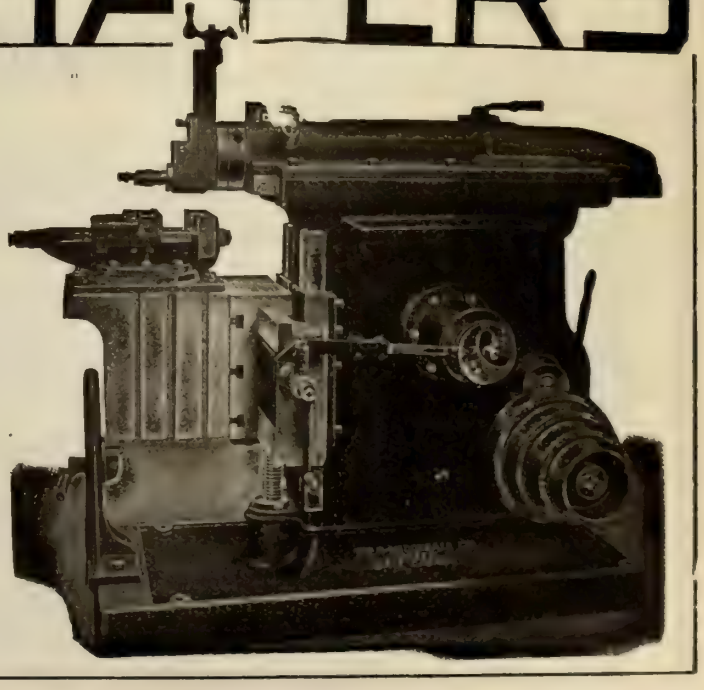
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VOL. XXVII, No. 17 APRIL 27, 1922

Inspection Methods That Have Proved Successful

See That Specifications are Correct—Incoming Material Should be Carefully Inspected Before Going Into Stores—Where Gauging is Most Effective—Co-operation of Departments

By H. ALTON

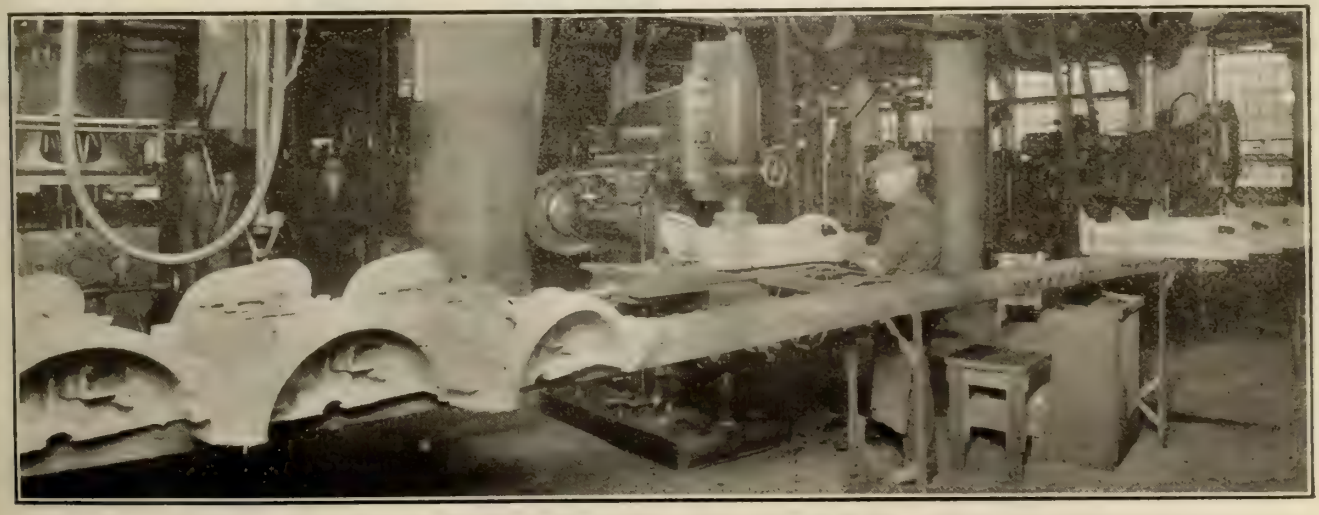
THE successful large shop always carries with it a more or less well-rounded-out organization, where we invariably find a well balanced inspection department. These inspection departments wor along certain well defined lines, being always producers of revenue indirectly, and directly a source of great satisfaction to the executives.

In the case of a small shop where the volume of work is not large we find the product is often of a variable nature, and even if an inspection department could be maintained, it could not work along hard and fast lines, as the work to be gauged or checked varied greatly. In such cases only a few general ideas can be suggested as it is more than probable that the details would have to be worked out separately. The chief engineer should see that the specifications for all material ordered are correct, and take steps to have these confirmed when the goods arrive. The engineer would prepare all blue prints, data, and specifications for the shop superintendent. Then from time to time the engineer should check all details as the manufacturing progresses. In other words the superintendent's duties would be to produce the article according to his instructions, and the duty of the engineer would be to check every point in a manner entirely independent of the shop superintendent, so that an oversight, omission, or error, could not fail to pass undetected. The sum and substance of this form of inspection is to have at least two competent individuals, working entirely independently of one another, check every factor and detail of the work, as it progressed through the shop. Of course, in larger shops operated on a production basis, a more definite description of the methods employed can be given. The experience of the writer in a shop of international reputation, will form the general basis of the data from which this article has been written.

Functions of the Inspection Department

The inspection department should be absolutely independent of, and in no way directly connected with manufacturing or production. In this way the department can be relied upon to exercise impartially its best judgment. It is not to be inferred that the inspection and manufacturing divisions should be antagonistic. That state of affairs would be extremely detrimental to the successful outcome of any business or plant. They should on the other hand, work in harmony but absolutely independently. It was found that several forms of organization work out successfully. In many cases where a general manager is an active and practical man, well informed about the business, and has a first class right hand man, he has taken over the active direction of all departments excepting say the sales and financial departments. Sometimes the term general manager, is changed to works-manager, managing director, or any one of several other appellations. Under this officer comes the following departments; engineering, purchasing, manufacturing and inspection. Of course these may be sub-divided further, other minor departments added, or some removed from the list, as special circumstances may determine. These departments in many shops are known by various names and often a rather complex organization is built up.

The inspection department has access to all engineering records and in addition receives specifications, blue prints, and all kinds of miscellaneous data from the engineering department. With this



These castings are thoroughly inspected before going to assembly department.

information it endeavors to keep the product up to the standard required, and to do this in a way that is efficient and interferes to the least possible extent with economic production.

Sources of Information

After it has been decided by the Board of Directors that a certain article is to be manufactured in quantities the engineering department prepares the specifications of the material to be used, suggests the machines, methods, tools, jigs and fixtures to be employed, etc. With this information the inspection department starts to function. We will endeavor to point out the various ways that inspection enters into the manufacturing, from the point where the raw material enters the shop to where it is shipped out as a manufactured article.

Incoming Material

As soon as a purchase order is sent out a copy of this order, without prices, should be delivered to the inspection department. A complete copy of the specifications, quantities, sizes, and all other information that would be of assistance in describing the material, should also be delivered to the chief inspector, if these details are not included on the purchase order. These papers should be filed so that they are readily accessible. As soon as any l. c. l. incoming goods are reported at the receiving department, before delivery is taken, the inspection department should be notified. In fact the inspection department should have complete jurisdiction over the receiving department. Packages should be carefully examined and if there are any signs of rough usage, or failure on the part of the package, same should be noted fully on the receipt given the carriers. At the same time, in connection with boxed and packaged goods, steps should be taken to verify, inasfar as it is possible, that the quantities agree with the quantities ordered shipped and invoiced. Sometimes goods are so packed that this is difficult, yet an experienced man can tell readily if a box of such a size is likely to contain half a dozen, or two dozen articles of a more or less perishable nature, the size of which is known. In attempting to describe these qualifications one is dealing with a rather abstract subject, but it can be readily understood that a little common sense applied along these lines will cause the elimination of more or less trouble. Following the receipt of such goods, same should be unpacked, checked in, compared to the specifications, or have these verified in-as-far as the situation would justify, and then if all the matters check up, the goods should be immediately checked in as to storage and a receipt obtained from the store-keeper.

In the case of incoming carload shipments the seal should be broken by the inspection department and all goods shoud be immediately checked in, as to quantity, quality, etc. Damaged goods or short shipments should immediately be reported and every step taken to establish a clear claim. Goods should be in their various storage warehouses or storehouses before the responsibility for them passes on to the store-keeper. Should it be found that it is difficult to check the material as to specifications without resorting to such highly specialized methods, as chemical analysis or tests of tensile strength, etc., it would be quite permissible to have such tests made, or to obtain a certificate that is above suspicion from a properly qualified authority who has made these tests for the manufacturers. If a certificate is obtained even then the acceptance of the fact that the goods are O. K. should be made under mental protest, as it were, and the goods carefully checked throughout manufacture. This is one of the cases where judgment will have to guide the chief inspector. Cognizance will have to be taken of the firm with whom the dealings have been made, and also the importance of the functioning of the goods in the manufactured article, and many other matters that it may seem expedient to consider. If any decision of importance has to be made in this connection, it should become necessary to inform the general-manager and he in turn would take up the matter with the engineering department. This step is necessary, because it is not the function of the inspection department to assume the responsibility of making any decision which should properly fall on the shoulders of the engineering department.

Railway claims figure rather extensively in the handling of many commodities and if shipments from a certain firm continue to arrive in bad order, whether from poor packages, careless packing, or other reasons attributable to the shippers it would be the duty of the inspection department to record this data and bring it to the attention of the general manager. A continuance of this practice would undoubtedly lead to a direct or indirect loss, of no small amount to the company receiving the goods.

Inspection of Articles in Process of Manufacture

The methods used in checking and inspecting articles in the process of manufacture are legion, and in the following paragraphs an attempt will be made to suggest ways and means that prove effective over a wide range of varying products that are commonly produced in our machine shops.

From the engineering department the chief inspector would obtain a full set of detail and assembly drawings of the part to be machined. Also an operation schedule would be provided showing the number of operations and sub-operations performed and how these were to be taken care of, what operations would be done with one setting, etc. Then, in consultation with the engineering department, it would be determined at what stages of the manufacture, gauging and inspection should take place. The ideal theoretical method would be to gauge every part from every machine immediately upon the completion of the operation. Practically, this cannot be done except in a few cases. Some products such as machine screws, studs, nuts, rivets, etc., being produced on automatics, specially tooled, are turned out in such quantities, and at a very rapid rate, that to gauge every piece would add over one hundred per cent. to the cost. Then again there is the product that may have one or more roughing operations, in which extreme accuracy may not be important as nominal variations can be taken care of in subsequent operations automatically and without additional cost. Obviously it would not pay to gauge every piece of such a product at these roughing operation stages, yet nominal gauging would be necessary. Thus it would be worked out at just what stages of manufacture it would be necessary to gauge work, and just what dimensions or points would be given attention.

There is an opportunity here for ability to be capitalized. The gauging should be such as to confirm every necessary measurement and condition, yet not one instance should exist one gauging operation overlapping another. It is also determined whether or not every piece will be gauged. The method of trucking, routing, and handling the product would be carefully considered, and the place where all gauging operations would be done and how they should be handled would be decided upon. In cases of gauging preliminary operations, that are not finish operations, it may be just as satisfactory and much more economical to gauge the material on a bench or table in the shop while it is enroute from one machine operation to another. Then again, shop layout character of the product, or peculiarity of the gauging or inspection operations, might be such as to cause this method to be impracticable or to be expensive. When such is the case an inspection room must be provided where the work can be accomplished to best advantage.

After the number of gaugings and inspections have been decided upon, the detail drawing would be consulted and the gauges or inspection apparatus would be designed. The manufacture of the gauges presents another problem. There are three distinct kinds or types of gauges to be made from every design it is desired to use. These are the reference or master gauges, inspection gauges, and shop gauges. The reference gauges are made with the greatest care and are provided with a very secure cabinet located in a room, free from dust, vibration and sudden changes in temperature. In fact such gauges should be kept between temperatures limited by two points not far apart from one another, the year around. These gauges should be designed to test all parts and to check as accurately as is humanly possible all measurements up to the limiting dimensions permitted in the design. These gauges are not used directly on the work except on rare occasions, but are kept to check the accuracy of the other gauges. The inspection

department usually is entrusted with the custody of them. In their design, adjustable features may or may not be featured. Should they be adjustable, the adjusting parts should be very effectively sealed to insure against careless or malicious tampering. Not all of these gauges, however, can be used directly on work, as they sometimes vary from the design of the inspection or shop variety by possessing certain extra flanges, or other sections, that prevent actual application to the work. Such gauges thus, can be used only for reference purposes. In addition to what might be considered a complete set of gauges for inspection or shop work, there appear in reference sets certain standards, such as plugs, internal thread gauges, thread plug gauges, etc., etc., which are useful for reference purposes only.

The inspection gauges usually are provided with tolerances slightly less than those permissible on the blue prints and those in the reference or master gauges. They are, however, quite capable of being applied to work and possess all the necessary qualifications for adjustments to compensate for wear. These gauges are used by the inspection department for the actual testing of work. The shop gauges have again a slightly smaller range between limiting dimensions than the inspection gauges. They are used by the production workmen to check their work as it comes from the machines.

Records Kept by Inspection Department

Every workman operating a machine should possess all the shop gauges necessary to test the work done on his machine. Work brought to his machine must have passed inspection in as far as the operations up to the present one, were concerned. Some record is, of course, kept of the work in progress, and whether the method of trucking is by elevating truck and special platforms, or other means, each lot is numbered and a record of its progress, rejections and rectifications must be kept by the inspection department. These records check up piece work records if such a system of remuneration is employed. Furthermore it produces an accurate record not only of each man, but of each machine, of each operation. It only takes a little additional clerical work to compile such records which are of inestimable value in picking out the most consistent producers, the machines that do the work without a shut down day after day, and finally it shows where a shop may be unbalanced. Further than that by recording the causes of rejections and reasons for rectifications it will be seen where the weak link in the method of manufacturing is located. There is a very wide scope for deduction here and the extent to which an intersection department is instructed to operate is only limited by the peculiar manufacturing problems of the shop which is being considered. Of course if the information obtained does not effect a saving greater than the cost of obtaining it, why it is poor business and should not be continued.

After it has been definitely determined to what extent records of machining operations should be kept, it should be determined how often reports should be submitted to executives, and also it should be seen that every executive interested in any of the features tabulated should receive a copy of each feature in which he is interested. Because it is a long way to the deduction that no matter how complete the records are, if they are not placed in the hands of the proper officers, they are next to useless.

Inspection of Foundry Work

Up to the present no mention has been made of inspection methods in connection with foundries. Supplies have to be checked in much the same way as machine shop supplies in-as-far as quantity is concerned. To check quality, chemical analyses have often to be resorted to. Pig iron, for instance, is always sold on analysis. Foundry facings, core binders, cupola washes, mounding sands, coke, etc., are usually sold with more or less rigid guarantees of certain analyses. Other products are marketed under trade names and the analysis is not generally known. But the old adage that says, "the proof of the pudding is the eating," is often true in the case of foundry work. If the castings are good and the cost within reason, not much criticism is offered. It is often assumed that if a very small percentage of castings is lost, it is better to leave "well enough alone" rather than attempt to introduce cheaper materials and methods at the risk of increasing the number of lost castings. Moulding appears to be a trade dealing with abstract things, and the moulders are sometimes temperamental. Thus no elaborate inspection methods are generally accepted and each foundry works out its own problems.

On the other hand a foundry is sometimes found where an intelligent supervision by qualified inspectors has worked out some remarkable results. No foundry can afford to let such matters drift. If machines are used, a record of the quantity and quality of the work done, should be kept. The results obtained from this core binder, this iron, and that facing, are very valuable to various executives and departments. The records of production of various men should be kept.

The inspection of castings is usually done by simply looking them over. If they look good they are assumed to be good. If defects turn up in machining the process is simply to scrap them. If a large number of castings, having the same defect appears, the reason is sought and conditions are changed with the idea in view of eliminating the cause of the effect. Probably in no other department of a metal working industry is it harder to suggest inspection methods of a general nature more than a foundry. The reason is that practices vary greatly and the methods of employing inspectors must be added to the conditions.

Final Inspections

After the various component parts have all passed inspection and these parts eventually find their way to the assembling department, the inspection department temporarily ignored. If parts refuse to go together, if machines refuse to function, then is the opportunity of the shop to "get back at", and tell the inspection department how useless they are. The inspectors have been "upper dogs" all along, but woe to them when the day of assembling occurs, becaues if things do not go right then it becomes a "day of reckoning." On the other hand if the machines do assemble easily, and function properly on tests, why they proceed to the paint room. Here all bright or finished parts are covered with some kind of a preventative for rust. Other parts are painted, stripped, etc. Then comes the packing, crating and shipping. Just where the authority of the inspection department ends, is largely a question of shop practice. In any event such supervision as is required in these connections is not of the highly skilled variety. Articles have to be substantially crated, and if for overseas shipment, exceptionally well so. Delicate parts should not be exposed to risk of damage, and many other self evident conditions of risk should be eliminated.

Scientific Apparatus

Discoveries in the field of science have been responsible for many scientific principles being applied to practical use for gauging purposes. Even a well informed engineer or mechanic is often surprised to learn of some peculiar application of a newly discovered scientific fact to the field of inspection. The thermo-electric couple, with the recording thermometers and pyrometers are great aids to the work of checking certain factors in a product. All recording instruments have a useful field. The sclerscope and the Brinnel methods of testing the hardness of steel are two examples of the more or less indirect application of certain principles applied to inspection purposes. To cover the field would be impossible, as usually each application is made only after a careful and exhaustive series of experiments have been made.

Organization of an Inspection Department

There is no hard or fast method of organizating an inspection department. Local conditions as well as the main organization of the factory, are often reflected in the smaller sub-organization. The chief inspector should have a first-class assistant. In each department he should have a foreman inspector. Each foreman should have under him, enough men to gauge the work as fast as it is produced, and to keep the necessary records. Should the department be large, it might be in order to appoint sub-foremen. The foreman's duties would be largely to supervise, see that gauges were properly used and were frequently checked, that records were properly and accurately kept, that production was not held up, that bad work was immediately reported, and the risk of spoiling work removed by having the machine produc-

(Continued on page 21)

Choice of Fixtures for Industrial Lighting

Type of Reflector Depends on the Work—Softening Shadows and Eliminating Glare—Keep Globes and Lamps Free From Dirt—Good Light Prevents Accident

By JOHN T. SCOTT

HAVING treated of the fundamentals of illumination design, we shall now consider the choice of reflectors and equipment in order that the best results may be had from our planning.

In the choice of reflector fittings for service, consideration is given to the class of work to be done, the area to be illuminated, location of operatives and machines, ceiling height, etc., as outlined in last week's Canadian Machinery. For general lighting, the type of metal reflector now generally used to obtain uniform results is the RLM standard dome, (abbreviation for reflector and lamp manufacturer standard), illustrated by Fig. 1. These reflectors are made under a standard set of specifications drawn up by the engineers of the principal metal reflector and lamp manufacturers, to obtain the best possible service from metal dome reflectors with gas-filled incandescent lamps.

Eliminating Glare

The use of the RLM metal dome reflector with the bowl-enameled or bowl-frosted lamp is desirable for a wide variety of industrial locations. This combination gives a direct lighting of full illumination value, but with softened shadows and freedom from glare, and is the type of lighting particularly recommended for machine shops and locations where reflection from polished metals is prevalent. The same care should be given to the choice of equipment for local lighting of machines or particular operations. Don't forget that the lamp filament should be concealed at ordinary angles of vision from the worker and other occupants of the shop. Also diffuse the light so that it does not reflect from the metal working parts.

Wherever possible avoid local lighting—in many instances it can be dispensed with. This can be made easier by the advantage gained from the development of a more efficient overhead lighting system. Even when local lighting is necessary, a high level of general illumination relieves contrast between the brightly lighted work and the remainder of the room, besides proving restful to the operatives' eyes. Care should be exercised in choosing the size of reflector equipment and to get it suitable to the size of lamp selected. Larger or smaller diameter reflectors will give poorer light distribution, and for the smaller size will reveal the lamp with annoying brightness.

Lamps And Voltage

Under-voltage burning of lamps from any cause results in a decrease in wattage, and therefore a decrease in current bills, but since this decrease in wattage is accompanied by twice as great a decrease in illumination, it really results in a net loss. In instances where a considerable increase in lighting intensity has been made or may be under consideration, it is important to investigate the amount of voltage drop caused by the increased load. The voltage delivered at the service switch may be up to standard, but if the circuits are overloaded, poor illumination and decreased wattage will result. In any instance where the desire to cheapen the wiring installation has resulted in the installation of insufficient copper, the voltage drop will be excessive, the illumination will be decreased, and the lamp efficiency impaired.

It is oftentimes found that people who do not fully appreciate all the resultant effects, are purposely using lamps whose rated voltage is higher than the circuit voltage, for the purpose of thereby increasing the life of the lamps. In practically no cases is such a practice justifiable, for the cost of the current consumed by a lamp is so much greater than the cost of the lamp that it is not economical to sacrifice even as small part of the efficiency of the lamp for the sake of even a considerable decrease in the renewal cost.

To purchase light efficiency, obtain lamps of known quality and of correct circuit voltage. Lamps have an average life of 1,000 hours and will maintain their luminous efficiency for that period with but very little variation.

Effect of Cleaning

Here is a single statement that would save hundreds of dollars if it was generally known. The loss of illumination due to the coating of lamps and reflectors with dirt may result in a loss of light equal to 60 per cent. or more before attention is given to the fact that they need cleaning. Think of what this

Author is engineer in charge of standardization work at the Sunbeam Lamp Works.



Example of well illuminated machine shop.

means in current consumption, loss of production, waste of materials, and risk of accidents. And then realize that the saving can be made by a simple plan of cleanliness; a periodic cleaning of lamps and reflectors with just soap and water. Shop cleanliness is a matter of routine—extend it to the lighting units.

It is surprising to see the way in which lamp units are neglected, and new and large lamps sometimes put into sockets where the only trouble was need for clean water. This is where use of



Bowl Enameled Mazda lamp.

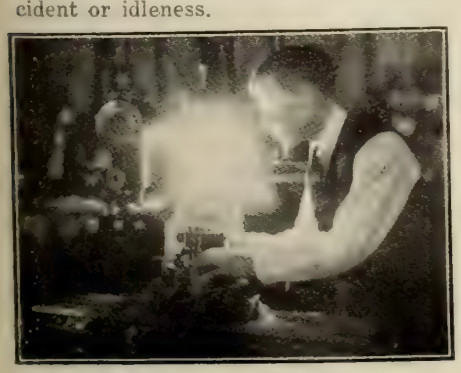
the foot-candle meter to check up lighting values is going to repay its cost.

Finally, we must consider the question of shadows. For satisfactory lighting there must be no sharp black shadows to confuse the vision. Shadows are usually present when the illumination is not uniform. It would need expensive equipment to eliminate shadows entirely, but it is not even necessary as a certain amount of softened shadow is necessary for easy defination of objects. A model of illumination in this respect and one which will be fully appreciated is shown in the illustration accompanying this article.

Summarizing

Unfortunately a lot of indifference has to be overcome to make plain the fact that lighting plays an important part in modern industrial plants. There are still in use many Topsy Systems that have "just growed." Faulty and insufficient lighting costs in the end far more than efficient illumination. Poor lighting reduces production and increases shrinkage—a loss of time and money.

An increase of four times the lighting intensity will equal a sum that is but a fractional percentage of the pay-roll, and the sum spent will be well repaid by measurable increase in production. More attention to illumination is only a matter of the possibilities of its service to industry being seen by responsible executives. Lighting has power to stimulate and where adequately used there is little chance for error, accident or idleness.



Poor Method of Local Lighting

INSPECTION METHODS THAT HAVE PROVED SUCCESSFUL

(Continued from page 19)

ing the bad work held up until repairs are made. These are just general suggestions, but a successful foreman will see a multitude of ways in which he can act for the benefit of increased production of first class goods.

The chief inspector would work with his foremen and assist them in many ways. He would get daily reports from all foremen and would probably look over these reports. Under him he would have a staff which would finally compile all records and place them in the hands of the proper executives.

A chief inspector would have to familiarize himself with many engineering problems and would find it necessary to watch and study closely the problems that faced the firm with whom he was working. In times of high production he has a delicate duty to perform in keeping up both the quality and quantity. The production department will quickly bring up the quantity but it is up to the inspection department to bring up the quality. It is in these cases that a little friction occurs. A great deal of tact is sometimes necessary and it must be clearly understood than an inspector, although he may be first class in all respects, except in tactfuness, can never be a success without it. Thus a really big man, can fill the position of chief inspector and find scope for all his talents. In fact he can be a "power" in his organization. Mechanical skill is not by any means a useless factor in an inspector. The opportunity presented, of studying general shop manufacturing methods is valuable, and occasions are frequently found where both the man and the factory are benefited by the mechanical knowledge of an inspector applied in a practical way.

The field of an inspection department varies a great deal in different manufacturing establishments. Thus to treat the subject in detail a close study of the product, the method of production, the volume of production, the shop layout, the possibility of frequent changes in design, and many other factors would have to be made.

Piece Work and Bonus Systems

Shops that employ the piece work or bonus system, or in fact any system that rewards a worker more or less directly according to the amount of work he produces are sometimes uncertain of the quality of the product. This difficulty is easily overcome if a close inspection of the product is made, and a man only credited with the pieces that pass inspection. In some cases on record, workmen have operated machines where they not only lost their remuneration on a piece that was spoiled, but in addition were subject to a nominal fine. This is somewhat unusual, and only extraordinary conditions would appear to justify such a practice. The method of closely checking a man's production and only giving remuneration for good work, really assists the inspection department. Production workers will then keep their gauges, machines, and tools in good shape and will be interested in turning out good work only. When indications are such that would lead the worker to believe his machine needed adjustment or repairs, he would report such a condition immediately, learning that "a stitch in time saves nine." He also is directly interested in seeing that his machine is quickly returned to service so that he can again produce.

If an inspection department keeps the spoiled material down to a minimum, does not delay progress of work through the shop, and if assembling and preliminary tests show that the work has been conscientiously carried out, it is an assured fact that the money invested in their salaries and equipment has been saved many times, in a direct or indirect manner. The information that is tabulated, from data obtained by the department, often enables executives to obtain better administration. In fact many policies of the directors have been changed, and new ones formed from studying various forms of inspection reports and making commonplace deductions. The inspection department is with us permanently as in our modern manufacturing shops they have become indispensable. The various functionings of such a department present a very interesting problem to many executives, and the field of usefulness of inspection is ever broadening, and seems to be limited only by the resourcefulness of the executives themselves.

CANADIAN NICKEL REFINED AT HOME

A better era is promised for the Canadian nickel industry. J. L. Agnew, president of the International Nickel Co., of Canada is reported as saying that:—"Remodelling of the exploitation department is the salient feature of the development of the regime under its reorganization. Experts of high standing have been engaged with a view to broadening the field for nickel and monel metal parts. In the past most of the nickel has gone into armament and war material, and with the disarmament conference over and disarmament a fact because of the agreement to reduce ships and armament, there will be a substantial reduction of nickel for these purposes. The industry is therefore facing an entirely new condition, where new uses will have to be forthcoming to make the industry a success.

"In the meantime, the Canadian end has assumed tremendous importance. The production of ore and matte is entirely in Canada, and hereafter all refinement of nickel will be done at Port Colborne, the company having some time ago announced the closing of the Bayonne works."

Taking the *"Please Remit"* Out of Collections

Sample Collection Letters Which Have Proved Successful—Humorous Style Not in Favor—Each Debtor Should be Dealt With According to Character and Nature of Business

WHAT style of collection letter can I use to obtain the best results? Is there such a thing as a standard collection letter containing enough fundamentals to apply to all manufacturing lines? These, and other questions of similar character are bound to arise whenever bad debts are encountered, and it is the collection manager who is able to send forth the proper type of appeal who can afford to smile as he sees the cheques coming in.

A short time ago, Canadian Machinery wrote to several well-known firms in diversified lines, asking for their opinion as to what constituted a first class collection letter, and while opinions varied in some respects, one point was firmly established, viz., that a standard form equally applicable to all lines of manufacturing was practically impossible.

A considerable number replied to the effect that they had absolutely no trouble in collecting accounts, while others again did not believe in letters, but sent someone to collect the money. In the April 6 issue, Mr. Quigley, collection manager for the Ontario Wind Pump and Engine Co., Toronto, gave his ideas regarding collection letters in general, and in the material to follow we shall present several other opinions, allowing each one to speak for himself.

G. F. Morris, sales manager of the time recorder division of the International Business Machines Co., Toronto, has given us a sample letter which they have found to be successful in bringing in the money. He remarks as follows: "Naturally we all recognize that the proper type of collection letter is extremely hard to standardize and must be worded to suit the necessities of the case. There is plenty of room for improvement in the practice of compiling such letters and we need hardly say that we are always willing to copy the successful collector and trust that the discussion you have started will produce some good material."

Leslie S. Hall, vice-president of the Williams Tool Corporation, says that the subject of collections is entirely foreign to their company, as they never have to chase up collections, business being principally with dealers who paid regularly. "Last year at our American plant," continues Mr. Hall, "we only had $131 bad debts, while at the Canadian factory, we had $37, so you see we have very little need to study the problem of collections."

Here is how W. E. Hensman, credit manager for Crane Ltd., Montreal, sums up the situation. "We appreciate your invitation regarding the presentation of our views on the proper type of collection letter, but regret to advise that, although we have read innumerable so-called 'go-getters,' we have not yet come across one that we considered presented the proper businesslike attitude. We do not consider that a humorous letter would maintain good relationships with a real business man. We admit that it might be used once to a particular individual with good results, but cannot understand how any man giving the proper attention to his business will care to do business with a house publishing humorous letters. Our practice is to first of all send out a statement with an overdue account accompanied by a short letter pointing out the overdue amount and, after that, to deal with each customer in a way that we feel suits that particular individual. Of course, we do not contend that ours is the only method, but are yet to be convinced that a special letter, or series of letters, will answer the purposes of the credit department of all kinds of trades or houses. To be concise, we feel our views are best expressed in the old saying—'One man's meat is another man's poison'."

P. Ford-Smith, president and manager of the Ford-Smith Machine Co., Hamilton, says that he does not believe in any cut and dried form of collection letter, nor does his firm use any. He feels a humorous letter is entirely out of place, and summing up the situation, here is what he says:

"The way we look at collections, and we may say that we have had practically no trouble in the whole of our business experience of any moment, is this. We sell our goods on certain terms, and when the account is due we expect to receive our money, and we make our financial plans accordingly. If an account is not paid within a reasonable time of the due date, we take up the matter firmly by letter and insist on payment At times we have had to call on people, and this has generally been successful. On the other hand, we pay our own accounts on a certain system without fail."

L. L. Wildman, collection manager for the S. F. Bowser Co., says that the important thing is to know the customer's character, sensitiveness, or other attributes. The letter which is shown in this article is not meant so much as an actual letter which would be sent from their office, as it is meant to portray the particular points they have found arouse results, in other words, something that will create interest, and appeal particularly to the debtor's mode of life and business.

Should any other manufacturer feel he has a collection letter which contains a stronger appeal than the two shown, send it along, and we will be only too glad to publish it.

Mr. John Smith,
Toronto, Ont.

Dear Sir:—

This is a collection letter but not the kind of a collection letter that says "Please remit," and leaves ill-feeling behind it.

We have learned from experience that 90 per cent. of all trouble starts with a misunderstanding. If we can correct this, there is no trouble at all.

You owe us $32.38 covering our invoice of Dec. 30, 1921.

You know that you owe us for the above mentioned invoice, and that you have not paid us promptly, but we don't know why, so we are taking this opportunity of asking you what is wrong. If there is a possibility of a misunderstanding on our part why just merely put it right up to us. We will come more than half way for you any time, but you surely do owe it to yourselves and to us to explain.

If there is nothing wrong, then you owe it to yourself and to us to pay up your indebtedness according to the terms as per the invoice. This is just good sense and square business, now isn't it?

Yours very truly,

This style of letter has brought good results for the International Business Machines Co.

The American Society of Steel Treating are holding a sectional meeting in Pittsburg on May 26, when a number of interesting papers will be presented.

Mr. John Doe,
Somewhere, Ont.

Re "Dusty Roads" vs. "Green Pastures"

Dear Sir:--

"Dusty Roads" controls an active business. Shrewd managership rewards him with a liberal profit. His business should be a source of enjoyment, but—it is not. A keen business insight leads him to invest profits until he cannot meet his bills. His mail is heavy with harassing creditor's letters demanding payment of overdue bills. Considerable time is spent explaining and promising.

"Green Pastures" also controls an active business—enjoys liberal profits and gets the best out of life. Why? He discounts his bills, meaning an addition to his profits. Creditors never trouble him; they seek his patronage. His time is spent solely in planning and developing his business.

Only a few hundred dollars represents the difference between "Dusty Roads" and "Green Pastures"—only a few hundred dollars stands between discontent and happiness.

Many businesses are reflected in our accounts, and often the writer thinks of "Dusty Roads" and "Green Pastures." Imaginary—yes; yet just slightly exaggerated types of people we meet every day.

Your account, Mr. Doe, has just been brought to my attention. You are again in arrears to the amount of $228.00. So many times has this same situation arisen, that I am wondering if you are not overlooking a good bet; whether you are actually getting all of the enjoyment out of life and business that you should. Why not make a little extraordinary effort and arrange to pay up all overdue accounts and start discounting your bills. Ten to one you would never get delinquent again. Better try it.

Anyway, let us have a remittance, as it is imperative that this account be brought up to date before the 20th instant.

Yours very truly,

This letter is designed to arouse interest, and appeal to the debtor's mode of life and business.

Consider Amount of Spoiled Work

Poster by Fred. G. Kent, Supt., Lodge & Shipley Machine Tool Co., Cincinnati, Ohio.

STOP a minute and consider spoiled work. If every man in this shop will appreciate fully what it means, the amount can be cut 90 per cent.

There is, first, the direct loss, which includes the cost of the material and the labor which has been spent upon it. There may be a small scrap value, but otherwise what is lost can never be recovered. But the direct loss is only a beginning. There are other greater losses. Spoiled pieces must be replaced, usually in a small quantity lot. It costs from three to ten times as much per piece to make ten pieces in a lot as it does to make a hundred; sometimes the ratio is even greater. Also remember that rush jobs are always more expensive than regular jobs, and replacement of spoiled work is always a rush job.

While this small quantity job is being done, there might be made, instead of it, some other job which is crowded out of its place in the schedule by the spoiled work. The upsetting of the manufacturing schedule is the hardest thing to put an exact value upon, but is the greatest loss that we have, due to spoiled work.

Remember that raw material not only costs money, but is often very hard to get. Every time the foundry runs on a short lot of a few pieces to replace spoiled work, it is taking time that would produce much needed material for regular work. It is also taking the time of the purchasing department in getting the order for this replacement material pushed ahead of the older orders already placed. Sometimes it is almost impossible to get the replacement material at all, and by the time it is obtained, the work for which it is needed has been delayed beyond the possibility of any approach to efficient production. In certain cases, such delay has caused a loss through penalty, which has more than wiped out any profit on the order. Also, where there are no penalties involved, the shortage on the erection floor will put off the shipment of some given machine at a time when there is nothing else that can be substituted for it on the shipment schedule. This is a loss that can never be made up. Work that is imperfectly done, so that it must be done over or patched up, may save the direct loss of the material, but the delay due to time spent on it is just as serious and expensive as in the case of spoiled work.

Careful observation of three small rules will help greatly:

First—Make sure that the first piece in every set-up is passed by the inspector before doing any further work on the job. This is a simple rule, and must be obeyed.

Second—If a blueprint is smudged so that you cannot be sure of the figures, or if you are in doubt as to the meaning, put it up to the foreman. Don't guess. Better lose time making sure than spoil the work. Don't use an indistinct blueprint; insist on a fresh one.

Third—Don't use a jig or tool that you think is in bad shape, put it up to the foreman. Don't use any jig before you are sure you understand how.

Cutting down spoiled work will save money, increase the production, cheapen the cost and raise wages.

PALM OIL AS A FUEL

Palm oil is reported to have given successful results as fuel for a stationary two-cycle semi-Diesel engine of Swedish make, the tests having been made in Belgium. The engine's storage tank for the oil was divided into three compartments, and so fitted that the hot exhaust gases and the cooling water from the cylinder melted the contents of the tank. The wire screening dividing the tank served to filter the melted oil. The engine was started with crude petroleum, and as it warmed up the change to palm oil was made through the automatic feed.

OVERHEATING IN FACTORIES

The commonest evil in air conditioning in factories, is the slight but highly objectionable overheating which obtains in any ordinary window-ventilated workrooms where there is no marked overcrowding and no special process tending to overheat or vitiate the air. This evil can commonly be controlled by watching the thermometer, by common sense regulation of the artificial heat supply and the use of windows before and during the shift. Heat hazards of high degree, says the U. S. Public Health Service, can not be summed up so simply. In cool weather, says this report, they can be adequately controlled by properly designed and operated systems of fan ventilation; but in summer time, although they can be mitigated by ventilating systems that produce vigorous air movement, they cannot be fully controlled except at prohibitive expense and must therefore, in general, be accepted as an unavoidable incident, of the employment. The effects, however, may be minimized by short spells of work alternating with rest periods.

When You Close the Plant at Night—Is It Safe?

Showing the Dangers Existing in the Oil Room of Many Factories—Points to Guard Against and How to Eliminate the Danger —Proper Storage of Oils Very Essential

IN CONSIDERING the dangers attendant upon the storage and handling of oils, we are apt to think only of gasoline and naphtha. This is a great mistake, as every oil carries with it a menace to life and property and its handling should be safeguarded in every possible manner. Until this fact is universally recognized and all oils are handled in fire-proof, evaporation-proof steel tanks, we must expect to pay an enormous fire loss due to the careless handling of these products. It is true that the danger of handling gasoline is greater than in handling other oils. This is so well known, however, that familiarity with it in many cases induced carelessness, so that it is well that we consider the treacherous nature of this product that we may always be on our guard.

Gasoline, unlike the other heavier petroleum products, throws off an explosive vapor constantly, even at extremely low temperatures. Five gallons will generate 8,000 cubic feet of gas, which, when ignited, expands to 4,000 times this space. The explosive force of one gallon of gasoline properly mixed with air and compressed is equal to 83 2-3 pounds of dynamite or fourteen times greater than dynamite. This means that if you have 100 gallons of gasoline on hand, you are storing the equivalent in explosive force to 8366 pounds of dynamite. Gasoline is, in fact, more dangerous than dynamite and there is more liability of an explosion. Dynamite will only explode from two or three causes which may be easily guarded against and which must occur in its immediate vicinity.

Safeguard Your Interest

The vapor from gasoline is heavier than air. It settles to the floor and runs along the floor much as a stream of water would only that it is an invisible stream. This vapor will settle and remain in a depression in the floor or under the floor for days and even weeks, unless disturbed by a circulation of air, until a spark causes the accumulated vapor to explode. This spark does not necessarily have to come from a lighted fire, but may occur through a person striking a nail in their shoe on a nail in the floor or other similar unavoidable causes. The records show that under certain atmospheric conditions, spontaneous combustion will occur in this accumulated vapor. A case is on record in which the gasoline fumes were carried out of the building to a lighted lamp thirty feet away from the building, taking fire and flashing back to the building, which was entirely consumed. If you are handling gasoline in any way but the right way, you are in just this position and you can never foresee when the blow will fall.

It is past understanding, in view of these facts, that many concerns with their entire capital invested in the business, will give so little thought to safeguarding their interests. With the factory, shop, mill, or mine heated, they will at night lock up this explosive in a warehouse or building adjacent to or connected with the main plant. After locking up fire and this explosive vapor together, they will, in effect, wager their entire investment against the merely nominal expense of fire-proof storage that this vapor and this fire will not get together.

Kerosene is not as dangerous as gasoline, yet at a temperature of 70 degrees F. or over, it throws off an explosive vapor. At a higher temperature in which there is an open tank of kerosene, there should be kept up a circulation of air equal to 200 cubic feet per minute for each gallon of the exposed oil. These figures vary, of course, with the volatility of the oil and temperature of the air and oil. Such a circulation of air is not practical in the usual manufacturing establishment. Hence the necessity is apparent for evaporation-proof, scientifically correct storage for kerosene as well as for gasoline.

Watch the Refuse

All petroleum products, including lubricating oils, produce the explosive vapor. The danger from lubricating oils, however, is chiefly from spontaneous combustion where waste, sawdust or shavings are used to absorb the oils spilled on the floors. Many fires in factories and oil rooms have been traced directly to this cause, as it is a very common practice to neglect the accumulated refuse, which in time, bursts into flames.

The gravest danger that confronts the consumer of oils aside from the gasoline danger is, however, from the paint oils, such as linseed oil and turpentine. A piece of cotton waste saturated lightly with equal parts of linseed oil and turpentine will, if left in a closed room, such as an oil house or stoveroom for the night, burn from spontaneous combustion in three hours' time. Instances are not even lacking of fires being started in this manner when the waste or oil-soaked cloth was left in the open air. Two years ago a fire occurred in Minneapolis from a cloth which had been used in oiling a floor and was left on the porch. North Dakota has, in the past year, suffered a loss running into hundreds of thousands of dollars from fires started by spontaneous combustion in oil houses. This property loss is appalling, but who can estimate the value of lives sacrificed annually to the mistaken policy of "economy" in equipping an oil room?

We are living in an age of increasing danger to life and property from many causes unknown to our fathers. Developments of modern inventions in all lines such as electricity, automobiles, etc,. each brings its corresponding increase in danger to life and property. These advances in the development of our civilization bring a responsibility that we cannot ignore. The merchants and the factories to-day are compelled to meet the conditions. For instance, they are compelled to store large quantities of various dangerous oils. Happily, we are, also, in an age when master minds have set themselves to the problem of minimizing all such dangers. The storage

(Continued on page 27)



A plant using this method of reclaiming oil will find an immense saving every year.

Features of Maag Type of Tooth Profile

No Undercutting of Pinion Teeth—Slip Practically Eliminated—Less Breaking Leverage and Greater Strength—Rack Shaped Cutter With Straight Tooth Profile

IN order to procure a gear tooth profile which would be an improvement on the present standard involute system, Max Maag of Zurich, Switzerland, after extensive experiments, has developed the gear tooth profile which bears his name. The new form of gear tooth does not tend to become undercut in pinions having a small number of teeth. In fact this feature is so marked that pinions with as few teeth as five have been cut and placed in successful operation. These pinions run smoothly and the teeth are not undercut..

The tooth form is a true involute, from the points right down to the fillets at the roots of the teeth. In ordinary involute gears the profile is symmetrical about the pitch circle and is a true involute only down to the base circle, beyond which point the flanks are radial or even an optional form is permitted, provided that the pinions will run freely. The result is an unsatisfactory profile in pinions of few teeth, where the base circle is relatively larger than in gears with a greater number of teeth. In these pinions the diameter of the base circle closely approaches the diameter of the pitch circle. Thus the effective part of the tooth is the face, or that portion of the profile which lies on the outside of the pitch circle. This condition, coupled with an undercut tooth does not make it practical to use pinions with much less than fifteen teeth. Consider the case where an ordinary pair of involute gears are used, with a pinion of a small number of teeth, if the thickness of both the gear and pinion teeth at the pitch line are approximately half of the circular pitch, the gear tooth is perhaps fifty to one hundred per cent. stronger than the pinion tooth. In the new gear tooth the profile is symmetrical more as regards the base circle so that such a condition does not exist. By referring to Fig. 1 the two tooth profiles can be compared. It will be seen that the Maag gear is shorter and is much more rugged at the root.

Generating Maag Gears

Maag gears are generated by rolling the gear blank in a rack shaped cutter. Fig. 2 shows how this is accomplished. The cutter operates with a reciprocating motion in a vertical plane. Between each stroke the blank is revolved and moved forward a little as if it were rolling in a rack. Due to the well known fact, that involute racks have straight sides, the cutter is comparatively easy to make and to measure with absolute precision. In the finishing operation, each tooth in the gear being cut, is generated by the same two or three teeth in the rack cutter, so that uniform accuracy in the gear is obtained. The accurate rack shaped cutter is one of the outstanding advantages of the Maag system. It is much easier to produce than a curved cutter, which itself must be generated. Thus one source of inaccuracy is eliminated here. As only one cutter is required for each pitch, independent of the number of teeth in the gear, to produce theoretically correct profiles, only a small number of cutters are required to handle a wide range of gear problems.

Straight Sided Back Cutter

The difficulties of grinding and measuring correctly the curved surfaces on an ordinary cutter, are apparent. Fig. 3 shows three Maag cutters. The straight lines of the profile of the rack tooth cutter are ground after hardening.

Cuts and data through courtesy of Miles-Bement-Pond Co.

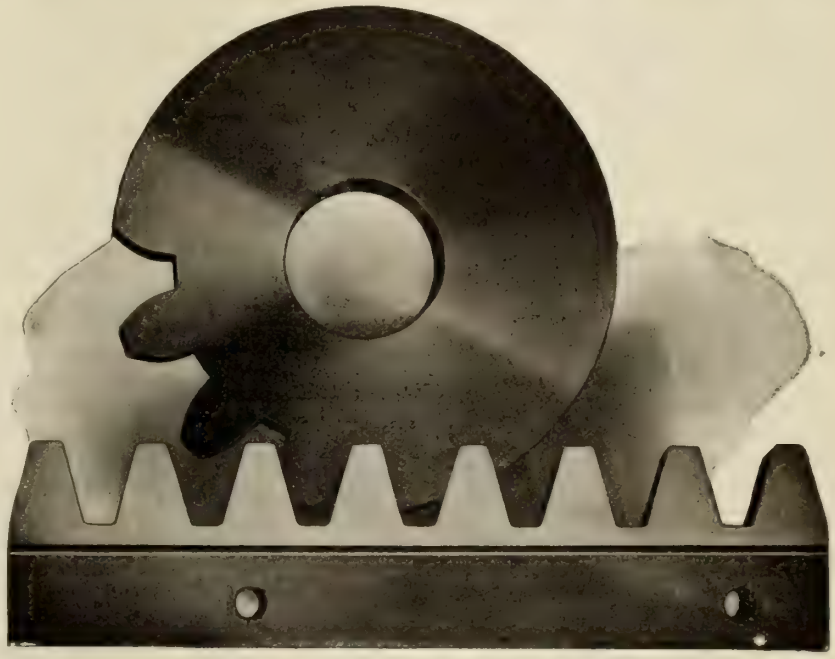


Fig. 2.—Maag gear being generated by a rack-shaped cutter.

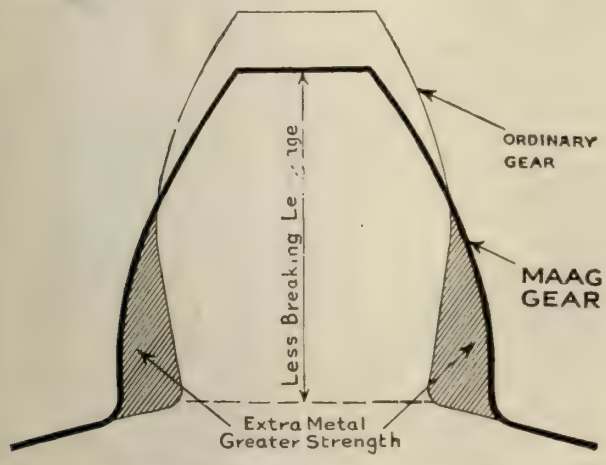


Fig. 1.—Maag gear profile superimposed on an ordinary gear profile.

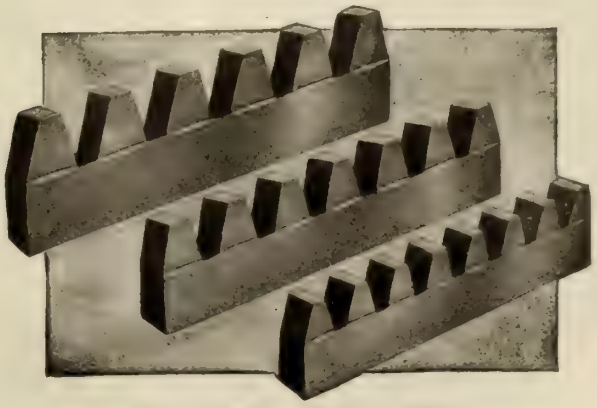


Fig. 5.—Maag rack shaped cutters.

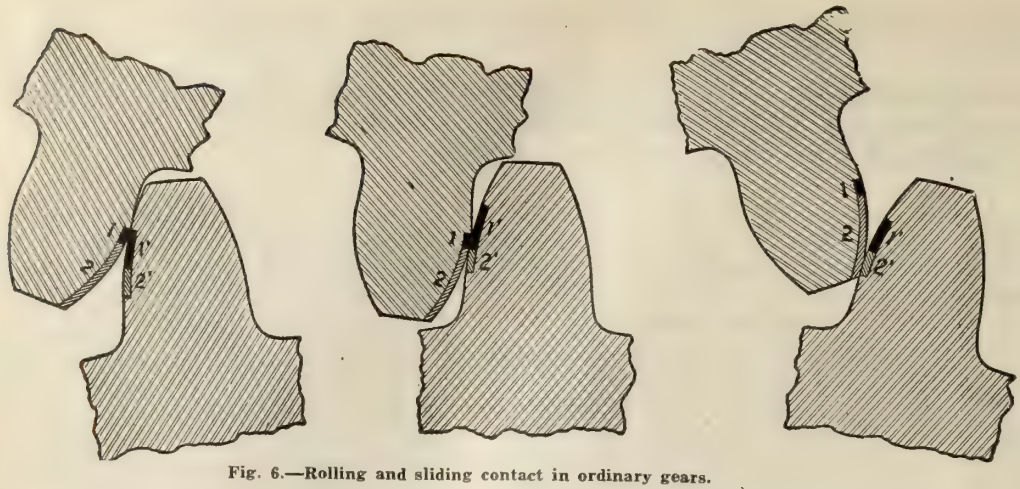


Fig. 6.—Rolling and sliding contact in ordinary gears.



Fig. 11.—Maag helical gears, 3 to 3.

Subsequent sharpening does not destroy the profile. The involute form of tooth that is generated by this form of cutter is smooth and theoretically correct.

The basic strength of the Maag form of tooth is shown graphically in Fig. 1. Both of the outlines shown are taken from 12 tooth pinions. At the base where the ordinary tooth is undercut the Maag tooth is widest. The difference in length is noticeable. The greater length of the ordinary tooth does not increase the working face of the tooth, but merely adds to the breaking levers on the base section. It is known among those who have studied gears carefully, that when teeth are stressed to their limit, they invariably break along the base line. Thus it is obvious that Maag gear design has strengthened the tooth at its weakest point.

Rolling vs. Sliding Motion

Rolling motion between gear teeth means quiet smooth operation. Sliding contact leads to friction, noise and wear. In the Maag gears, it is the rolling motion that is predominant. This is clearly illustrated in the Figs. 4 and 5. Fig. 4 shows two teeth of a standard drive, as frequently used in machine tools, cranes, etc., while Fig. 5 shows the same two teeth generated by the Maag method. In these diagrams the different parts of the tooth profiles which work together have been marked such as 1 and 1', 2 and 2', etc. If these portions were of equal length true rolling motion would be accomplished. The difference between the sections 1 and 1', 2 and 2' therefore represents the amount of sliding.

The Maag type of tooth more closely approaches the ideal condition. ratio of rolling to sliding contact in the Maag tooth, is nearly three times that in the ordinary type, which fact results in a reduction in noise and wear with a corresponding increase in life.

A further comparison of these diagrams shows other differences. In ordinary gears, the amount of tooth face that actually generates motion—the active profile—is only a portion of the whole profile. The rest is valueless as far as performing work is concerned. It will be seen that nearly the whole of the Maag tooth profile is active. This feature serves to better distribute the wear, giving long life to the gears. Grooves and ridges are not easily worn, and consequently the original tooth profile is preserved throughout the life of the gear with the quiet and smooth running features.

Uniform Speed Problem

The tooth outline of ordinary pinions having a small number of teeth, is modified to prevent interference. This modification of the true involute curve causes the pinion to drive with varying velocities, depending upon which part of the tooth is in contact. This varying velocity drive is one of the fundamental reasons for the noise and unsatisfactory service ordinary pinions give at high speeds. Maag gear teeth generated to the true involute form, drive with velocities practically uniform. Such advantages are extremely important in drives for paper machines, printing presses, and similar equipment where a varying velocity is extremely detrimental to the quality of the work produced.

In ordinary gear design, as the number of teeth in a pinion decreases, one of two expedients becomes necessary to avoid interference; either the teeth must be undercut, thus weakening them, or the involute curve must be altered, causing noise and rapid wear. To limit this faulty action, most engineers agree that 12 teeth is considered the limit, below which it is considered both unsafe and undesirable to go.

Strong-toothed Maag pinions can be produced wth 8 or 10 teeth, and in exceptional cases with even as few as five teeth. In accomplishing this, no sacrifice of those desirable features which distinguish the Maag gears with the larger number of teeth, is entailed. Thus this type of gear, offers to machine designers and gear users an increased freedom in the selection of gear drives, especially in regard to centre ditances, pitch, and number of teeth. Fig. 6 shows the comparison between the two types of gears, each with the smallest desirable number of teeth, as regards tooth strength.

Maag Spiral Gears

The Maag system of gears is reasonably flexible. It lends itself readily to the production of spiral gears. Practically any combination of numbers

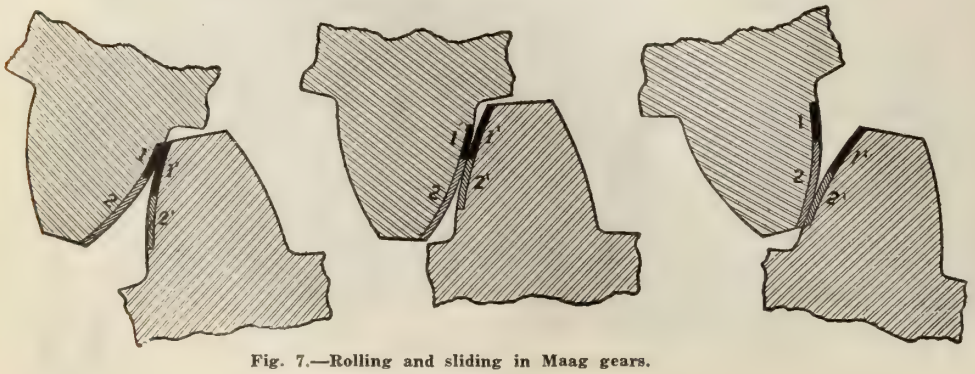


Fig. 7.—Rolling and sliding in Maag gears.



Fig. 12.—Maag spiral gears.

of teeth can be cut with standard cutters. The superior strength and other features of the Maag form of tooth are equally as advantageous in spiral as in spur gears. Maag spiral gears are used largely for timing gears and governor drives on internal combustion engines, on account of their accuracy. Fig. 7 shows a pair of Maag helical gears with a tooth ratio of three to three. Fig. 8 shows the valve shaft drive on an internal combustion engine, where Maag spiral gears are used.

Applied to Herringbone Gears

Maag herringbone and helical gears are planned and generated on the same type of machines and with the same cutters as spur gears. The ideal theoretical involute tooth profile is simply carried from the spur to the helical form. The most suitable gearing for a drive is selected, then these gears can be actually produced regardless of pitch or helical angle. Since any angle of helix can be cut without the necessity of special cutters, the angle that will produce an overlap of the teeth practically equal to the circular pitch (or the multiple of same) is determined and used in practically all cases. The resulting advantage is that with an even overlap, the length of engagement is always constant. This means that in Maag gears the load is always carried by the same total working length of teeth. In gears with an uneven overlap this is not the case. This uniform working length of teeth permits of quiet and smooth operation and also tends to add to the length of life of the gears.

The possibility of making correct pinions with a very low number of teeth, permits of designs that would be impossible with ordinary gears. Smaller centre distances can be often used to great advantage. Higher speed motors, in motor drives can be used, which often is a factor in materially reducing first costs of equipment.

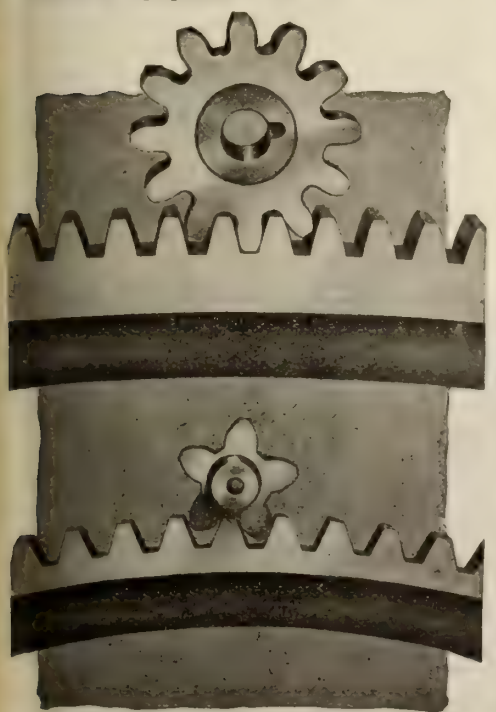


Fig. 9.—Standard 12-tooth pinion and a Maag 5-tooth pinion.

WHEN YOU CLOSE THE PLANT AT NIGHT—IS IT SAFE?

(Continued from page 24)

and handling of oils has been reduced to an exact science, so that there are now available means of handling gasoline as safely as spring water.

Special equipment has, also, been designed for handling each and every oil in a manner best suited from the standpoint of economy, convenience and safety. The up-to-date merchant to-day is taking advantage of these appliances, so that we may in confidence look forward to a time when fires caused by careless handling of oils will be unknown. This will be brought about by various causes. The instinct of self-preservation is strong with everybody, and all must realize the risk in the careless handling of explosives. The fact that these safety appliances conserve the efficiency of the products, preserve the quantity intact and enable losses to be turned into profits brings enormous pressure to bear upon the thoughtful man. Public opinion, national and state safety boards, will soon demand that every man will, at least, cease to menace his neighbor's property and his neighbor's life by unnecessarily lax methods in the handling of dangerous explosives.

Proper Storage Essential

The increasing prices of all kinds of oil and general economic requirements demand the proper storage and distribution of these liquids. Millions of dollars are lost annually due to the deterioration of the quality and waste in handling improperly stored oils. Hot and cut bearings, prematurely worn machinery are very frequently due to deteriorated or contaminated oil. This enormous loss is usually never traced to the right source—poor oil storage. The same criticism can be made of improperly stored paint oils, varnishes, dryers, etc. Competition in practically all lines demands economical production—that means elimination of waste so far as possible in every department of the industry.

Your oils, etc., can be checked in as they are received and accurately recorded as they are used. You can keep just as accurate account of your oils as you can of your tools. All railroads, mines or manufacturing institutions maintain stockrooms for the purpose of receiving and distributing all of the supplies used by the institution. This is considered absolutely necessary in order to reduce losses and to maintain a cost system. Money is invested in oils just the same as any other supplies, yet it is a known fact that in most institutions no record is maintained as to the quantities received or dispensed. The purchasing, storing and the distributing of lubricating and paint oils, gasoline, naphtha and other similar liquids is just as much a science and a part of the shop cost system as any other department.

Industrial plants of all kinds, especially railroads, are experimenting continually to learn how the cost of lubricating can be reduced and methods improved, forgetting apparently to investigate the oil house of the storeroom where the oils are stored and issued, the place where the percentage of loss is usually the greatest. The installation of a modern storage system for oils, etc., need not necessarily imply the outlay of large sums. We have found this "big investment" idea on the part of men in charge of industrial institutions has frequently prevented them from considering the purchase of equipment. It is not always necessary, or even advisable, to put in at one time all the equipment the management might feel would be needed ultimately.

Modern storage equipment for handling liquids is really divided into two general types. One for handling volatile liquids, such as gasoline, naphthas, paint oils and varnishes and the other for handling non-volatile liquids such as lubricating oils.

The first of the two general types requires underground storage tanks for gasoline or naphtha and above-ground storage for the paint oils and varnishes. This arrangement usually meets with the demands of the various laws governing this type of storage. Where underground tanks are required they should be cylindrical in design. If made of galvanized steel all seams and rivets should be carefully made and then soldered inside and out. If heavy metal is used such as three-sixteenths steel or heavier weights as conditions or the capacity of the tank may make necessary, then all seams and rivets should be carefully caulked. Storage tanks for volatile liquids require special care in construction.

If above-ground tanks are essential these are made in rectangular shapes, the height and length remaining constant and the width varying according to capacity desired. This arrangement permits the addition of other individual units to the system and does not destroy the uniformity of the battery of storage equipment. Rectangular tanks are made with the same care as the cylindrical designs.

Specially designed pumps of either measuring or non-measuring type are connected by pipe lines to tanks buried underground or inserted in the top of tanks for above-ground use. Accurate dives are prov'ded on the measuring pumps for the delivery of desired quantities of liquid. Gear driven meters may be added for the purpose of checking consumption. Locks are supplied on both types of tanks and on the pumps as well. This prevents unauthorized usage and theft. Where a battery of individual units is used barrel track and barrel drainers are used in connection with small chain hoists. This makes it very easy to handle the barrels and drain them comp'etely into the manhole of the tanks. This saves labor, time and liquid and prevents the loss of liquid due to the return of liquid in barrels which have not been properly drained by the old style spigot method. Dirt, dust and sediment are kept from the liquids, fire danger is entirely eliminated, valuable storage space is saved, labor is lessened, cost and consumption are easily arrived at.

Adjusting Vocational Training To Local Needs

Large Sum Appropriated for Promotion of Technical Education —Great Impetus Given to Movement—Branches of Activity to Which Program is Being Adjusted

SPEAKING about technical education in "Canada as a field for British industries," a writer remarks as follows:—"Another question affecting labour in Canada is that of technical education. In 1910 the Canadian Government appointed a royal commission which spent two years investigating technical education in North America and Europe, and prepared a definite programme for the development of this work in Canada. Industrial training or technical education as outlined in the report of the commission has for its aims: (1) preservation of health and the vigour of life; (2) the formation of good habits; (3) the development of the sense of responsibility and duty; (4) the preparation of the body, mind and spirit for following some useful occupation; (5) the cultivation of the mental powers, the acquisition of knowledge and the development of the scientific spirit with direct reference to the occupation; (6) the promotion of goodwill and desire and ability to co-operate with others; (7) the maintenance of standards and ideals; (8) as all-inclusive and ultimate, the perfecting of the human spirit, the improvement of the quality of life itself and the betterment of the conditions of labour, leisure and living.

The war prevented immediate action on the recommendations of the commission, but in July 1919 the Government passed the Technical Education Act by which a total of $10,000,000 is to be granted to the provinces during a period of ten years for the purposes of promoting technical education. This assistance has given a decided impetus to the work and every province is now building new technical schools. The total number operating in the Dominion in 1920 was 139, with an aggregate enrolment of 60,546 students.

Variety of Courses

These schools conduct courses in every branch of industrial and commercial occupation. Pre vocational classes prepare juniors for apprenticeship or for regular vocational courses. Part-time co-operative or continuation classes provide special instruction for apprentices and juvenile employees. Evening unit courses are provided for skilled and unskilled workers in all branches of industry who wish to prepare themselves for promotion. Vocational and technical day classes prepare students for employment in industry and for entrance into advanced classes in technical and commercial colleges and universities. Special courses are provided for women and girls. Correspondence courses in mining are conducted in British Columbia, Alberta, and Nova Scotia

The major lines of activity to which the vocational or technical education programme is being adjusted are; (1) wholesale and retail business, including importing and exporting; (2) banking, brokerage, and insurance; (3) metal products-hardware, machines and tools, automobiles, heating and ventilating equipment, electrical equipment, farm implements and machinery, steam power equipment—stationary, marine and locomotive—and railroad equipment; (4) wood products—buildings, furniture, pulp and paper, farm equipment vehicles, and automobile bodies; (5) mining—coal, gold, silver, copper, and nickel; (6) railroad operation—apprentices, shopmen, trainmen, enginemen, telegraphers; (7) marine engineering and navigation; (8) stationary steam engineering and steam power plant operation; (9) hydro-electric plants—transmission of electrical energy for lighting, heating, street and interurban electric railway purposes; (10) home-making and wage earning occupations for girls and women; (11) the skilled and semi-skilled trades; (12) agriculture; (13) municipal, provincial and federal civil services.

Vocational schools are controlled by advisory committees of the municipal boards of education, consisting of representatives of the board, employers and employees. The courses of study are organized to meet the needs of each community—industrial, agricultural, or whatever they may be—and new courses are added as occasion demands. The point of most significance to the manufacturer is that the advisory committee co-operates with local industries in providing the most beneficial type of instruction to all classes of workers.

GRAPHITE AS A LUBRICANT

It is well known among lubrication experts, but not by the average run of mill and factory officials, that the consistency of any grease or oil has to be suitable to the weight and rapidity of motion of different machine parts, a lightly constructed machine, such as a watch, requiring a very thin oil to enable it to run. On the other hand, a thin oil proves to be unsatisfactory for roll and pinion necks, as it is squeezed out by their weight before it can get in efficient work. Suet and water mixture is like a thin oil, it being very costly in the end as regards the length of time that rolls can be operated before they are thrown away in the scrap heap. Graphite works on an entirely different principle from oil, and it is the best lubricant of all for heavy machinery in rolling mills. Metals are never smooth.

PRODUCING FIREBOX STAYS ON THE AUTOMATIC

Many manufacturers have taken advantage of the quiet industrial period to develop improvement in existing equipment. Without making any outstanding alterations in design the Alfred Herbert Co., have by slight modifications and general tuning up, succeeded in obtaining marked increase of output on their automatic copper stay machine. The revised machine has reduced the production time per stay from 70 seconds to 42 seconds, an increase of well over 50 per cent.



Can Welfare Work Be Carried To Excess?

Should Football and Baseball be Played in the Noon Hour?—Do Card Games Create Bad Feeling Among the Workers?—Actual Experience in One Plant by Shop Superintendent

"LEE BLANK & Sons have decided to purchase several baseball outfits for their men to use in the noon hour this year." I remarked to a superintendent of 18 years' standing and his reply is well worth recording. In fact, the best way, is to let him speak for himself.

"So I notice—oh well, they will soon find out the folly of the new move. You know, I don't want you to think from my seemingly sarcastic remark, that I do not favor the worker, for I do. I was one of the boys myself several years ago, and when in that position, felt that the superintendent was a hanged old grouch, who wanted to grab off all the glory for himself. No doubt quite a few feel the same way about me but however—

"To explain why I don't agree with the use of baseball outfits in the noon hour, I'll have to still further back to the time we first started this so-called welfare work. Right off the bat, let me put myself on record as favoring all welfare work that doesn't smack of paternalism.

"What started us off on the noon hour period was this. We had a few employees who were good workers, but men who felt the bosses were scoundrels who could own automobiles simply through the profits made by the workers. Note carefully that the superintendent was not included as a working man. Unfortunately these men were kept under cover pretty well, and used the noon hour for their soap box oratory. We discharged the worst of them, but the seed of discontent was there, in spite of the fact that we knew we were paying high wages, treating the men right, and keeping the factory in good shape for them to work in.

"After some thought we built a rest room, and some card tables, and it was surprising how the men took to it—at first. Like some old woman's tea party, they soon bunched off in cliques, and unfortunately bitter rivalry developed. One particular case is well worth mentioning. We had an old man working for us, who was crippled. In fact we kept him, more through kindness, than for his usefulness. Well, old Dad, as we called him, was always given a place at one of the card tables, and although he was always the last to arrive at the table, he was sure of his place—until one day, I hired a new man, who while a good worker, was inclined to be a bully. Of course, I didn't know that when I hired him.

The first noon hour, this man spied the empty chair at the end of the table and plumped himself down into it. Someone remarked that Dad would soon be coming along, but Mr. Newcomer stuck. In a few minutes along came Dad, the boys explained the unwritten law, but with no effect. Rather than lose their card game, they started to play with the new arrival and old Dad went into discard. In fact he's there yet. I heard about it, went to the new man, explained the circumstances, and he came back at me to the effect he had as much right as Dad to play, which, although so fish, was perfectly true.

"The next trouble we ran up against was that the men got so interested in their card games, that they ate their dinner before noon, in bitefuls, and once the whistle blew, there was a rush for the time cards, then the playing cards. Soon, the keen rivalry became almost fighting, and in fact, had it not been that I made it a point of dropping in occasionally, trouble might have developed.

"Luckily, or unluckily, spring came along, and the open fields called the boys outside. Someone brought a football, and we erected goal posts for them. In fact I used to play football in my earlier days, and one day decided to go out kick a few myself. I wasn't long in the game before along comes the card table trouble maker, who had now established a name for himself as a roughneck. He was a semi-professional footballer, and better than all the rest there. Someone passed the ball to me, he charged, I went down in a heap, and after I got up, I went over to him and said, 'Look here Joe, have a heart. This isn't a final game for the cup you're playing. Play easy.'

"This paper is not fireproof and therefore cannot record his answer, and had it not been that the move would have been put down to spite work, he would have been minus a job right then. However, I do not believe in holding a grudge and his work was satisfactory inside the plant, so he stayed on.

"My experience was duplicated many times by others, and before long, very few cared to go out on the football field with this man as he was so rough.

"Next came the baseball and without entering details, the same trouble occurred. In this case he wasn't the only rough one, and dirty tactics crept in. From this recital one might gather the impression we were a rough bunch, but such was not the case, previous to the sporting ? spirit.

"The lost time after the noon games was awful. The men got so that they paid little attention to the warning whistle, and would come running in on the last minute, punching their clock, and gasping for breath at the same time. Of course it took at least an hour before they could produce at anything like normal, and I had quite a time preventing them discussing at length the events of the noon hour.

"Since then, we have discouraged the freedom before allowed. The men still have their rest room, but if they play baseball, they MUST be in on time, and if they come in all heated up and exhausted they are told about it plainly. In other words, we were forced in no uncertain manner to put the men in their proper place. Who is to blame for this condition? Surely not the firm. They tried to give the men all the freedom possible, but a few spoiled it for everybody. This holds good for practically every factory. There are always a few who spoil it for the rest, by overdoing it, and until the end of the world we can expect this condition to remain.

"We are not unfair to the workers, far from it, but they must toe the mark, thanks to themselves. Some say I am pretty strict, but none can say I am unfair. Mr. Bully is still with us, but much subdued. He knows where the door is, and that he would walk out of it without a job if he showed any signs of insubordination. What does all this mean? Does it infer that welfare work is useless? To my mind,—'No,' but it does show that one must step warily, otherwise the workers will walk all over you. We hope to install a cafeteria shortly, and this, with our rest room, will be sufficient welfare activities for us."

REDUCING BEARING FRICTION

The proper lubrication of all bearings, whether they are roll necks or engine slides, seems not to be so well understood by the average run of superintendents as might be the case, as many seem to think that all that is necessary is to supply the machine with grease or oil and let it go at that, the men accepting all wear on journals as an evil which cannot be avoided. It is true that wear on any bearing and journal cannot be prevented, but it is also true that it can be minimized to the lowest possible extent by using the right type of lubricant for differing sets of working conditions among various classes of machinery.

It has been stated that a busy blooming screw-down motor, which raises and lowers the top roll of a blooming mill, is sometimes called upon to reverse as many as 22,000 times in 24 hours. This works out at more than 15 times per minute throughout the entire period, and makes it clear that the necessity for starting and stopping very quickly is a paramount consideration in its design and operation.

Practical Ideas for Shop Executives

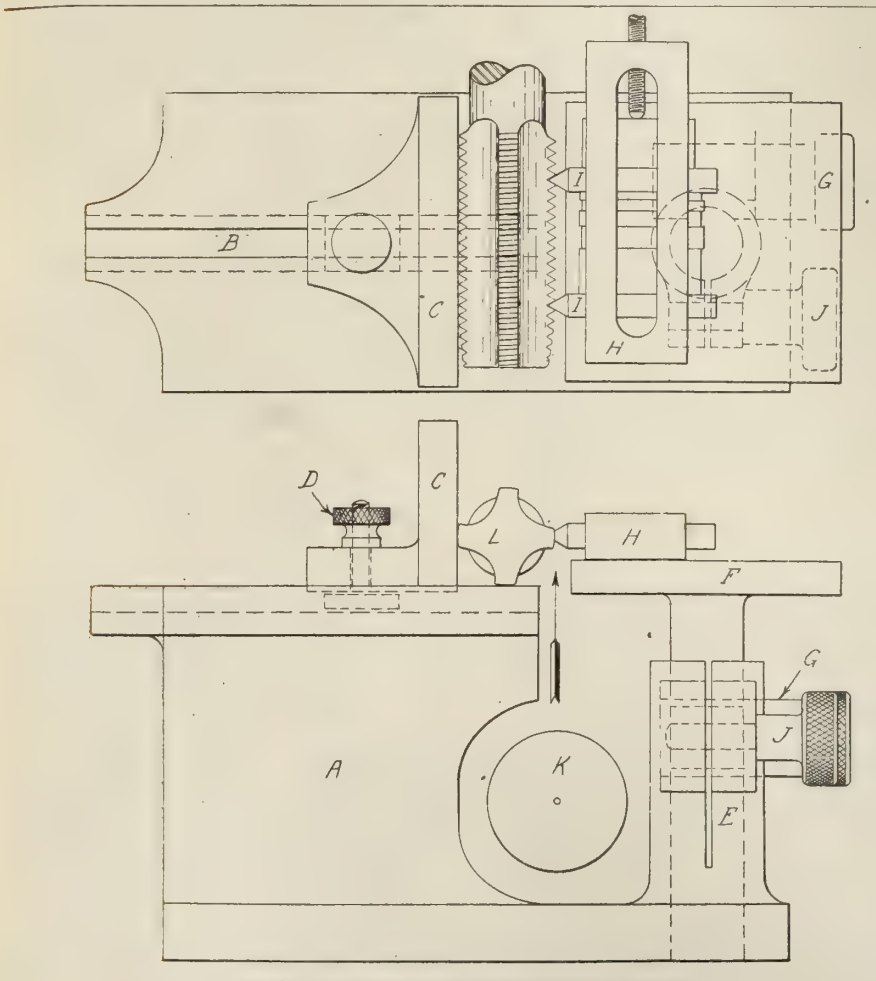
THREAD TESTING DEVICE

By Cecil H. Smith

The accompanying sketch illustrates a device constructed by the writer to facilitate the gauging of screw threads on taps and gauges. It is used in connection with precision gauging blocks.

It is much easier to detect the error in thread heads than to correct them. The object of the apparatus here shown is to enable the operator to locate the error with the least inconvenience. The device consists of a base, A, provided with a wide top surface in which is located the groove, B, along which the angle block, C, can be moved to any desired position and locked by means of the knurled D. The long dove-tailed head of this clamping bolt does not bear on the lower portion of the block, but on the beveled edges of the groove B. On the right hand end of the base is a post, E, split as shown for clamping the piece F, at the desired height. The movement of this piece is obtained by the knurled portion, G, the inner end of which is a pinion acting in a rack on the cylindrical section of piece, F. H. is the frame that carries the gauging centres I I. An ordinary electric light globe (shaded with light paper) is placed at K to direct the illumination upwards, so that it is easy for the operator to determine the error in lead.

The pieces I are ⅜in. dia., so that, when selecting blocks for testing the head, it is only necessary to select those that will give a measurement ⅜in. less than that to be tested. To gauge one and one-half inches of thread, seven threads per inch. Include 10 threads in the test which is 1.4286in. Subtracting .375in. the dimension required would be 1.0536in. After a little practice slight errors can be determined very closely.

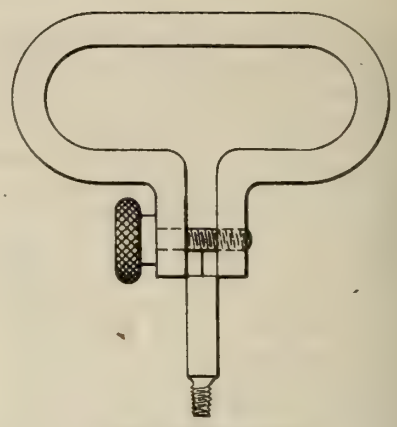


Device to facilitate the gauging of screw threads.

TAP SAVING WRENCH

By Harry Moore

The wrench shown at Fig. 4 is advanced not so much as a time saver as a tap saver. It is intended to be used as a wrench for the smaller taps which break very easily when held in the wrench usually furnished; which may be a good wrench for the larger sizes, but which allows perhaps a little too much leverage for the smaller taps. As the squares of these taps are usually made one size regardless of the diameter of thread, very little adjustment is required in the wrench, only enough in fact to release it when the screw is loosened. As shown here a piece of ¼ rod is bent to form a handle, the two ends being brought together after slightly flattening the inside faces and cutting a shallow V. A knurled screw is used to spring the ends together sufficiently to hold the tap in place. With a holder like this the "feel" is very sensitive and the user can tell at once when the strain on the tap is becoming too dangerously near the breaking point.



A tap saving wrench.

ATTACHING PUNCHES TO HOLDERS

By F. Scriber

It frequently happens that in punch and die construction an insufficient amount of attention is given to the proper method of fastening the punches in position on the holders. They are frequently held in place by screws in such a manner that the screws will jar loose, with the result that the punches fall down and are broken, necessitating expensive repairs for which no one apparently is to blame. Another source of trouble is that the punches are put in place in such a manner that they are difficult to remove when replacement becomes necessary. The object of the accompanying illustrations is to show a few simple methods of attaching punches, and an attempt will be made to point out essential differences which make some methods more substantial than others.

Referring to Fig. 1 the view at the left shows a punch, A, which has a shoulder and a reduced shank, B; this is held in a steel plate, C, the upper end of the shank being headed over so that it is securely held in place when withdrawn through the stock which it perforates. The plate, C, is attached to the main por-

tion of the punch holder by means of screws and dowels not shown. This punch requires quite a little machine work to make and can hardly be considered as good construction as that shown to the right of Fig. 1. This punch, D, has a head, E, at its upper end, it is simply made a drive fit in the plate, F; the large head prevents it being pulled out of the plate when it is being stripped from the stock punched and its large head also provides a greater bearing surface, so that it may better withstand the end thrust of punching. Both of these examples show round punches.

In Fig. 2 are shown two examples of methods of holding rectangular shaped punches in place. At the right of this illustration the punch, A, is simply held in the holder by means of a set screw, B; it is almost impossible to keep this set screw tight enough so that the punch will not fall out by the continual jar incidental to punch press operation. This can be readily comprehended when we stop to consider that an ordinary punch press will make about sixty strokes a minute. At the left is shown a similar punch which is held in place by means of two straps, C. The punch, D, is notched at its upper sides to form a tee slot and the straps are screwed to the punch holder thus clamping the punch securely in place. At the left of Fig. 3 is shown a punch, A, dovetailed into a holder, B, a set screw, C, coming against a gib, D, securely holds this in position, and while more expensive than the last method, if well made, is very serviceable and although the screw may loosen slightly the punch will not fall down. It may work sideways if not prevented in some manner, such as for instance, by using a dowel pin of slight depth, E. At the right of Fig. 3 is shown a punch, F, which has flanges formed integral therewith; this is held in position by means of screws and dowels in the manner shown, a groove being cut in the punch holder, G, to receive the same. This is a very substantial anchorage. In Fig. 4 is shown a punch holder which contains three punches all of which are held in place by interlocking tee slots. This punch holder, A, has a groove cut in it for a depth equal to B. The centre punch C, has grooves cut in at X. The end punch, D, has flanges on it and between this punch and the centre punch is a strap, E. To the extreme left is a round punch, F, and this is contained in a carrier, G, which is flanged. A strap H, completes this arrangement together with screws and the necessary dowels (not shown). It will be noticed that in making these units interlock with each other the whole becomes held in such a manner that one punch cannot pull away without the entire arrangement loosening up.

It should hardly be necessary to mention that whenever any particular die carries an excessive repair cost through breakage, that careful attention should be given to the points brought out in the foregoing as a good deal of die trouble can be traced directly to the loosening up of the various units used in their construction. This pertains not only to the punch and holding means but also the die construction.

There are practically no metals in commercial service that cannot be successfully welded by the oxy-acetylene torch, if the proper filling metal and manipulation of rod and blowpipe are employed.

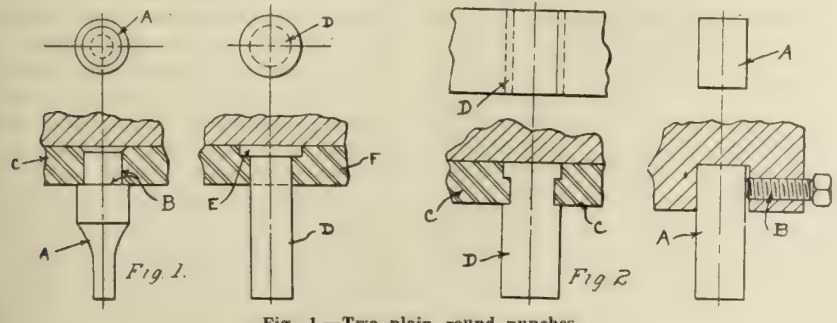


Fig. 1.—Two plain round punches.
Fig. 2.—Punch held in T-slot, and plain type.

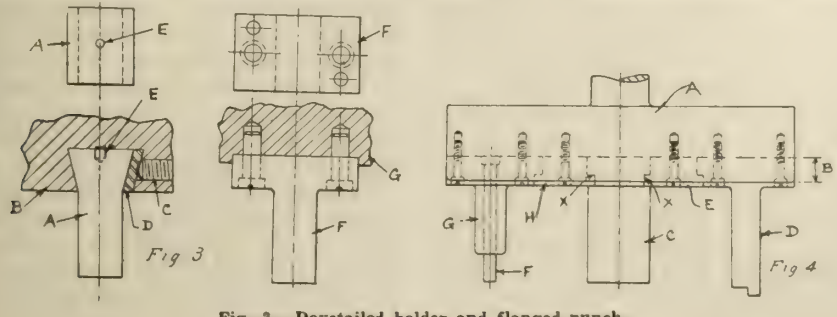
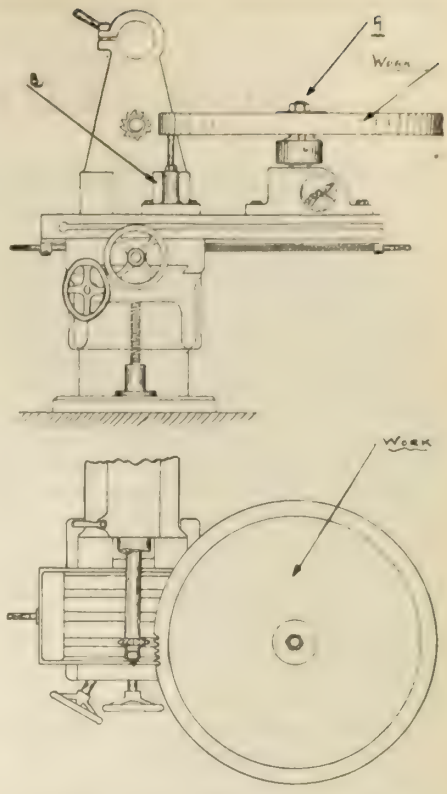


Fig. 3.—Dovetailed holder and flanged punch.
Fig. 4.—Punch holder with group of punches.



Cutting a large gear on a small miller.

CUTTING A LARGE GEAR ON A SMALL MILLER

By G. Blake

The cutting of a large spur gear does not present any difficulties if one has a machine with a wide range, but on the other hand where there are only limited facilities, the machining of large gears becomes a real problem. Our problem was to cut a spur gear, 148 teeth, 5 diametrical pitch, 30 inches diameter, 2¼ inch face. The only equipment suitable was an ordinary horizontal miller and a universal dividing head 7 inch centres. As the maximum distance from the milling machine table (when lowered to its limit) was 20 inches from top of milling table to centre of cutter arbor, to cut the gear on a mandril held between centres on the dividing head was impossible, so other means had to be adopted. The dividing head was tilted (see sketch) so that the spindle nose was vertical instead of horizontal. A stud A was made to fit the bore of the gear, having a shoulder to register the boss on and turned down on the other end to be gripped in the 3 jaw chuck on the dividing head. Next, to support the gear whilst being cut, a small jack B was used to take the downwards thrust of the cutter. The sketch shows the arm and arbor support removed so that a better view can be obtained of the method, the cutter was fed in to the required depth and then to traverse across the face of the gear, the operator raised the knee of the milling machine slowly by hand. In the manner described we solved the problem and the writer passes it on in the hope that it may help others in a similar difficulty.

New Things in Shop Equipment

GAP TURRET LATHE

A 20 in. turret lathe, the bed of which is equipped with a gap, has recently been placed on the market. The lathe has all the regular dimensions of the standard 20 in. turret lathe manufactured by the firm. The gap provides for a maximum swing over the bed of 28 ins. The length of the gap from the face of the chuck is 9-1/8 ins. The machine is regularly equipped with an air chuck, power feed for the cross travel of the cutoff rest, and power feed for the longitudinal feed of the turret. Special feeds and accessory fittings can be provided on special orders. The machine is manufactured by the Cincinnati Acme Machine Tool Co. of Cincinnati, Ohio.

OFFSET DRILLING AND MILLING ATTACHMENT

There has been recently developed and marketed, an offset drilling attachment for work where a very small clearance space is available. The tool is intended especially for drilling, milling, countersinking, and counterboring port holes and grooves in the cylinders of air-driven tools such as drills, hammers, and riveters. It is made to reach into the main bore and drill or mill the vents or ports from the inside. It may be used to drill or mill to a specified depth, to counterbore, or to mill circular, transverse, or longitudinal slots. It has, of course, other applications such as machining oil grooves, keyways or splines. Owing to the small space and comparatively long overhang with which these tools must work, practically no clearance space is allowed; and the offset or horizontal arm is as large as the bore of the air chamber and the depth of drilling or milling will permit. Both the power transmission parts and the offset arm are made of tool steel heat-treated, ground and lapped. The clearance space inside the arm is very small, so as to add to the strength of the arm. Drills, mills, and counterbores, having special shanks ground and lapped to fit the spindle in the outer end of the arm, are used. They may be easily changed and have a limited adjustment for depth to allow for grinding and setting. The attachment has a wide variety of uses and can be fitted to a large range of machines. It is manufactured by the H. G. Harris Engineering Co. of Bridgeport, Conn.

AUTOMATIC CYLINDRICAL GRINDING MACHINE

Recently there has been placed on the market an automatic cylindrical grinding machine that is intended for grinding cylindrical parts held on centres, and having diameters larger than ½ in. It is a fully automatic plain grinding machine. The principal features are the simplicity of construction and the speed of operation. It is adapted particularly to grinding shafts, bolts, valve tappets, piston pins, and similar work. The maximum length of the grind is six inches, while work up to ten inches can be held between centres. If desired it can be arranged to hold work in draw-in chucks. The machine weighs about 7,000 pounds, which fact is stated to assist materially in performing operations with smoothness and accuracy. The grinding wheel is 18 in. in dia., and can be used in faces up to six inches. Forced lubrication is furnished to all bearings. The machine is entirely self contained and power is furnished by a 15 h.p. motor through a 4-1/2 in. belt. Alternative drives of a cone pulley and countershaft, or a constant speed pulley, can be furnished. The machine controls are accessible to the operator and if necessary one operator can take care of four machines. The automatic operation enables production at high speed to be maintained. It is claimed that on piston pins 7/8 in. in diameter, and 3-1/4 in. long a production rate of five per minute can be maintained. It is further claimed that the machine requires less time to be set up for an operation than would be ordinarily required by an automatic screw machine. It is manufactured and marketed by the Warren F. Fraser Co. of Westboro, Mass.

PORTABLE MOTOR-DRIVEN GEARED-HEAD LATHE

A very novel form of engine lathe has recently been offered on the market. The novel feature consists of the fact that it is a real rugged machine, in the heavy duty class, having swings of 18-1/4 in. and 20-1/4 in., being built in two sizes. The headstock is supported by what we would describe as a cabinet leg. This leg does not touch the floor. It is supported by two truck wheels mounted on gudgeons extending from the side of the leg. Instead of a leg under the tail stock end there is a single truck wheel mounted on a swivelling device to which is attached a regular truck tongue with a tee end. In the cabinet leg under the headstock an 1,800 r.p.m. motor is located. The power is conveyed to the all geared head through the medium of a belt, fully covered by metal guards. In other general respects the lathe resembles a well built standard machine of the stationary type. The headstock provides sixteen spindle speeds in almost geometrical progression, with the use of only ten gears, all of which are heat treated. The headstock housing forms an oil-tight case for all running parts. The spindle is hardened and runs in phosphor-bronze bearings. All other shafts in the headstock run on ball bearings. The spindle nose has two diameters, one in front and one behind the threads, so as to give firm bearing surfaces to the face and chuck plates. The forward and reverse motion is obtained through friction clutches running in oil. The control handles for the reversing mechanism are located both at the apron and at the head end of the lathe, so as to be always within convenient reach. The clutches require no adjustment, and are capable of carrying a slightly heavier load than the work will require. The starting-box for the motor is mounted on top of the headstock. The lathe has a standard set of quick-change gears, locking device for tail stock spindle, and a rod and screw shift. The mounting of the motor does not increase the width of the machine, so that the machine can be moved through very narrow isles. The manufacturers are the Lehmann Machine Co. of St. Louis, Mo.

DRILL AND TAP CRIB GAUGE

Recently there has been placed on the market the "One-Glance" drill and tap crib and gauge. The device consists chiefly of a small drill crib with a drill gauge built into it. The entire crib is 41 in long by 9¾ in. wide, and contains sixty semicircular pockets 1¼ in. wide. The pockets in the lower row are 4⅛ in. long, and are intended to hold drills from Nos. 1 to 30. The upper pockets are 2-15/16 in. long and hold drills from Nos. 31 to 60. The holes for the drill gauges are located just at the ends of the pockets in hardened steel strips. These strips are inserted in the wood of the frame, in which heavy type numerals give the number of the drill required to fit each hole, as well as the drill diameter in decimals. Since the figures are ¼ in. in height, they should be readable at a distance of eight feet. The taps are placed perpendicularly in holes in the member dividing the upper and lower pockets. Holes are provided to hold three taps of each size from 14-20 to 4-36. Each set of taps is adjacent to the correct drill to use in drilling the hole for it, in order to tap a full thread. A red line extending along the board indicates the largest size of drill that could be used. It is thus possible to select a drill for either half, three-quarters, or full thread. It is unnecessary to refer to tables in order to find the necessary drill for each case, as the relation between the sizes of the drills and the taps can be observed, by noting

the relative positions of the tools in the crib. The holes for gauging the taps are drilled to the proper size, so that a larger tap than the required size cannot be placed in it, while a smaller one will fall through the board. It is thus possible for the workman to pick out the correct size of tap merely by knowing its proper position on the board. Besides serving as a container for taps and drills, the board may be used as a ready reference table of drill sizes. The board holding the pockets is carried on trunions by two posts mounted as a base, so that the whole unit is easily portable. Due to the fact that the trunions are tightly pinched in the brackets of the posts, the tray may be tilted to an angular position, and will remain so fixed. The base can be attached to the wall, so that bench and floor space can be saved. The equipment is manufactured by the Victor R. Lawson Co. of Boston, Mass.

SPEED LATHE WITH A. C. MOTOR HEAD-STOCK

There has recently been placed on the market a 12 in. swing speed lathe for bench mounting. The lathe is intended largely for wood turning in training schools and for pattern work. The manufacturers suggest that the lathe be mounted on a bench, which in reality is a chest of drawers, which extend right down to the floor, resting on legs that are only an inch or two in height. A half horsepower motor is mounted directly on the spindle of the lathe, and the motor housing is the head-stock. The 45-carbon steel spindle has a ⅝ in. hole throughout its entire length. A No. 2 Morse taper accomodates the center point. The nose of the spindle is 1⅛ in. in diameter and has V-threads, ten to the inch. On the outside end (left hand end) of the face plate a combination 8 in. pulley and face plate is mounted. This face plate can swing work larger than that which will pass over the shears. The pulley may be employed for belting the motor to auxiliary equipment. The spindle is provided with S. K.F. radial and thrust ball bearings carcied in dust-proof housings. The motor is fully enclosed. The bed is equipped with flat ways, and can be supplied in 4, 5, or 6 ft. lengths. The maximum distance between centres for the above lengths of bed are 25, 37, and 49 in. respectively. Short legs for bench use are ordinarily supplied, but long legs for supporting the lathe from the floor can be supplied. The bed is widened out under the headstock to accomodate the controller. A casting bolted to the headstock leg and to the lower part of the bed serves to fully enclose and protect the starting device. The a. c. motor is of the variable speed type. Speed changes are obtained by manipulating a handle on the front of the bed under the headstock. Four speeds are provided, name'y 575, 1,160, 1,750, and 3,450 r.p.m. The wiring between the motor and controller is fully enclosed. A tailstock, fitted with an adjustable spindle and a device for clamping it to the bed, is provided. The rest holder is clamped by means of a single handle. Each lathe is equipped with a spur and a cup centre, three T-rests, a 5½ in. faceplate, a 3 in. screw chuck, a knock-out rod for the head centre, and one right angled rest. Additional equipment may be furnished to special order. The lathe is manufactured by the J. G. Blount Co. of Everett, Mass.

SMALL ENGINE LATHES

A line of engine lathes suitable for tool rooms and automotive service stations has recently been placed on the market. There are three sizes, namely 13 in., 14 in., and 16 in. swings. The 13 in. size has semi-quick change gears, and a single back gear. It swings over the shears 13¼ in. and over the carriage 8 in. The 14 in. lathe can be equipped with single or double back gears, has quick-change gears, and swings 14¼ in. over the shears, and 10⅝ in. over the carriage. The 16 in. size has double back gears, quick-change gears, a cabinet leg under the headstock, and a swing of 16¼ in. over the shears, and 11⅜ over the carriage. A three step cone with countershaft is the regular design. Bowl headstocks are employed, and the gears are fully enclosed. The spindles are made from high carbon steel. The 14 in. lathe has a hole of 1¼ in. throughout its length. The spindle bearings are phosphor bronze. The tail stock is of the offset design to permit the compound rest to be swung around parallel to the ways. Provision for setting over the tail stock has been made so that tapers can be turned.

The quick change gears permit of cutting all standard and odd threads from 3 to 64 per inch, either right or left hand. Sliding gears are employed in the gear box. On the 13 in. semi-quick-change lathe, three changes of feed are provided by shifting a lever. Additional changes are made by means of removable change gears. A reversing lever for the feed is provided on the apron, as well as an interlocking device to prevent two feeds being engaged simultaneously. The carriage can be securely clamped to the shears for facing operations. There are both front and back gibs to the carriage. Taper gibs are used on the cross slide and the compound rest.

Standard equipment for the lathe is; —large and small faceplates, chuck plate, steady rest, follow rest, double friction countershaft, centres, wrenches, and a thread indicator. Other special attachments such as those for milling and keyway cutting, taper turning, and increasing the swing, can be furnished. The two large sizes when equipped with a 6 ft. bed can swing between centres 39 in. With a 5½ ft. bed the 13 in. lathe weighs 1,300 pounds. The 14 in. lathe with a 6 ft. bed weighs 1,700 pounds. The 16 in. lathe with an 8 ft. bed weighs 2,100 pounds. The lathes are manufactured by the Carroll and Jamieson Machine Tool Co. of Batavia, Ohio.

ALL GEARED HEAD ENGINE LATHE

A new design of electrically driven engine lathe has been placed on the market recently. Among the new features, is the one of having all the gears in the head, in mesh, constantly, the various speeds being obtained through the medium of levers on the head stock. The range of speeds consists of twelve, ranging from 9 to 350 r. p. m. The lathe is driven by a motor attached to a base-plate on the back of the single cabinet leg supporting the head stock end. This motor is belt connected to a constant speed pulley on the head stock. The drive from the pulley to the headstock is through a friction clutch.

The spindle is a heat-treated, chrome-nickel, steel, hammered, forging. The head stock is fully enclosed. The top cover of the head-stock has a removable plug which permits of ease in filling with oil, as all the gears in the headstock run in oil. A gauge glass indicates the height of the oil at all times. The lathe can be arranged to cut threads from 2 to 56. All studs in the apron have a bearing at each end, as the apron design is of the double plate type. All feeds are reversible, and the various mechanisms are so arranged that the longitudinal and cross feeds cannot be engaged while cutting threads. The head-st ck control lever is located at the right hand end of the apron, sliding on a control rod. The head-stock spindle is stopped, started, and reversed by this lever. A second lever mounted on the control rod but at the left-hand end of the apr n functions in a similar manner. The tail-stock is of the offset type, permitting the compound rest to swivel around parallel to the ways of the lathe. The tail-spindle is also made of chrome-nickel steel and is hardened and ground. A side adjustment for taper turning is provided. A constant speed motor, from three to five h. p., with a maximum speed of 1,160 r. p. m., is recommended. Some of the principal dimensions are:— actual swing over bed, 19½ in.; swing over carriage, 13¼ in.; diameter of hole in head-stock spindle 1½ in.; distance between the V's of the carriage, 14 in.; and the distance between centres on a lathe having an eight food bed is 4 ft. 2 in. The weight of the lathe with an eight foot bed is 4.75 pounds. The manufacturers are the Boye and Emmes Machine Tool Co., of Cincinnati, O.

Major Frank Williams, representing Holman Brothers' Ltd., of Camborne, Eng., has arrived in Canada and will work in co-operation with the Alfred Herbert Co. who are Holman Brothers' agents in this country. Major Williams will devote his time exclusively in developing sales on mining equipment of all kinds, such as hoisting engines, derricks, rock drills, crushers, etc.

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The Noon Hour Problem

ON PAGE 29 of this issue appears an article dealing with the noon hour danger. It is a well known fact that the noon hour of practically every plant, is the period when men get together for a smoke and a chat. Almost every factory has at least one disgruntled employee and often this one man spreads discontent, and stirs up a harmonious staff into a dissatisfied crowd. Several ideas have been tried, some with great success, while other factories, using the same successful idea adopted in one plant have been bitterly disappointed when they tried to apply it to their own. It is another case of one man's meat is another man's poison.

The article appearing on page 29 is by a shop superintendent of 18 years experience, and is based on fact, not theory. For this reason, it is worthy of special consideration, and although it may not apply directly to your factory, it will at least provide food for thought.

It seems to us that any noon hour games should either be of such character that overheating would not occur or if baseball *is* played, the men should realize that it is not a championship game they are playing, but merely something to break the day's routine. The best solution is to eliminate baseball or football for even standing in the sun is exhausting in hot weather.

The value of the cafeteria is unquestioned, for if run on a no-profit basis, the workers can get pure food at low cost, this making for good health and contentment. Card games, checkers, and other games where over-exertion is not necessary, are good things to provide, but the moment that bad feelings and bitter rivalry creeps in, let it be understood that the games will be stopped if the trouble continues. It seems to us that this would have solved the difficulty mentioned in the other article.

Good music is very desirable, and several have found that this helps to solve the noon hour problem. Some use gramaphones, while others again gather an orchestra together from the staff, allowing them a reasonable time off for practice. Concerts are held at noon, and we have visited several of these entertainments and enjoyed them thoroughly.

Comfortable rest rooms are also very desirable, but one point the superintendent seems to have overlooked in his article is the value of good books. Note that we say good books, not the usual trash. Not that they should be all business books, but when fiction is included, be sure of the author. Several firms have now installed libraries, and while skeptical at first, as to whether their employees would read such high class literature or not, they have, without exception, been agreeably surprised. The only reason the workers did not read such books before, was their inablity to afford them. Good books soothe the mind, make for contentment, and stir up the seeds of ambition. The noon hour problem is nearer solution to-day than it ever was, but the secret does not lie out on the athletic field, but in the comforts of an easy chair, good music, and a good book.

Eliminate the Danger

STORING and handling oils is a dangerous task, and should be treated as such. Instead, we find many plants content to stick their room off in some dark corner, trusting to luck that nothing will happen. Constant handling without disaster is pointed to by some as ample proof that oils are not dangerous, but the folly of this belief is shown clearly in the article appearing on another page of this issue.

It tells of a case where gasoline fumes were carried outside to a lighted lamp 30 ft. away from the building, taking fire and flashing back, the result being, the structure was entirely consumed. In spite of this fact, we find many concerns, with their entire capital invested in a business, giving little thought to their oil room, which perhaps is their greatest danger point.

Luckily, all plants are not alike, for we viewed a splendid installation recently, where oils and paints were stored in an excellent fireproof manner. Even where used in another form, an arrangement was provided whereby, should the material catch fire, it would be extinguished within two minutes. Should the extinguisher fail to function, they had still another safety device, which would automatically let the unignited liquid run outdoors. This firm realized the danger, and knew that once they let a fire get beyond their control, their complete factory would be doomed. It pays to play safe when handling oils, and if you have not yet provided for proper storage, there is still time, but there won't be—after the fire.

* * * *

Link Up Your Efforts

WHILE passing through an Ontario manufacturing plant recently, we were much impressed with the care taken to check up parts going through the factory. The inspection system was simple, but thorough, and the method of watching costs, arranging for jigs and fixtures, etc., had been well thought out. The manager of this plant knew exactly the cost of his product, what it took to sell the goods, and knew even to a fraction of a cent, the profit made. He had eliminated guess work, with the result that while several plants in his locality were operating on part time, his factory was employing a full staff and running right up to record business.

In these days of keen competition the importance of keeping close tab on costs is further emphasized, and if a plant manager hopes for success he must stop groping around in the dark. After a cost system has been installed and is working smoothly, use it to discover if operation costs as shown on cards can be reduced. Make a point to have the plant superintendent constantly on the lookout for better manufacturing methods. In the plant we first referred to the superintendent is a live wire, eager to discover new methods, and in several cases, without purchasing any additional equipment, he has reduced the operation cost as much as one fourth of the original figure. This means a considerable saving, but he accomplished the result through constant study of the task on hand. Link up the efforts of the factory and office, show the superintendent where you believe the operating costs are too high, and in many cases even this hint alone will bring forth surprising results.

Improved Buying Develops in Many Lines

Increased Sales of Pig Iron and Steel Commodities—Small Supplies Moving Freely—Strike Not Yet Seriously Affecting Production of Steel—Prices Likely to Advance

CUSTOMERS SHOWING INCREASED INTEREST

WHILE nothing of outstanding importance has developed in Canadian markets, there is a hopeful note sounding in many lines of industry. The strength that was reported in the iron and steel section last week continues to retain the interest of dealers, and this also is true in other branches of metal working activities. The advance in bars recently recorded in the States has not yet been felt on the local market, as dealers here follow the lead of the Canadian mills, and so far, these have not advanced quotations no commercial products. With U. S. mill prices higher, the difference in exchange works to the advantage of Canadian dealers and the ultimate price to consumers here remains virtually the same.

No change is noted in the general condition of the non-ferrous metal situation, but the undertone is improved as a result of the better inquiry of the past week. There is a feeling that consumers are showing a little anxiety regarding the future and may desire to protect themselves against a possible advance caused by curtailed output.

Pig iron is the one local commodity that has been directly influenced by existing conditions. Canadian producers report a heavy demand for pig and believe it is caused by the fear that the next few months may result in the closing of some of the smelters owing to the shortage of coke.

The movement of machine tools remains at a low level, dealers stating that an occasional sale is made, but that little big business is in prospect. The encouraging factor in this line is in small supplies and reports indicate that the volume of sales are not only held, but in many instances gradual improvement is shown.

In old materials the market continues unchanged, with prices firm and demand light. Dealers are encouraged, however, by the better movement in commercial materials and feel that this will eventually influence the buying of scrap.

The coal strike is the main influencing factor in respect to developing conditions in the steel and metal industries, and while no serious effect is yet noted, the passage of time and gradual depletion of raw material supplies, may create a condition that will require some able handling to prevent a tie-up throughout the entire country.

Dealers and merchants in this district are encouraged by the better volume of business that is in sight for the near future.

Toronto

April 26

EVERY indication points to a steady improvement in all lines of industry. While much of this results from seasonal demand there exists a belief in many minds that the better business is of a permanent character and that the summer will continue to show the gradual return to a more normal condition in all branches of trade. With few exceptions the reports are of an encouraging nature.

Iron and Steel.—The improved demand that was reported last week in iron and steel markets continues to feature the situation this week. Consumers are buying more freely, and while many are doubtless protecting their stocks against the possibilities of the future, the fact is impressed on many dealers that a steady increase is taking place on the present actual consumption of iron and steel commodities. Sales show that the demand does not come from any particular industry, but the range is wide and distribution of such a character as to indicate slow but gradual improvement in almost every trade. Construction material is moving freely and likewise the gauge sizes of sheets and plates.

While no pronounced anxiety is shown in local circles regarding the coal strike in the States, there is considerable interest manifest in the possible duration of the strike. The stocks on hand, together with present production, is sufficient to take care of all requirements for a couple of months, although some manufacturers are taking steps to regulate the consumption of available coal supplies. Should no settlement appear possible at the end of a couple of months, the situation will take a more serious turn and the restriction of production of basic metals will effect the manufacture of semi-finished and finished lines, and this will doubtless be reflected in higher quotations in all lines of iron and steel products.

Local prices on iron and steel are still firmly held, and advances in the States have not been reflected here, as Canadian dealers continue to quote the normal price of $2.75 on bars, stating that they take their cue from the mills here and so far no advance has been made. Imported product, however, would likely carry the advance, but as one dealer remarked: "The difference in the exchange almost makes up for the American advance, so that the situation, as yet, is not materially changed." The basic prices are unchanged as follows:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—A steady increase in demand has been experienced by pig iron producers in Canada since the first of the month, and it is stated by dealers that this is largely due to the fear on the part of users that the market will be dominated by the coal strike and that production will be curtailed beyond the normal requirements of present consumption, a condition that would naturally result in sharp advance in prices.

Non-ferrous Metals.—Little change is reported in this market, although inquiry has been better during the week. Dealers are interested in coal strike developments, as the metal situation will be indirectly effected by a restricted supply of coal and other raw materials. Local prices are firm and unchanged as follows:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	00 8
Aluminum	26 00

Scrap Metals.—The old material situation remains the same with light movements of supply. There is a slightly better undertone, which may be developing in sympathy with the iron and steel activity but the actual sales of scrap are on a par with previous weeks. "Slight fluctuations in price take place from time to time," remarked one dealer, "but this cannot be taken as a normal condition, as it is more the result of a specific trade than market trend." Following are present nominal quotations:

Copper, light per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools and Supplies.—Nothing of special character has developed in machine tool circles. Sales of heavy tools are light, but well distributed, and nothing big seems to be in prospect. One dealer stated that he had several good things on the way but that the prospect-

ive purchasers are holding off until the last moment, and that this seemed to be the prevailing attitude of all users, just buying when they are forced to. The movement of smll tools, and supplies, on the other hand, is showing a steady increase and few dealers are complaining of the volume of business in these lines. One dealer stated that sales have steadily increased since the first of the year.

Oils and Greases.—A steady business is reported in oils and compounds and prices are firm and unchanged as follows:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal.	1 35
Linseed oil, raw, single bbls.	1 00

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bls.	1 00

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	18
Mixed colored	14		

Montreal

April 26.

NO DECIDED change can be reported in the general trade conditions for the past week. In many lines there have been slight or even fair improvements, but on the whole the situation can best be summed up in the statement that, locally, business has only done a little better than hold its own. The marked improvement in the steel business in the United States has not been reflected in Canada to any great extent. The mills here are only producing on a small percentage basis, and are prosecuting a very vigorous sales campaign. Prices on most steel and iron products are at a very low level. This factor, coupled with the fact that the volume of business is small, makes it difficult for producers to show any profit at all. Many deals show dead losses. For this reason manufacturing costs have been receiving very close scrutiny and a large number of economies have been effected. These economies will enable the mills to turn out material at very reasonable figures when increased demand appears. Building operations are being pushed to a marked extent all over Montreal Island. The demand for all kinds of building material is exceptionally good, although somewhat below that of the high mark set during the past few years. Some new developments are expected in pig iron, but trading locally has been very light. Very little change is noted in the machine and wood working tool field. The non-ferrous metal market is very quiet locally.

Iron and Steel.—It is expected that the steel situation in the next few weeks or months, will be directly influenced by the developments in the coal strike. For some time past the local mills, dealers, and jobbers, have predicted an upward revision in prices. Up to date no actual advance has been announced, although there is definite stiffening in quotations. Local business has been fair. The jobbers and mills have a fairly good supply, when the light demand is considered, and all orders have been promptly filled. If the demand increases, through conditions arising out of the coal strike, there is no doubt but that quotations will be materially increased. It is extremely difficult to forecast the future even a few days ahead. The reported improvement in the U.S. steel industry has not yet influenced local markets.

Structural steel is still moving at a fairly satisfactory rate. Merchant bars are a little more active than they have been, but the demand is still rather light. It is confidently expected by representatives of the two mills that roll rails that orders will be forthcoming at an early date. For some time past these orders have been expected, and although up to the present such have not come through, it is only reasonable to assume that the placing of this business is not far distant. Plates are quiet. Sheets are in better demand. The orders booked in the last few weeks for both black and galvanized sheets are very satisfactory, when all things are considered. English galvanized sheets are stiffer but as they can now be imported directly by water, a saving in freight can be effected which will tend to offset the advance. Other lines are moving fairly well. There are no changes in the local quotations which are as follows:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—During the week pig iron has been advanced two dollars a ton. No. 1 iron is now quoted locally at $31.80 per ton. Heavy bookings have been reported here, and one producer states that sales of considerable volume have been placed in the United States. It is also claimed on good authority that there will be a further price advance in the course of a week or ten days. The bookings of some of the American furnaces are greater than has been expected and deliveries are being given at future dates. The coal strike has accelerated the situation, but it has not been entirely unexpected.

Machine Tools and Shop Supplies.—Iron working tools are in small demand at present and there is no change in the situation. Wood working tools are in better demand but even in this department business is spotty. Supplies are still moving nicely. It is hoped that the April turnover will be in excess of March and there is every reason to expect this. Jobbing and contract shops are showing a desire to come into the market a little more freely, but the increase in business is not great as yet.

Non-Ferrous Metals.—Markets in the United States and Great Britain are somewhat more active than they are locally. Quotations are somewhat stiffer in these quarters and in sympathy local figures are up. There is no increase in the local demand, but at the same time the small amount of business moving is not diminishing. The local quotations are as follows:

Lake Copper	16 75
Electric Copper	16 50
Castings, Copper	16 25
Tin	35 00
Lead	6 75
Spelter	7 25
Antimony	6
Aluminum	23 50

Scrap Metals—There has been a somewhat better demand for scrap metals locally and in a few instances quotations have been increased. The real source of this improvement originates in the States, where demand has developed to a marked degree. Locally the demand has increased, as many of the smaller shops are enjoying a better business. In fact, the last two weeks have been more encouraging to dealers than any time for several months. Local quotations are as follows:

Copper, light per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	7 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	18 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	3 00

Pittsburg

April 26.

IN THE past few days production of coke in the Connellsville and Lower Connellsville region has been approximately stationary, at about one-third the rate in March. There have been a few fresh strikes, at individual works, while on the other hand some men have returned to work and the working forces are better aligned for production. The shipments of coal out of the region are reduced more than the production of coke in the region. The regular union strike, in the Pittsburgh and other union

districts, proceeds without incident and no developments in it are to be expected in the near future. The union strike was expected to last anywhere from two to six months. The non-union strikes, which are important only in Western Pennsylvania and West Virginia, are expected to begin waning about May 1. These non-union workers are not accustomed to striking, while with the union coal miners striking is quite a habit, as there has been a "suspension" almost every time the biennial scale has come up in the past quarter century. Since the war there have been two off-date strikes, a big one late in 1919 and a group of little ones in the late summer of 1920. The probability is the non-union strikes will be over before the regular union strike comes to a head. The United Mine Workers cannot pay strike benefits to its own men, not to speak of the non-union men it has induced to strike.

On the whole, the effect upon pig iron and steel production of the Connellsville region strikes has been less than might have been expected. Quite a number of blast furnaces, particularly in the merchant group, are banked, and a few steel works have been closed, but production has increased in districts that draw their fuel from elsewhere. For instance, the Illinois Steel Co. is operating at 83 per cent, while the steel industry as a whole is running at something like 70 per cent., or at a rate in steel ingot production of between 36,000,000 and 38,000,000 tons a year. The rate was about 35,000,000 tons at the end of March and 30,000,000 tons at the end of February. Thus steel production as a whole has not decreased since the general coal strike started April 1, but it has not increased as it was increasing during the first three months of the year, the rate in December having been under 20,000,000 tons a year in ingots.

As a matter of bare fact there is little doubt that the coal strike has been a blessing in disguise for the steel market. There would have been trouble if buying and production had kept on increasing at the phenomenal rate of the first three months of the year, for no one can possibly imagine that consumption of steel has been increasing at any such rate. After a drastic liquidation in stocks of steel in 1921 the country was stocking up, partly in anticipation of the coal strike and partly in anticipation of better business. Now the coal strike is retarding further increases in production while it is stiffening steel prices, some of which, particularly prices for bars, shapes and plates, had gotten altogether too low, far below the cost of production.

Steel Prices.—Bars, shapes and plates are now very firm at 1.50c, which has been the ordinary market quotation for nearly a month, but has hitherto been subject to more or less shading in the case of particularly desirable orders. Some mills have largely withdrawn from the market by setting their prices at 1.60c or 1.65c, but obtain some prompt business, in small lots, at these figures. Independent wire mills continue to hold nails at $2.50, while the Steel Corporation remains a seller at the old price of $2.40. Hoops and bands are up $2 a ton to 2.00c, the price established just previously by the hot rolled strip mills. There are some purchases of small lots of sheets at the prices as recently advanced, $3 a ton to 2.40c. for blue annealed, 3.15c for black, 4.15c for galvanized and 4.50c for galvanized sheets, but the amount of selling and contracting done before the advance now seems larger than was at first estimated. This develops from the fact that some sheet mills, that use purchased sheet bars instead of making their steel themselves, have been in the market to buy sheet bars, not having embraced fully their opportunity in March to buy sheet bars at the then market of $29, against their sales of sheets at the old prices. Apparently they thought they could advance the sheet market without the steel mills advancing sheet bars in turn. The lowest quotation on sheet bars is $33 as on account of the coal strike the steel mills are disposed to save their steel making capacity for their own finished products.

Further stiffening in the steel market, quite likely with some definite price advances, is in prospect, due both to the coal strike directly and to the general change in sentiment whereby there is a sellers' market in steel instead of a buyers' market. Taking steel products as a whole, purchases made in the first three months of the year are going to prove distinctly profitable.

The strength of the steel situation at the moment, and for the nearby future, is well recognized although the more conservative observers have strong doubts as to its permanence. In many quarters one hears the opinion expressed that the movement has come about six months too soon and that, but for the possible saving influence of the coal strike, it was almost certain to have an inglorious ending this summer.

Pig Iron Much Higher.—In view of the merchant blast furnaces that pig iron has been selling at far below the cost of production, it is entirely natural that the great majority of the furnaces in this general territory should have withdrawn from the market when coke supplies were so greatly reduced by the Connellsville region strikes. It is difficult to find sellers at all, and an actual market cannot be quoted. What is definitely found is that one cannot buy basic pig iron at less than $22, valley, though it is not certain one can buy at that price. The pressure is to buy basic iron, but foundry and Bessemer certainly would not be sold at less than basic, hence the market can be quoted as being not under $22, valley, for Bessemer, basic or foundry, against prices of $19.50 for Bessemer, $18 for basic and $19 for foundry before this coke development began. When a full supply of coke becomes available again, as it may possibly in as little time as three or four weeks, the furnaces will undoubtedly endeavor to hold pig iron prices where they stand at the time, and those prices may, and probably will be, higher than the $22 figure just mentioned.

Coke, on the other hand, is hardly likely to be established at a much higher level than obtained in the first three months of the year. Just now no regular market on coke is quotable, because there is so little to be had. In furnace coke there are a few carloads offered here and there, not enough to run one blast furnace, and so the furnaces do not bid for it, their idea of price being $3.50 in view of the low prices at which they owe pig iron to customers. In foundry coke a little demand has developed, though the great majority of foundries stocked up freely in anticipation of trouble, at $4.25 to $4.75, the market ruling in March. A few carloads in the past week have brought about $6.25.

THE BASIC INDUSTRIES

There is now substantial evidence that the basic industries are, in the United States, on the up-grade. The United States Steel Corporation is now operating at 60 per cent. of normal capacity, which is about twice what it was last year. Agencies in Canada representing American steel producers report a satisfactory increase in the volume of orders. In Nova Scotia, orders from abroad for iron ore brighten a prospect that is otherwise dull. The labor disputes prevent the resumption of coal mining on a large scale. It cannot be said that Canadian steel fabricating plants have a cheerful outlook just at present; but the tide is on the turn, and when the banks feel at liberty to release funds, there will be enough business in construction work and in providing equipment to make our steel men smile once more.

NEW STEEL DEVELOPED

As the result of research work carried out by H. H. Ashdown and others at their Openshaw works at Manchester, Armstrong, Whitworth & Co. have produced a steel known as Vibrac. What is claimed for the new steel is that in addition to responding satisfactorily to even higher mechanical requirements, particularly in respect to elastic limit, than those obtained from nickel-chrome steels, it may, subject to any normal treatment, after tempering, be either furnace cooled or cooled in air, thus cutting out risks of distortion, and yet will give higher impact values than nickel-chrome steel treated under the most favorable conditions.

The composition of a welding rod should be of such a nature that during the welding the metal is not so liquid as to run easily over the unfused metal, covering up impoperly fused and oxidized surfaces.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	27 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 2 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 00
Castings, copper	16 25	17 00
Tin	35 00	34 50
Spelter	7 25	7 25
Lead	6 75	6 75
Antimony	6 50	6 75
Aluminum	23 50	26 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 25	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 00	3 50
Medium brass	**4 50**	**4 50**
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00

	Per Ton	Gross
Boiler plate	$7 00	$7 00
Heavy melting steel	9 00	10 00
Axles (wrought iron)	17 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	18 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 25
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. p'ates all bright	8 25	...
Galvanized sheets, No. 28		5 55
Queen's Head, 28 B.W.G.	7 00	....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 55
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 30
Linseed oil, raw, single bbls.	1 05

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored.13
Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

The **Fulmanite of Mercury** plant at Prescott started operations Monday.

J. Arena, of Smiths Falls, is preparing to build a business block to replace the one destroyed by fire last fall.

Archibald & Holmes, 709 Yonge Street Toronto, has been awarded general contract for erection of the addition to the Conservatory of Music, approximate cost being $50,000.

James Hird, formerly in charge of the Cost Department at W. H. Banfield & Sons, is now associated with the Commercial Fixture Co., Toronto, manufacturers of electric fixtures.

J. Johnstone, architect of Vancouver, B. C., has been instructed to draw plans for the preparation of the addition to the Telephone Exchange, the cost of which will run about $40,000.

Goldstein Manufacturing Co., Toronto, are now located in their new building on Beverley Street. They will specialize in the manufacture of copper and brass tubing, likewise seamless rods.

The steamer St. Lawrence recently purchased by Canadian interests will be in commission again this season among the Thousand Islands. She is now being remodelled in drydock at Kingston.

An entirely new installation of heating and ventilation for the Myrtle Street public school of St. Thomas, Ont., has been recommended by Donald Stewart, consulting engineer, of Windsor and Hamilton.

Announcement is made of the incorporation of Water Products Ltd., with a capitalization of $500,000. They will manufacture machines for making oxygen and hydrogen by the electrolytic decomposition of water.

The Robertson Construction Co. of Niagara Falls, Ont, has secured the contract for the erection of a new sub-station for the Hydro Electric Division at Niagara Falls. The cost of the structure will be about $67,200.

The Steel Trough and Machine Co. Tweed, Ont,. have opened an office in Montreal to take care of their Quebec business, under the management of R. L. Welsh. Their Montreal office will be Room 216, St. Nicholas Building.

Robt. Gardner & Sons of Montreal, are manufacturing the machinery and equipment that will be installed in the biscuit factory for David & Frere at Maisonneuve, Que. The contract price of machinery will be about $50,000.

Drummond, McCall Co., 28 Victoria Square, Montreal, will erect a warehouse on Wellington Street. The contract for the wrecking of the old building has been let to the Hochelaga Demolishing and Cartage Co., Montreal.

The Ottawa Auxiliary Bible Society has purchased a site for the erection of a permanent home and the financial campaign to raise $10,000, which is a condition of two anonymous donors of $5,000 each, is already in full swing.

Negotiations are now in progress for the erection of a large addition to the Misericordia Hospital, Edmonton and it is expected work will be started early this summer. The proposed extension will be north of the present structure and the estimated cost will be approximately $250,000.

The Canada Iron Foundries of Montreal, have obtained a contract for 10,000 feet of class "C" six inch cast iron pipe at $68.00 per ton for the city council of Edmonton. The council has also awarded contract for lead pipe at $10.50 per 100 pounds, to the Metals Limited of Edmonton. These figures are f.o.b. Edmonton.

Tenders for the masonry, brick and carpentry work on the new civic hospital will be received May 4. The trustees will then call for tenders for heating, plumbing and ventilation of the main building and possibly also for the power house and building for female help, leaving only the nurses' home, plans for which are well under way,

At a recent meeting of the Non Ferrous Metals Division, Waste Trade Dealers' Association of America, Edmond L. Frankel, general manager of Frankel Brothers, Toronto, was elected president for the forthcoming year. Mr. Frankel is to be congratulated on being elected to such an honourable position.

The Provincial Government of Alberta have passed estimates recently which include $2,000,000 for extension to the Provincial Government Telephone system. A new normal school and technical institute receives $562,000. Construction and improvement to railway lines in the province controlled and endorsed by the Alberta Government will receive $3,218,000.

The Dominion Wheel and Foundries Co., 131 Eastern Avenue, Toronto, report that they sold more car wheels during the first three months of the present year than during the entire year of 1921. They also delivered some fairly large castings from their jobbing department, so that on the whole they have no complaints to make regarding business and prospects for this year.

With the amicable settlement of the dispute between the members of Local 71, Plumbers' and Steamfitters' Union and the Master Plumbers' Association, there would appear to be no possibility of any trouble on May 1 in the building trades. The painters and plasterers do not expect any, the Laborers' Union has accepted the award of the conciliation board of 45 cents an hour, and the electricians expect to sign a new agreement within a few days.

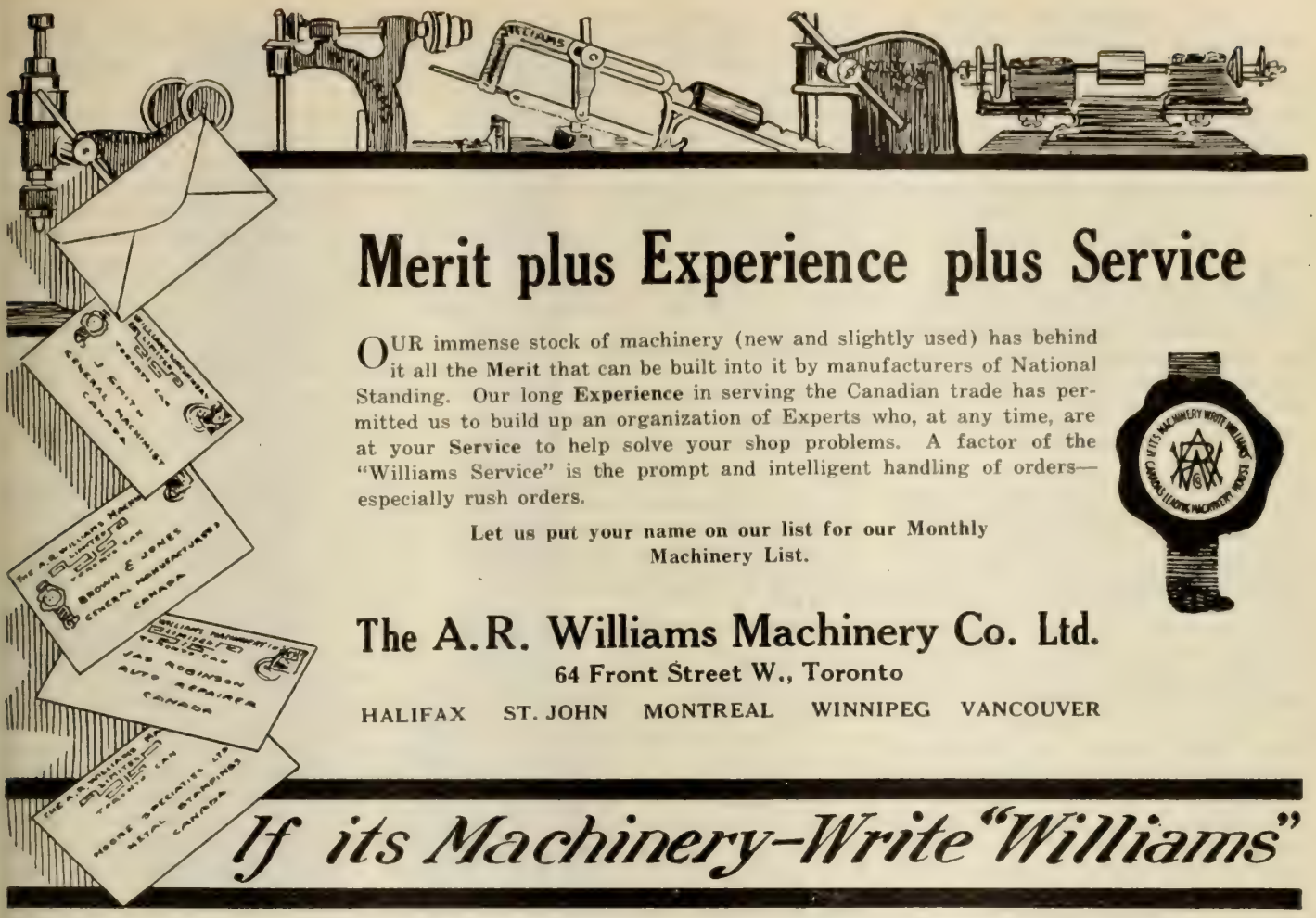
The general contract for the construction of the collegiate institute and technical school of Guelph, Ont., has been awarded to the Yates Construction Co. of Hamilton. The contract price, namely $252,500, is to include all work with the exception of plumbing, heating and ventilation. The contracts for the last three mentioned has been awarded to W. C. Edge and Co., of Ottawa, at a cost of practically $54,000. The building will be of reinforced concrete.

The Hydro-Electric Power Commission of Ontario has decided to start work on the construction of a new line on the St. Lawrence between Morrisburg and Brockville, to provide for the increased load created by the establishment here of the Eugene Phillips Electrical Works. Work will be carried on from both ends of the thirty mile stretch of line and all the insulators and cross arms will be changed, owing to the increased voltage from 25,000 to 44,000.

Reports from Saskatoon, Sask., announce the following contracts closed for construction work. A new chemistry building at the University of Saskatchewan will be commenced shortly, the estimated cost to be about $440,000. Bennett and White of Calgary are the general contractors. Green and Lister of Winnipeg have received the contract for plumbing and heating. Wathton Electric Company of Saskatoon have obtained the contract for the electrical work.

The following construction work has been added to the industrial activities for Hamilton for the present year. W. H. Cooper has received a contract for the construction of a Masonic Temple. The estimated cost for this building will be $300,000. Three additional sections will be built to the grandstand in Scott Park. The contract has been awarded to the Hamilton Bridge Works Co. the estimated cost to be $16,500. An addition, costing about $150,000, will be added to the "Towers," the former residence of George E. Tuckett, which sometime ago was acquired by the Ancient and Accepted Scottish Right.

Once again the ice-breaker "J. D. Hazen" has changed hands and is now back to its original owners, the Dominion Government. The recent purchase



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HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

was negotiated by Assistant Deputy Minister of Marine, Mr. Hawkin, who is now in France. The figure mentioned is $400,000. It will be remembered that sometime early this spring the Canadian Government was negotiating with the Canadian Vickers of Montreal for the construction of a new icebreaker at a cost of $1,500,000. However, these plans were abandoned with the result that the previous icebreaker constructed by the Canadian Vickers Company some years ago will soon be back on Canadian waters.

Building operations for the coming season in Montreal include the following: Rebuilding of the Church of the Sacred Heart, which was destroyed by fire recently, will be started shortly. Anglin-Norcross Limited have received contract for the construction of a large medical building on the south-west corner of Guy and Sherbrooke Streets. The building will be ten storey high. A new public school at an estimated cost of $350,000 will be constructed by the Protestant Board of School Commissioners in Notre Dame de Grace. Kenneth C. Rae is the architect. The Catholic School Commission of Montreal has acquired a site for the erection of a large residence and school, estimated cost of both being about $200,000.

At a recent meeting of the representatives of the machinery manufacturers of Toronto held at Exhibition offices at Canadian National Exhibition at Toronto, George E. Irving was in the chair and the meeting discussed plans for a new Machinery Hall. The proposed sight is at the east end of the grounds facing the new road that is contemplated by the Harbour Commissioner. Prospects are that the building will have a frontage of 450 feet and will contain approximately 125,000 square feet of floor space. The building will be constructed on unit system, the first unit to contain approximately 80,000 square feet of floor space. It is stated that 25 per cent. of this space has already been subscribed for. The estimated cost of the building is $300.000.

High water in the Ottawa river, during the past week played havoc with local lumbering industries. It is known that 60,000 logs owned by John R. Booth, Ltd., and other local lumbering industries broke loose from their berth. The sorting gap and booms of the Shepard and Morse Lumber Co. were swept away. It is estimated that some 300,000 logs just west of the dam held back the flood waters from the Chaudiere Falls, water lots, and power driven machinery of various Chaudiere companies. The J. R. Booth and E. B. Eddy industries carried on with great difficulty and in both plants the pulp mills were only working part time owing to the high water having submerged the water wheels. The stock of sulphur in the E. B. Eddy sulphite mills has been considerably damaged.

Time and again the Campbell power plant, owned and operated by J. M. Campbell, president of the Kingston Navigation Co., has come to the aid of the city when the Hydro failed and this was again the case recently when the severe electric storm late one morning damaged the Hydro lines west of Belleville and cut off Kingston's supply. The Campbell power from Kingston Mills was switched on and carried the load very successfully. But for this very valuable source of supply, the city of Kingston would have been "stalled" on many occasions.

A committee appointed by the Sydney Mines Town Council to look into and report on the matter of changing and improving the water service system of the town has recommended that the ratepayers be asked to authorize the borrowing of $100,000 or whatever sum they deem necessary for the purpose. The report was approved except that the amount was named at $200,000, and a ratepayers' meeting will be called for the purpose.

The town of Bridgewater, N. S., is taking separate tenders for erection of a fire hall and for the plumbing and heating for same, tenders to be in by May 8th.

A petition for the winding up of the Acadia Shipping Co. is to be presented in the Supreme Court and the hearing is to be on April 25. The petitioner is E. K Spinney Ltd., a body corporate, of Yarmouth.

The Dartmouth, N. S., water committee will purchase an air compressor and gasoline engine, 5 tons of half inch lead pipe, body gate valves, and cast iron pipe, the possible requirement of which will be thirty-five tons.

It has been announced at Queen's University, Kingston, that the authorities there intend to go ahead with the erection of the new library building this summer. At the present time the plans are being prepared and the work on the foundation will be pushed along as quickly as possible. The building will be of stone and will mean a great deal of work for stone-cutters and masons. It is fully expected that it will give a long term of work to many men. The new edifice is to be erected on the corner of Union Street and University Avenue, north of Ontario Hall and adjoining Gordon Hall.

The Grand Trunk shops at Point St. Charles will close down on Friday, April 21 until May 1. Notices to this effect were posted in the shop last week and it is stated that the action has been taken largely because of slackness in traffic, resultant on the coal strike in the United States. At the offices of the vice-president it was stated, that up to the time of the coal strike, business had been steadily improving, and that it had been hoped that the Saturday off would soon become a thing of the past in the Point St. Charles shop. The continuance of the coal strike, however, is making a difference in traffic which renders retrenchment necessary until conditions improve.

Prof. L. A. Zufelt, superintendent of the Kingston Dairy School, received the proposed plans for the new dairy school building here, to replace that destroyed by fire a short time ago. The architect employed by the Ontario Government has submitted a couple of sets of plans to the superintendent. Prof. Zufelt knows exactly what is required and he and the architect have been conferring together. It is expected that work on the new building will commence in the near future, so as to have the school ready for the opening of the fall course, near the first of September. The building will be fireproof and the steam plant to furnish the power separate from the main school.

As a result of recent investigations in Japan respecting the possibilities of that country obtaining Canadian manufactured goods, a very promising field has been opened up in the matter of exporting grinding wheels to Japan. Tentative inquiries made on all sides on this subject have elicited great interest and several important firms in Japan have expressed their desire to be put in touch with a Canadian manufacturer of grinding wheels, in a position to export same, with a view to acquiring the sole agency for such. While it is impossible to state now just what actual business would be forthcoming as a result of correspondence interchanged between the Canadian manufacturer and the Japanese importer of grinding wheels, still there is a demand, and directly trade conditions brighten it is safe to say that this demand will increase more and more.

Among the interesting articles which will appear in forthcoming issues are the following:—Automatic Work Produced at High Speed, May 4; Storing Small Tools Increases Their Life, May 11; Proper Piling of Goods Reduces Costs, May 18; Saving Money By Means of the Turret Lathe, May 25.

A correspondent in Belgium in response to a recent enquiry as to the possibilities for Canadian machine tools in that country says: "I see no reason why specially efficient Canadian machine tools of a lighter type should not find a market here when exchange improves, say by even a few francs on the dollar." He refers to the fact that Canadian saws, forks, rakes, hoes, valves and much Canadian agricultural machinery are already on sale in Belgium.

The contract for the construction of the new chemistry building at the University of Saskatchewan has been allotted to Messrs. Bennett & White of Calgary, Alberta, whose tender of $400,000.00 was the lowest of the eight received. David R. Brown, Esq., of Montreal, is the architect to the University. The contract for plumbing, heating and ventilating has been awarded to Messrs. Green & Litster of Winnipeg, at $115,000.00, and the Wheaton Electrical Co., of Saskatoon, were the successful tenderers for the electrical work at $20,000.00. The work will commence on this building during the next two weeks.

The Williams Tool Corporation have built at their Brantford plant a 20 inch pipe threading machine—the largest of its kind on record—for delivery to the International Petroleum Co. in Peru, South America. This machine weighs 11 ton, the head alone having a weight of 3,000 pounds. Just recently the machine was put through some severe tests in the presence of E. C. Kitchen, Toronto, representing International Petroleum Co., representative of the Canadian Fairbanks Morse Co., through whom this business was placed, and members of the engineering and sales staff of the Williams Tool Corporation. In their oil well operations the International Petroleum Co. use miles of casing pipes, lengths of which are joined together by means of a twelve inch coupling. A thread of about six inches is therefore required on each end of the pipe—and using a thirteen inch pipe as a test the machine made a satisfactory performance, producing a clean cut job on a six inch casing thread. The strain on a thread and coupling when a casing is being pulled after boring operations, is sometimes more than 200 tons. Delivery of the machine will be made about the 1st May.

CANADIANS SHOULD SUPPLY SAMPLES OF GOODS

One of the features of export business which Canadian manufacturers have not thoroughly grasped is the need of supplying samples in making a bid for trade. One Canadian firm, states A. B. Muddiman, Acting Canadian Trade Commissioner in Bristol, Engand, failed to secure orders through this cause, taking no less than twelve months before they supplied samples to the British buyer, who in consequence lost all interest in the placing of the order. Once specifications and designs have been submitted, the Canadian manufacturer should make speed with the samples in order that the English commission house may push sales. The Germans are well aware that the secret of success in marketing woodenware is to have their samples speedily on view.

FIFTY DOLLAR TAX ON TRAVELLERS

The following letter, which has been received at this office from H. M., Senior Trade Commissioner in Montreal, depicts the attitude assumed by city officials in the capital of Newfoundland.

Dear Sir:

I have to-day received notification from the Deputy Minister of Customs in Newfoundland, to the effect that the Municipal Corporation of St John's has recently passed an act imposing a tax of fifty dollars ($50), on all commercial travellers entering the city. This tax is not payable outside the city limits.

Yours faithfully,
H. M. Senior Trade Commissioner,
in Canada and Newfoundland.

OBITUARY

John E. Davey

John E. Davey, manager of the Manitoba Steel Foundries, died recently at his home in Selkirk, Man. The late Mr. Davey was born at Whitby, Ont., and for a number of years was associated with the Canadian Brake Shoe Co. at Sherbrooke, Que. He moved west six years ago, and for the past four years has been with the Steel Foundry Co, holding the position of manager for the last three years.



It Was Just A Matter of Grinding

The same set of Thread Chasers cut these two threads.

Observe what a clean cut the Chasers gave on this open hearth stock after they had been correctly ground. Note how neatly the Chasers curled out the chip. Before given the right form of grind, the Chasers simply pushed out the stock.

How To Grind Thread Chasers

Instructions for the Care of Thread Chasers are very completely given in a 27-page booklet published by us.

The Book Is Free

To those having the care of Thread Chasers. It is printed and distributed with the hope that the rules given will be followed, and if they are, it will be the means of an inestimable saving of time, money and trouble.

If you have anything to do with the care of Thread Chasers, ask us for the book. Although there is no charge for the book, it is full of value. It will cost you the price of a postage stamp only, and will save you trouble, increase your value to your employer and save a lot of money that is needlessly wasted in time and scrapped work.

Right on the Lead

THE GEOMETRIC TOOL COMPANY
NEW HAVEN CONNECTICUT

Canadian Agents:

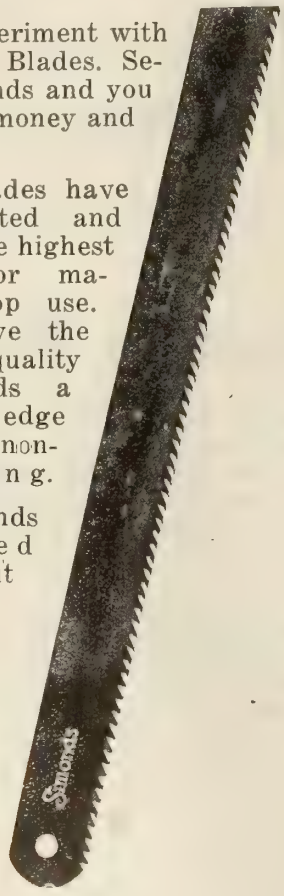
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Hack Saws

Don't experiment with Hack Saw Blades. Select Simonds and you will save money and time.

These blades have been tested and proved the highest grade for machine shop use. They have the steel quality that holds a cutting edge and are non-breaking.

Thousands are used throughout Canada.



Simonds
Canada Saw Co., Ltd.
"The Saw Makers"
Montreal, Que.
St. John, N.B. Vancouver, B.C.

GENERAL ELECTRIC TO BUILD VACUUM TUBES

The Canadian General Electric has undertaken the construction of vacuum tubes for use in wireless instruments. The supply has been limited in view of the immense demand for this very necessary part of radio equipment and a heavy investment has been made for the manufacture of these tubes. At the present time the output is approximately 200-300 per week, but with the installation of more equipment this output will be brought up to 200 per day. The bulbs or tubes so far produced have been what are known as the U. V. 200 and the U. V. 201, the former tube for the detection of wireless signals and the latter for detection amplification.

Considerable damage was caused by the bursting of a large generator at the power house of the Ontario Power Company last week. No definite reason is given for the cause of the accident but it is possible that racing of the rotor was responsible, the excessive centrifugal force resulting in dislocating some portion of the heavy mass. It is likely that some time will elapse before repairs are completed.

In last week's issue Brown and Sharpe Co. was credited with supplying the data and cuts for the article on page 24. This should have read the Pratt and Whitney Co.

F. C. Wilson of the firm of Williams and Wilson, Ltd. of Montreal, sails on April 29th on the new White Star steamer Regina after spending the winter in Europe.

W. H. Winterrowd, chief mechanical engineer of the Canadian Pacific Railway, gave a paper before the weekly meeting of the Engineering Institute of Canada on Thursday, April 20, treating on the modern refrigerator car. Mr. Winterrowd stated that in the United States and Canada there were 153,000 of these cars, and that they carried practically all the perishable food that fed the two nations. It was pointed out that the Canadian Pacific had spent a great deal of money in trying to apply mechanical refrigeration to this type of car. The experiments were successful from an engineering point of view, but were not economically commercially. Owing to widespread points of origination it was best to have cars complete in themselves. The problem of insulation was the great study at present, and second only to insulation was efficient air circulation. The upkeep of these cars was a difficult proposition as the wear and tear of traffic quickly broke down the insulation.

P. S. Howes of the Hall Engineering Co. of Montreal, in a recent interview stated that the contract and repair business, which was very dull with his firm toward the latter part of the year, commenced to improve about the middle of January, and this improvement has continued right up to the present time. For some time past the shop has been employing a night shift in order to get out the work. No particular line of work appears to be in evidence, but the present state of affairs is accounted for by the fact that the firm has sought business very aggressively and no job was too small to accept. Mr. Howes states that many invoices for less than one dollar are mailed out of the office. With the opening of navigation, ship repairs will provide for the company a great deal of new business that was not available during the winter months. In order to prepare for the additional volume, changes in the interior arrangement of the Jurors Street shop are being made.

Oil Tempered Steel Springs



for every purpose and the best for each use.

Special styles of all kinds to order.

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Cleveland, Ohio U.S.A.

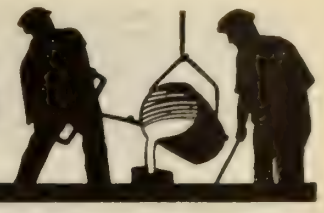
WEAR IN BEARINGS

Viewed under a powerful microscope, the most highly polished pieces of metal resemble a nutmeg grater; there are many pin points sticking up, with all pores in metal, tool marks and other irregularities that, taken all together, help to produce friction. When the oil on a bearing squeezes out, these irregularities and pin points interlock, with pin points breaking off; this is termed wear. Tiny particles of metal are then carried by the oil into the bearing parts, thus acting as an abrasive. The use of graphite grease containing a large percentage of graphite entirely overcomes this state of affairs.

In order to obtain a high grade weld by the oxy-acetylene process it is necessary to fuse the edges of the base metal and the welding rod at the same time, and to obtain an intermingling of both metals.



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Malleable.

S. Vessot & Company
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Miller Bros. & Sons, Limited,
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Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
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LIMITED
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A. F. McCulloch
OSHAWA, ONT.
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370 Victoria Street, TORONTO, ONT.
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The Robert Mitchell Co., Ltd.
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Langley & Austin,
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Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
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The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
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Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

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Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
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Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

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MECHANICAL ENGINEER IS OPEN TO consider partnership or interest with manufacturer with a view to producing new high grade lines of engineering equipment. Must have good reputation and manufacturing facilities. Box 808, Canadian Machinery. (C.16M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience, 10 years general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery, (c23m)

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ACCURATE RIGID DEPENDABLE
Manufactured in various types and sizes for all classes of milling.
KEARNEY & TRECKER CORPORATION
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FOR ALL KINDS OF HEAVY LIFTING
Send for complete catalogue showing 50 styles 10 to 100 tons capacity.
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Founders, Machinists, Millwrights and Engineers
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Contractors' Derricks and Equipment—Belt and Chain Elevators—Conveyors—Paint Machinery



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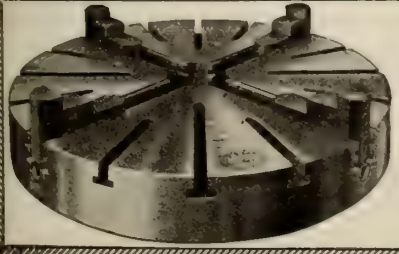
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combine perfect balance with correct speed to insure a degree of accuracy never before obtained with portable grinders. Write for information concerning what they will do for you.
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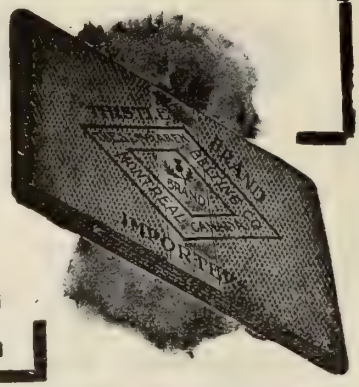
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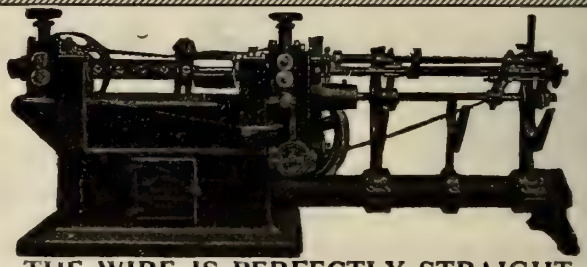
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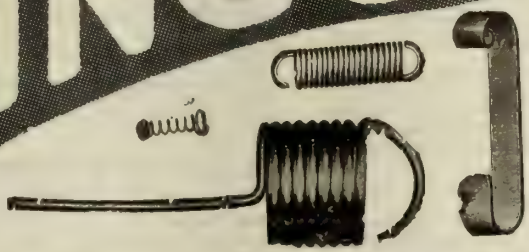
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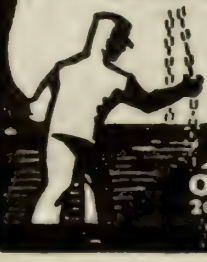
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McDougall Co., Ltd., R., Galt, Ont.

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Armstrong Bros. Tool Co., Chicago, Ill.
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Canadian SKF Co., Toronto, Ont.

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Boring Tools
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Canada Metal Co., Ltd., Toronto, Ont.

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Oakey & Sons, Ltd., John, London, S.E. Eng.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.
Goldie & McCulloch Co., Ltd., Galt, Ont.

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Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

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Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N.Y.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Castings, Aluminum, Brass, Bronze, Copper, Die-Molded, Ferro-Alloy, Iron, Semi-Steel, Steel.
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Brown-Boggs & Co., Ltd., Hamilton, Ont.
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Can. Steel Foundries, Ltd., Toronto, Ont.
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Dominion Foundries & Steel, Ltd., Hamilton, Ont.
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Tallman Brass & Metal, Ltd.
Vessot & Company, S. Joliette, Que.
Wells, W. W., Toronto, Ont.

Chains (See Sprockets and Chains)
Falls, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

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Bertram & Son Co., Ltd., The John, Dundas, Ont.
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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
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Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
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Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

Chucks, Drill and Tap
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Bedford, Mass.
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Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
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Union Mfg. Co., New Britain, Conn.

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

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Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
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Clamps, Machinists'
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks,
Chicago Watchman's Clock Co., Chicago, Ill.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Limited, Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., B. S., Philadelphia, Pa.

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Petrie, Ltd., H. W., Toronto, Ont.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and parts
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Can. Desmond-Stephan Co., Hamilton.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co, Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Elmer Motor Co., Ltd., Orillia, Ont.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
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Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

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Burke Machine Tool Co., Conneau Ohio.
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Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Equipment, Elevator Safety
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Norton Co. of Can., Ltd., Hamilton, Ont. Montreal, Canada.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Ucolofson Elevator Co., Galt, Ont.

BUYERS' DIRECTORY

Fittings, Pipe
International Malleable Iron Co., Guelph, Ont.
Fittings, Limited, Oshawa, Ont.

Flexible Shafts
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Medburn Ltd., John T., Toronto, Ont.

Foundry Equipment
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Petrie, Ltd., H. W., Toronto, Ont
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Thread
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Limited, Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges, Vacuum and Pres
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whitten Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Crescent Machine Co., Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The Jon Dundas, Ont.

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Wheels
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co. of Can., Ltd., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence, R.I

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill
Starrett Co., L. S., Athol, Mass.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Oliver Machinery Co., Grand Rapids, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Oliver Machinery Co., Grand Rapids, Mich.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Ta.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Manganese Steel
Can. Steel Foundries, Montreal, Que.

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mechanics' Fine Tools
Lufkin Rule Co., Windsor, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence,
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Vertical
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nipples
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patterns, Wood and Metal
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
Can. Fairbanks-Morse Co., Ltd., Montrea
Underwood Corp., H. B., Philadelphia, Pa
Williams Machinery Co., A. R., Toronto.

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Pipe
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Fittings, Limited, Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shi..
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
J. R. Baxter & Co., Ltd., Montreal, Que.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. E., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

BUYERS' DIRECTORY

Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Limited, Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.

Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

Screens
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.

Screw Machine Work
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R.I.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
National Acme Co., Montreal, Que.

Screw Plates
Butterfield & Co., Inc., Rock Island, Que
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Stoll Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que

Slotting Attachments
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont

Steels, Tool
British Empire Steel Co., Montreal, Que

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.

Union Drawn Steel Co., Hamilton, Ont.

BUYERS' DIRECTORY

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton Ohio

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng
Can. Steel Foundries, Montreal, Que
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co. of Can., Ltd., Hamilton, Ont
United Alloy Steel Corp., Canton, Ohio
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland
Williams & Co., J. H., Brooklyn, N.Y

Studs
Galt Machine Screw Co., Galt, Ont.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que

Tachometers
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co., Windsor, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Preston & Schwartz, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B. Hespeler, Ont.
National Acme Co., Cleveland, Ohio

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Preston & Schwartz, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Tool Work
Brown Engineering Corp., Ltd., Toronto.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa

Trolleys and Tramways
Can Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg Co., Lisbon, Ohio

Trolley Wheels,
Langley & Austin, Galt, Ont.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd. Toronto, Ont.
Dominion Engineering Works, Limited, Montreal Que
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co, Madison, Wis

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis

Tyres.
Beardmore & Co., Ltd., Wm., Mon-

Unions, Pipe
Fittings, Limited, Oshawa, Ont.

Valves
Can. Fairbanks-Morse Ltd. Montreal, Q
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ont.

Voltmeters
Bristol Co., Waterbury, Conn.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
National Electro Products Co., Ltd

Welding Apparatus.
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont
National Electro Products Co., Ltd.

Welding Machines, Oxy-Acetylene
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont
National Electro Products Co., Ltd.

Welding, Electric
McLaren Belting Co., J. C., Montreal Que
Steel Co of Canada, Ltd., Hamilton, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.

Welding Supplies
Carter Welding Co Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont
National Electro Products Co., Ltd.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, On
Greening Wire Co., B., Hamilton, Ont
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Shuster Co., F. B., New Haven, Conn.

Wire, Welding
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products, Ltd., Toronto Ont.

Wires, Special
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery Co., A. R., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

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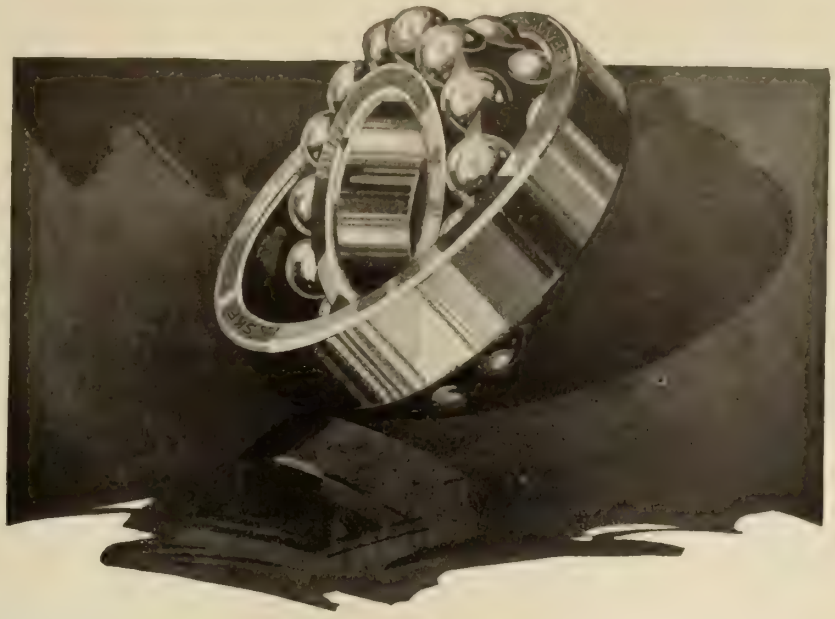
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page 45

SKF



Wherever Misalignment is a Factor

THE operation of your machine will not be successful unless its bearings function in complete harmony with other parts. Deflections in the shaft, weaving in the frame and other causes may create severe stresses in all parts of the bearing, unless the latter has some inherent means to compensate for this misalignment.

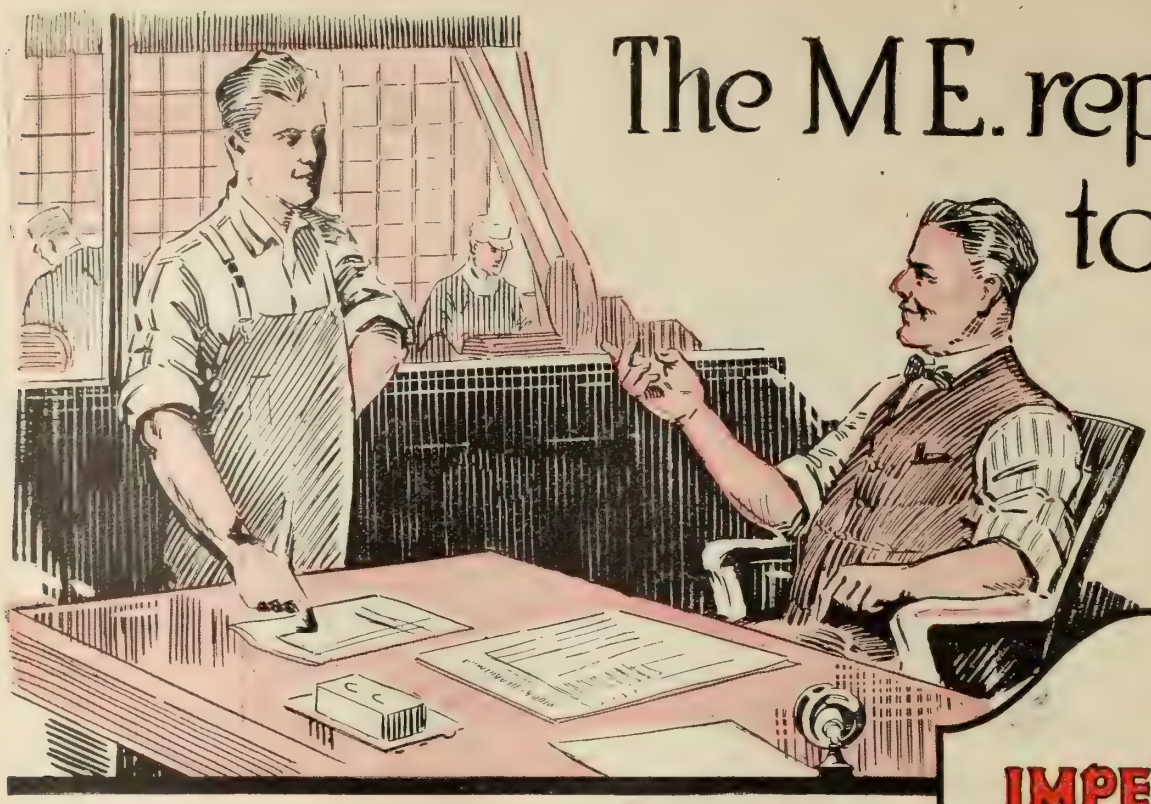
The SKF marked self-aligning bearing operates on the same principle as the ball and socket joint and is therefore capable of taking care of the severest misalignment. Moreover the aligning action is positive, immediate and automatic.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVII. No. 18 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | May 4, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page



Make Your Decision Now to Be in

ROCHESTER

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to June 9th

Every Canadian Foundryman Should be sure to be There

ARE you interested in keeping your foundry practice right up to the minute? Are you interested in placing your methods on bigger, better, more profitable foundation? Then be sure to be at the next Annual Convention of the American Foundrymen's Association at Rochester. There will be lectures, discussions and exhibits—and an entertainment program that will surpass the best of past.

You are expected to be present and freely partake of all the good things this great occasion makes available.

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140 S. Dearborn Street, Chicago, Illinois

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We make these three right.

1. Exacting analysis of the physical and chemical properties of our steel insures a uniform product.
2. Intelligent workmanship constantly striving to produce the better tool yields the Pratt & Whitney quality.
3. Rigid inspection of the work in process and of the finished product guarantees tools for longest service.

The finished product must be right

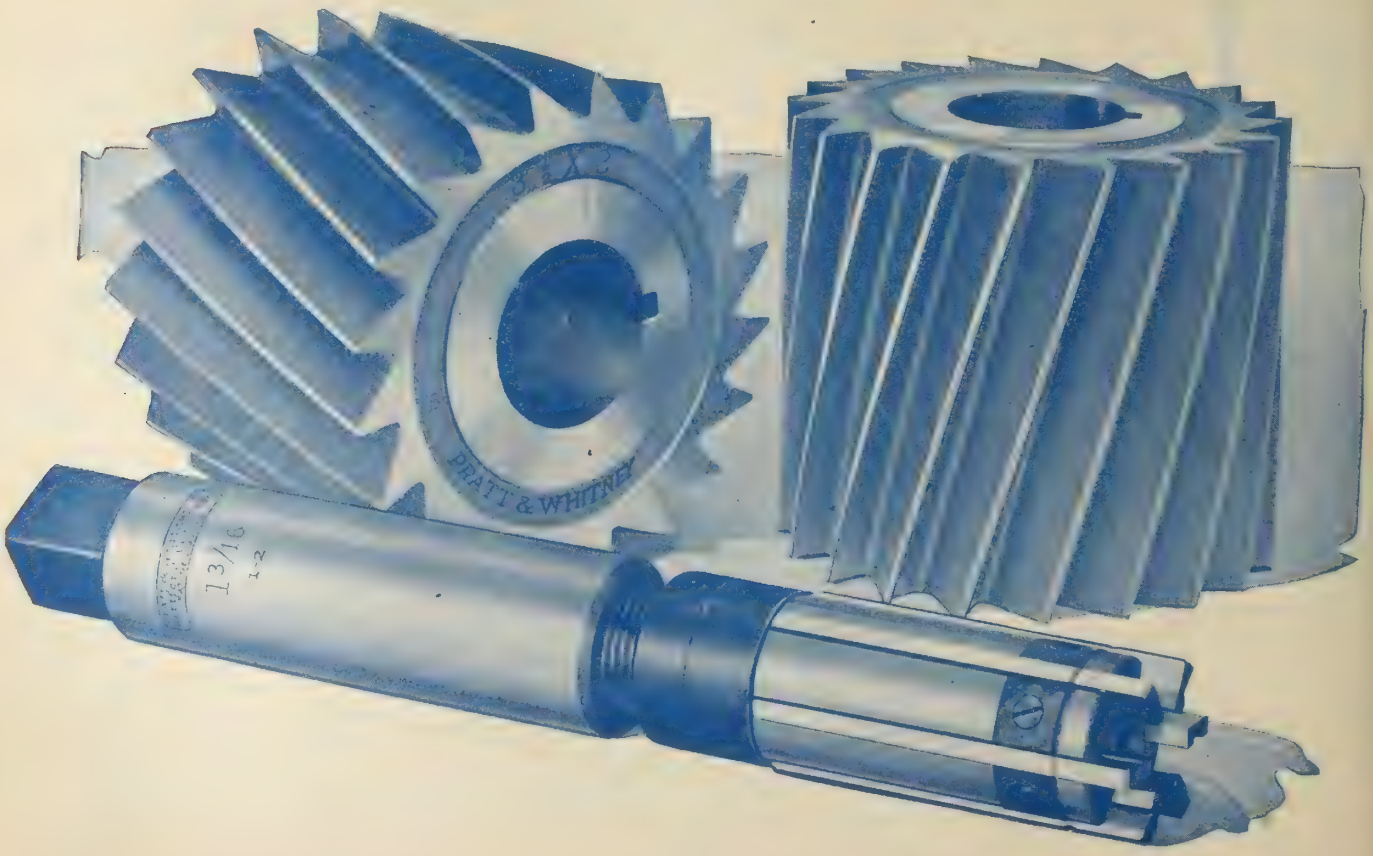
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Works : Dundas, Ontario

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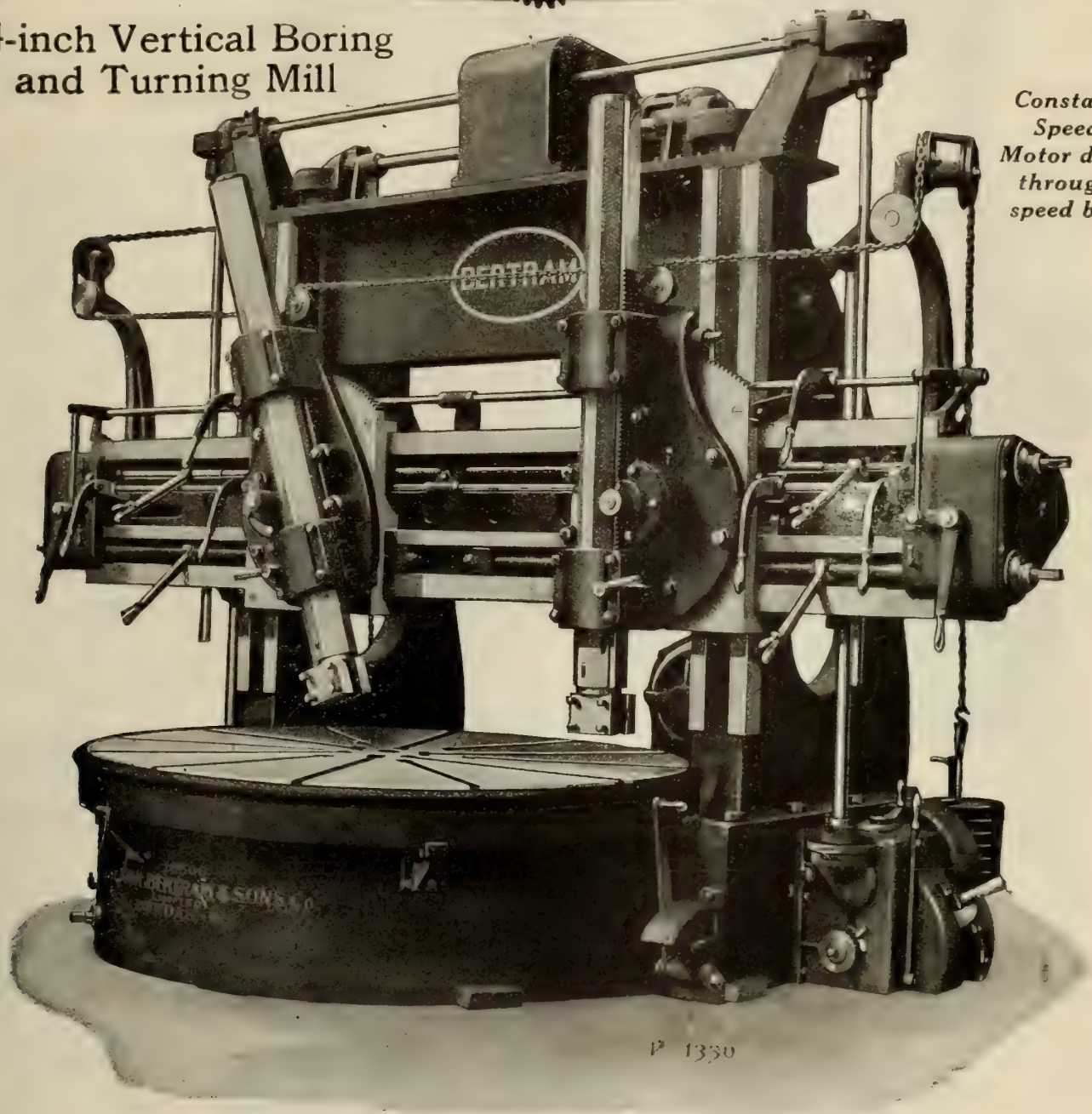


The BERTRAM Page

MACHINE TOOLS

84-inch Vertical Boring and Turning Mill

Constant Speed Motor drive through speed box

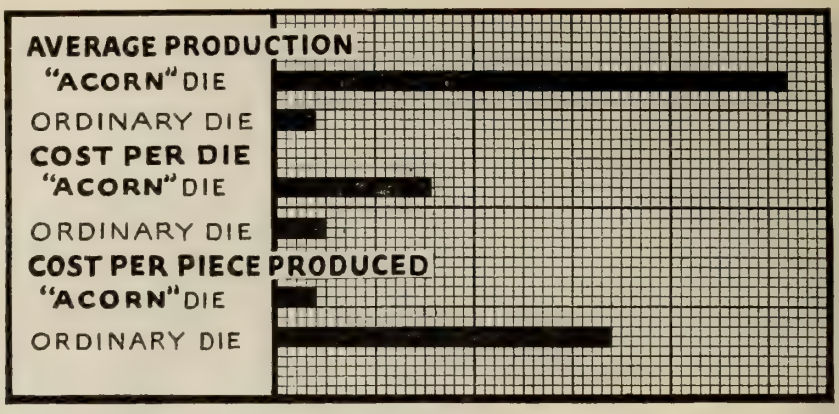


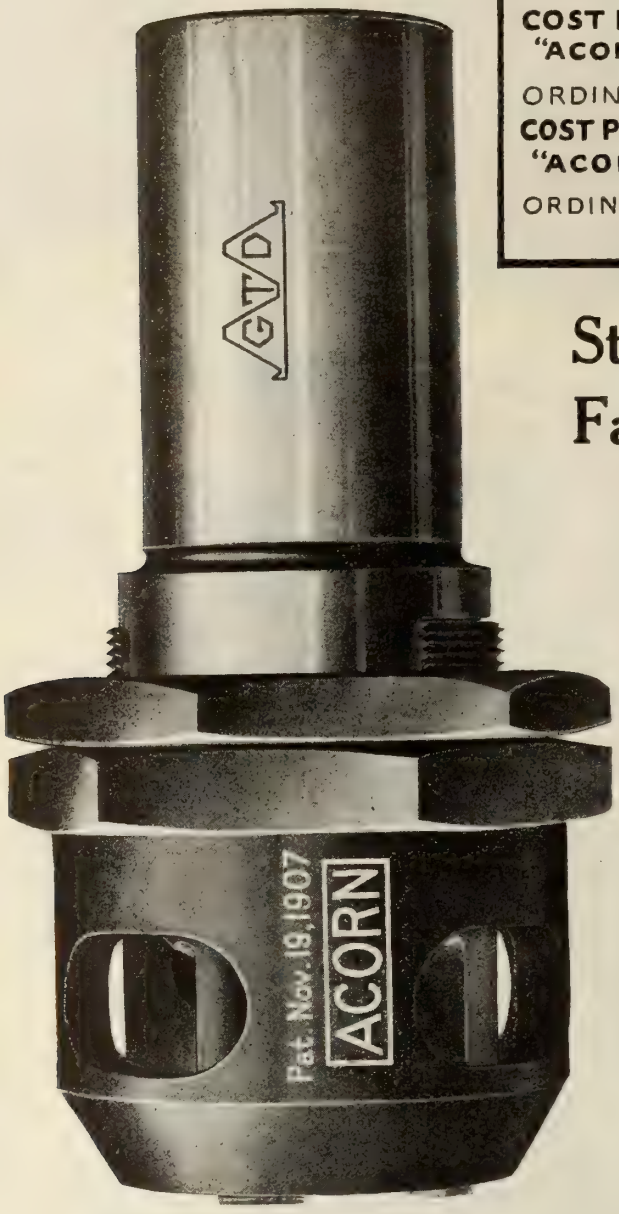
P 1330

The John Bertram & Sons Co., Limited

DUNDAS, ONTARIO, CANADA

MONTREAL Drummond Bldg. | TORONTO 32 Front St., W. | VANCOUVER 609 Bank of Ottawa Bldg. | WALKERVILLE 103½ Sandwich St. | WINNIPEG 1205 McArthur Bldg. | HALIFAX Roy Bldg.





Enlarged photo of "Acorn" Die and Holder. Note the compactness of the whole. Conical cap gives concentric adjustment—extremely accurate.

This is only one of many GTD tools designed to increase production and reduce cost.

Study the Evidence in Favor of the "Acorn" Die

Four well-known concerns which regularly use GTD "Acorn" Dies furnished the data from which the above chart was compiled—among them the Singer Manufacturing Company, the Wheeler-Schebler Carbureter Company and the Century Electric Company. Through the courtesy and co-operation of these people we were able to formulate an exact comparison between the performances of "Acorn" and other dies, under typical but totally different working conditions, in diverse fields.

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We base our claims for GTD small Tools on their performances; and our engineers are ready to co-operate in effecting a typi- GTD reduction in cost. Write today.

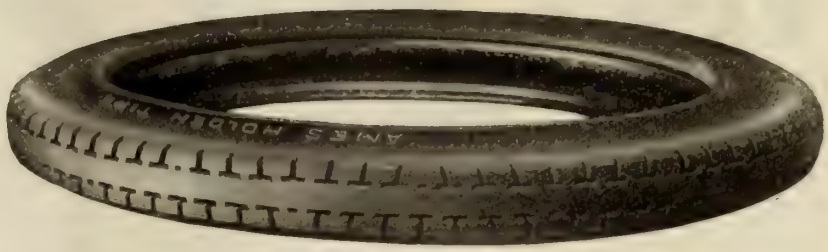
GTD Screw Plates, Taps, Dies, Drills, Reamers, Milling Cutters, Gages, Pipe Tools and Machine Tools.

GREENFIELD TAP AND DIE CORPORATION
OF CANADA, LIMITED GALT, ONTARIO

Greenfield Tap & Die Corporation
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Buy Your Belting

Like You Buy Tires



—BY MILEAGE!

If a tire purchaser ever forgot to buy mileage but bought instead on a low price basis he would find himself the loser by several thousand miles of service — altogether out of proportion to the price difference saved.

The same thing happens when you forget to buy belt mileage.

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Genuine British Oak Tanned



LEATHER BELTING

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PARKER VISES



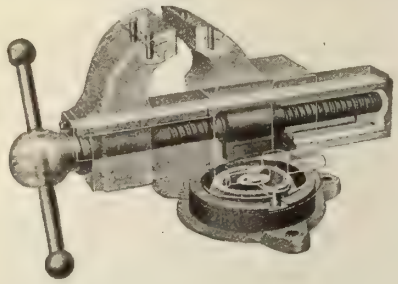
The Handle Will "Stay Put"

They "Grip Like a Grizzly"

Parker Superior Vises have a spring in the handle that prevents it from sliding down its full length with a bang, every time it is used.

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Send for Folder No. 12.
It describes and illustrates several other Parker features.



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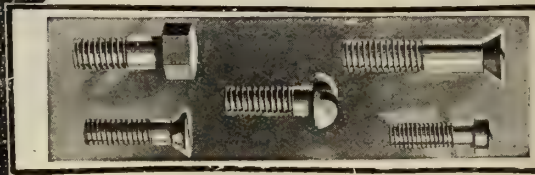
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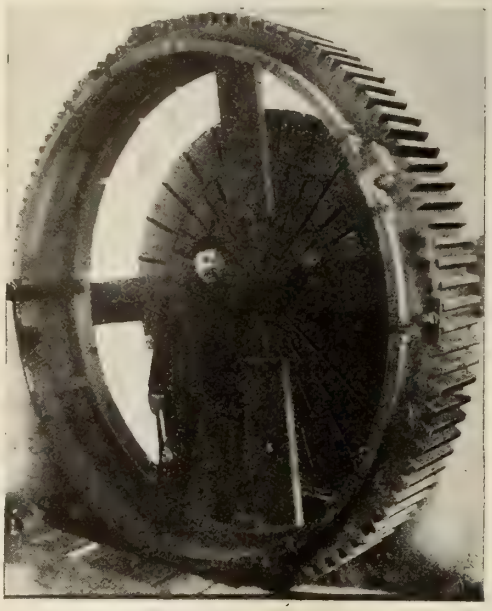
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D27

Hull Iron and Steel Foundries, Limited

HULL, QUEBEC



Specify "HISCO" Regd. Products

Steel, Chrome, Manganese and Nickel

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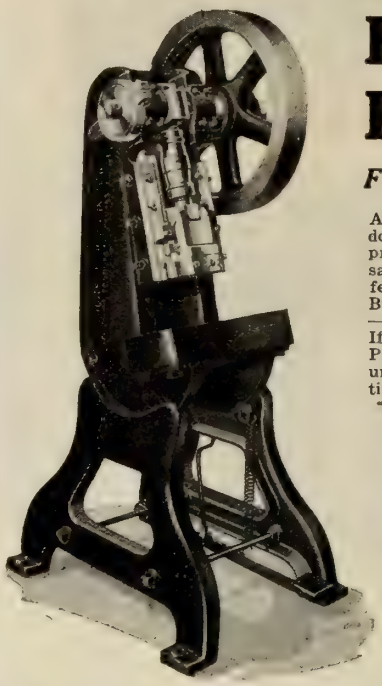
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"HISCO" machine-moulded gears, while requiring no pattern, insure accuracy, dependability, quality, and the price is minus the cost of patterns—which in these days of high prices of lumber and labor is something to be considered.

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For Long Service—

After all, you could no doubt buy any number of presses that would give the same production the first few weeks of operation. But after a year—two years—three years — What then? If it is a **Hepburn** built Press you get production unslackened by constructional weaknesses.

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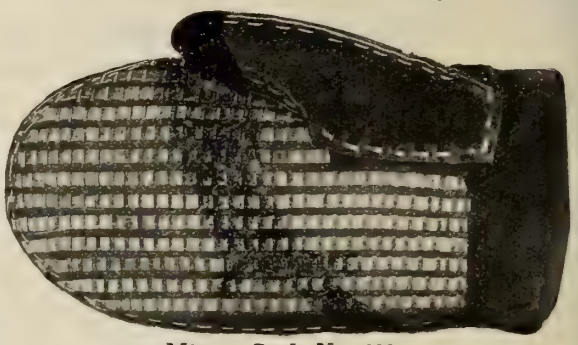
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Engineers and Iron Founders

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Means Better Work



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Roelofson Elevators

Reduce Freight Handling Costs



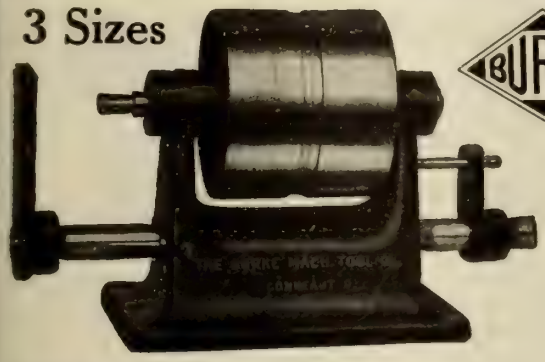
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GALT, ONTARIO

3 Sizes



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It is really amazing the amount of work unskilled labor turns out with Burke Tapping Machines. The sensitive construction prevents tap-breakage; work is done accurately; production costs are considerably reduced. In three sizes: 3-16″ at $25.00, ⅜″ at $45.00 and ⅝″ at $60.00. Ask for details.

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Write for the name of the dealer located in your city.



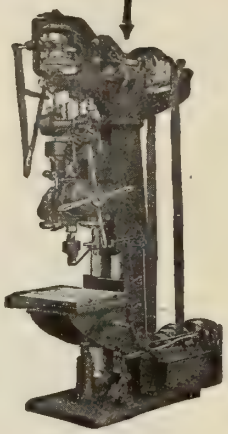
You can obtain **Perfect Results** with this **HIGH SPEED DRILL**

Morse Twist Drill and Machine Co.
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THE JOHNSON FRICTION CLUTCH

As Used on the

TURNER TURRET →

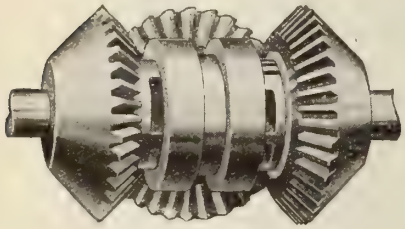


One in the back gears. Another in the tapping reverse.

Size used, No. 5 special double.

"Friction Control" means better machinery.

Courtesy of The Turner Machine Company Danbury, Conn.



Johnson double clutch between bevel gearing.

There is nothing more essential to the efficiency of a machine than a dependable friction clutch. Use the Johnson and take no chances.

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STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

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OWEN SOUND, ONTARIO
ESTABLISHED 1860

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BLISS DOUBLE-CRANK TOGGLE DRAWING PRESSES



"Patented" Bliss Double Crank Toggle Drawing Press in Production

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"Specify Bliss Presses"
"Standard the World over"

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No. 191



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"LION" GRINDING WHEELS

Vitrified and Silicate Processes

CANADIAN WHEELS OF QUALITY

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for grinding low tensile material

LION GRINDING WHEELS LIMITED

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—and when the cutter was taken from the furnace he found—

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That's the kind of results you can get with Hoskins Electric Furnaces. The heat is clean and the temperature control is right under your thumb. The man who does the heat treating does not have to fuss around trying to get the right temperature—he takes care of the **tools,** and **not** the **furnace.** He gets greater production and better tools.

Hoskins Electric Furnace will save you money. Not just for tool rooms are they an economy but wherever metal is heat-treated.

Tell us the work you want done and ask for catalogue No. 122.

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LIMITED
Walkerville, Ont.

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Full service from a file is possible only when the teeth cut keenly.

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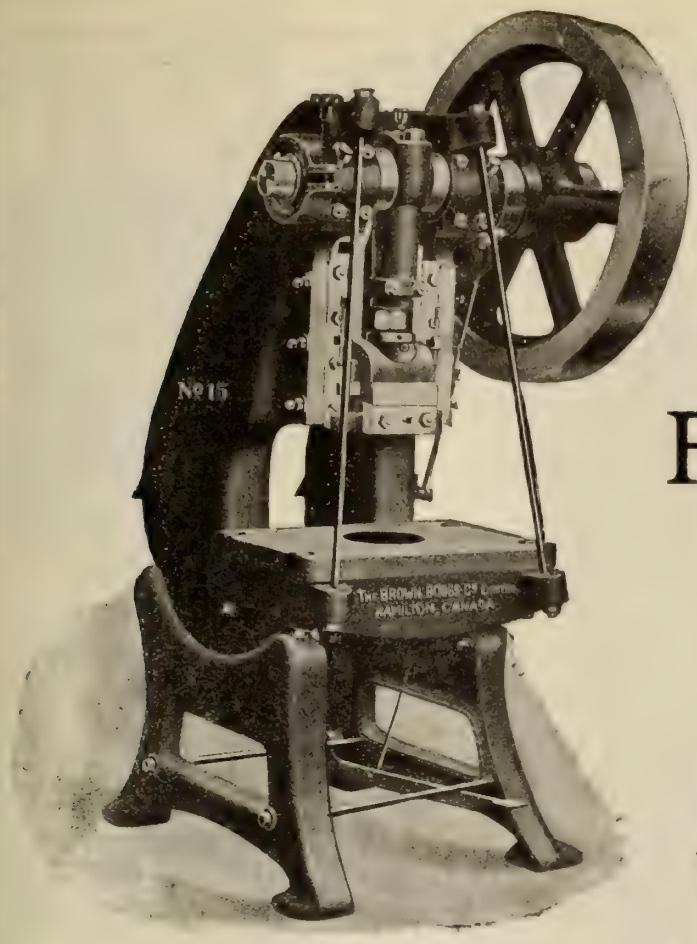
To get long-lasting efficiency, specify one of these brands:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario

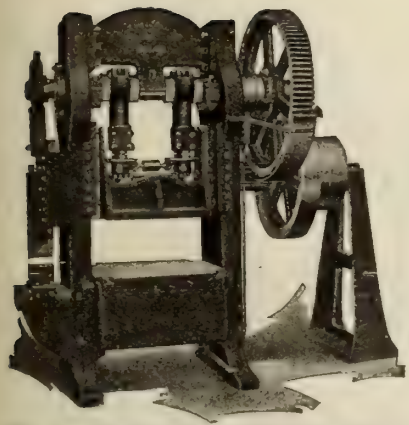


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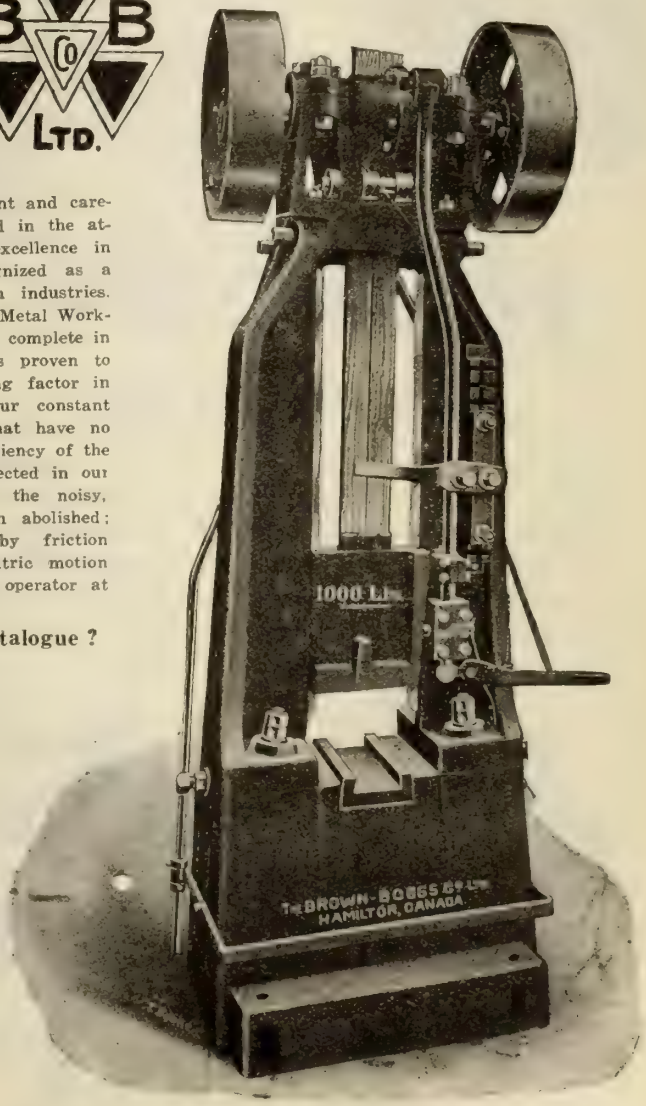
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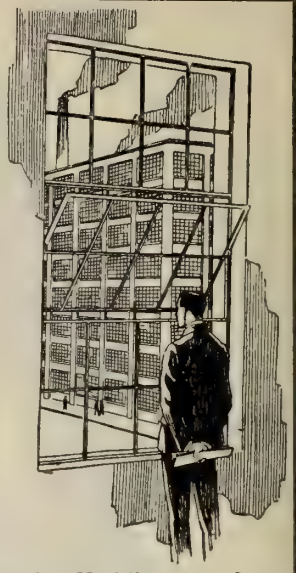
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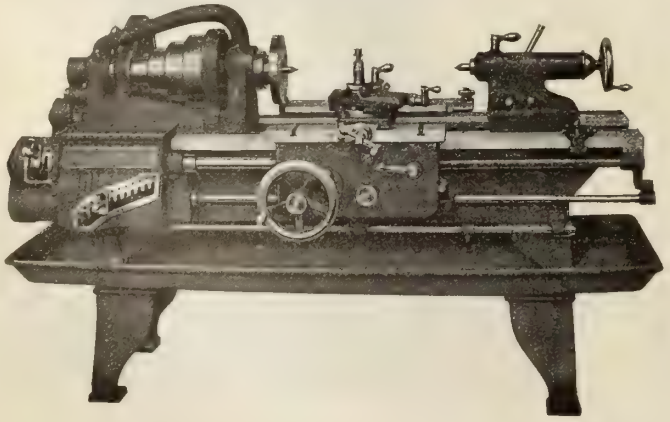


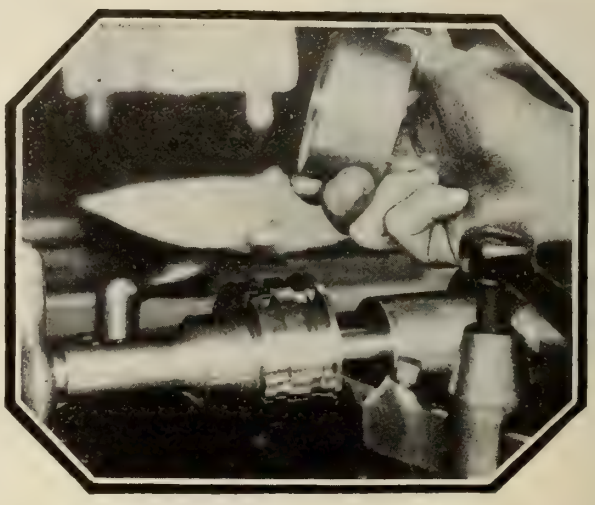
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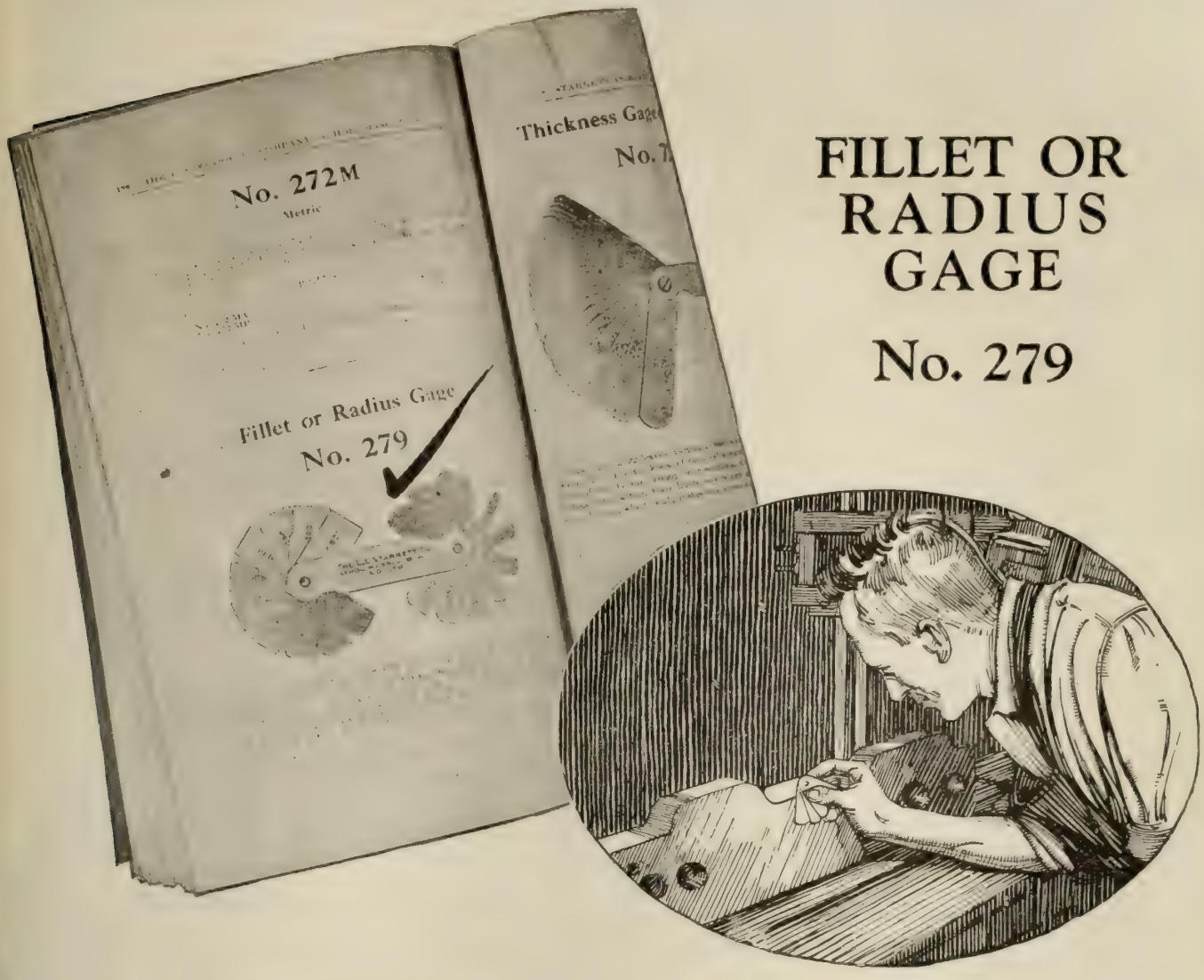
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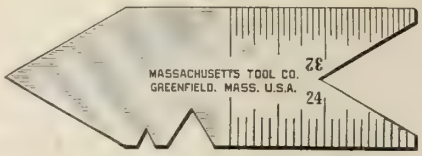
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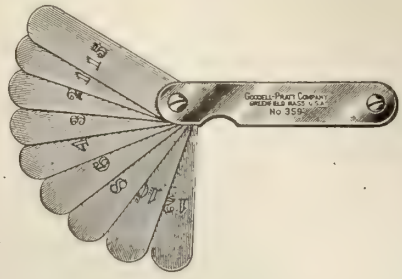
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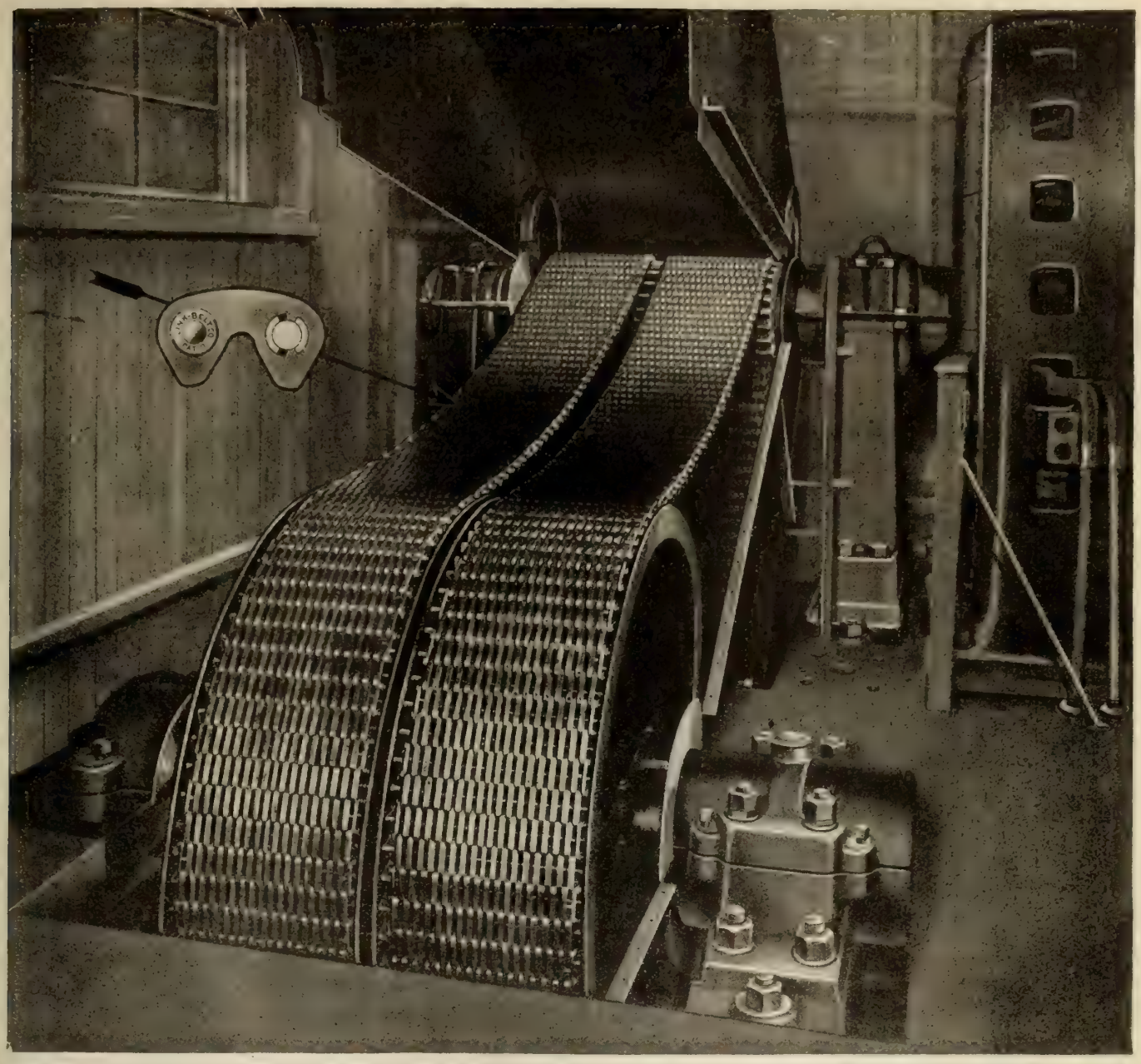
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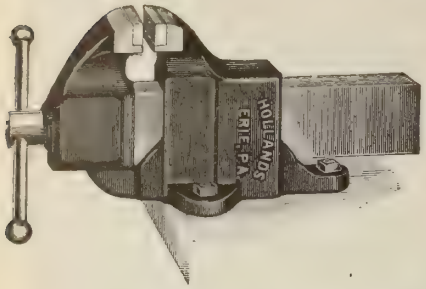
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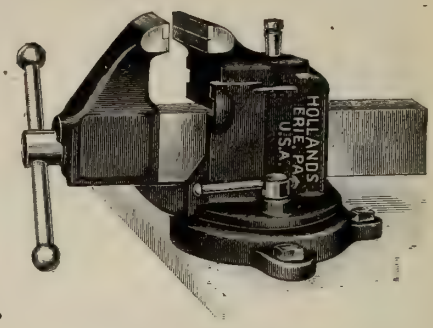
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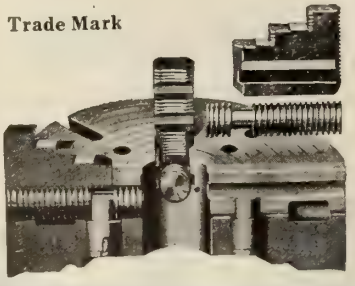
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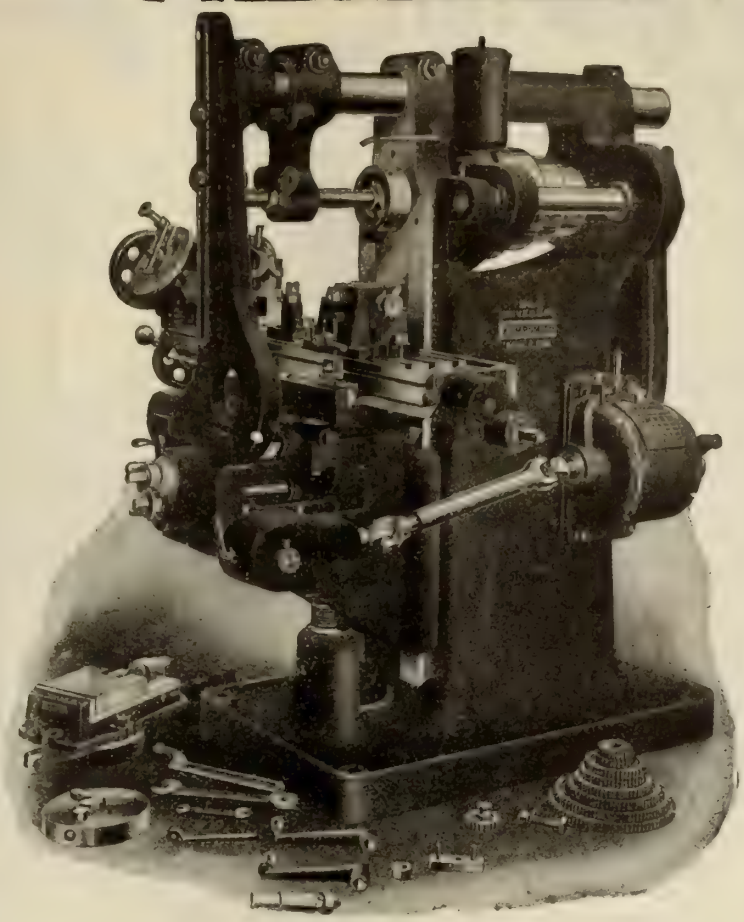
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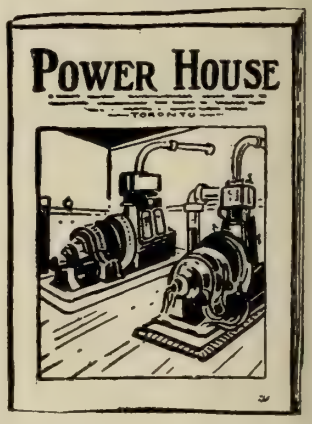
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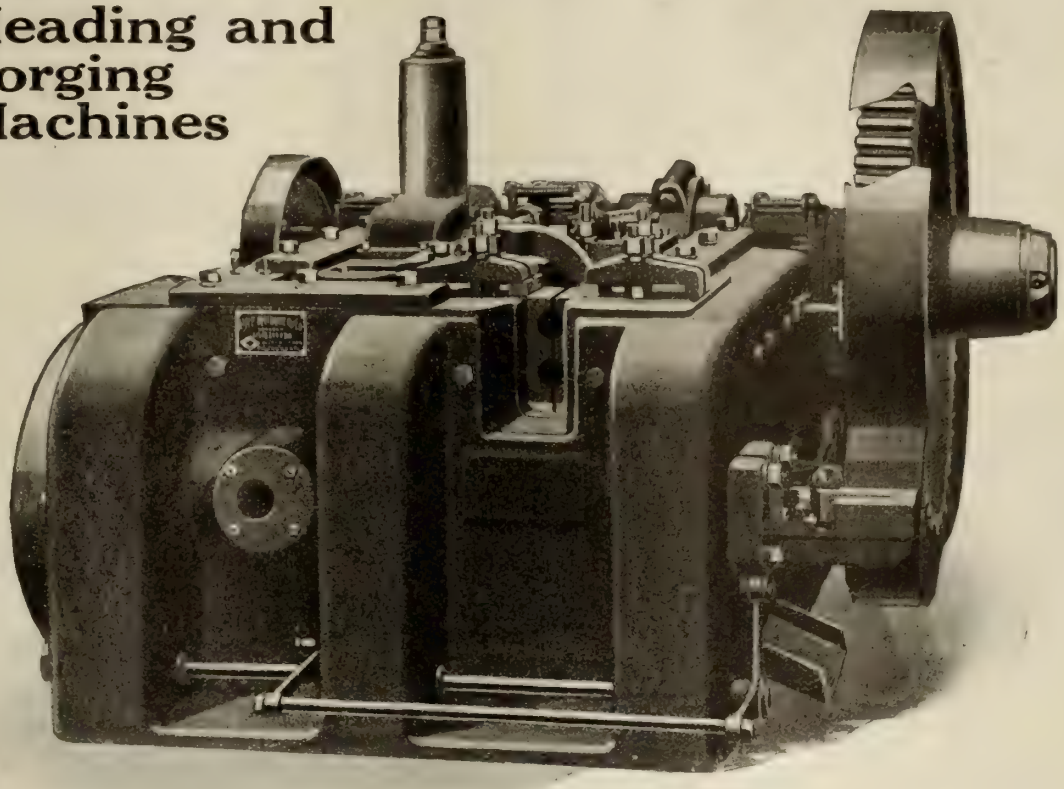
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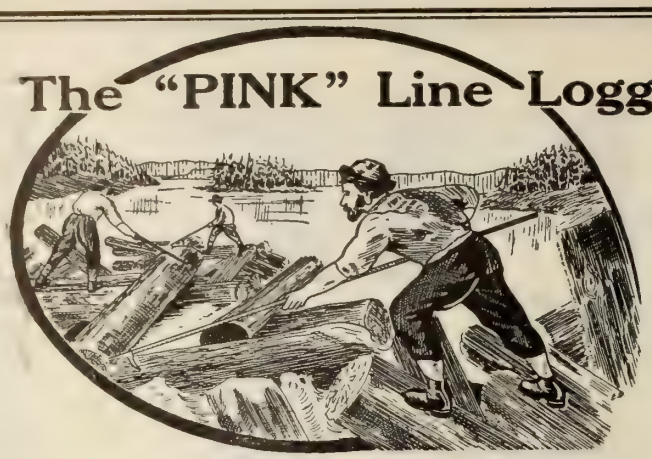
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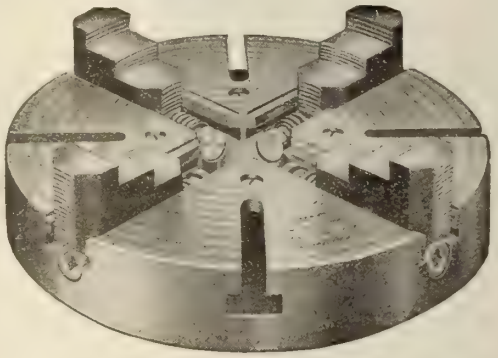
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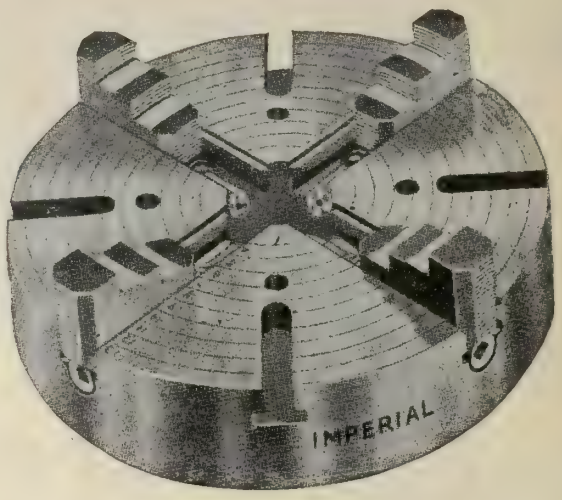
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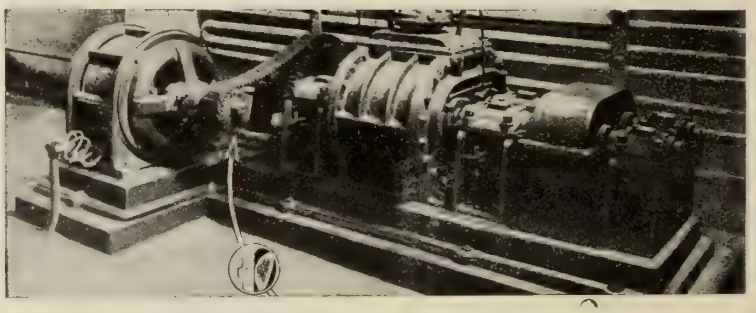
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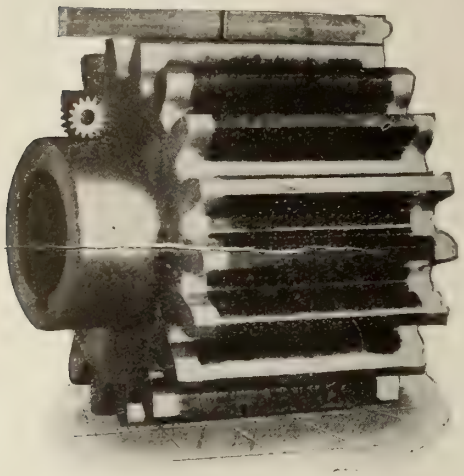
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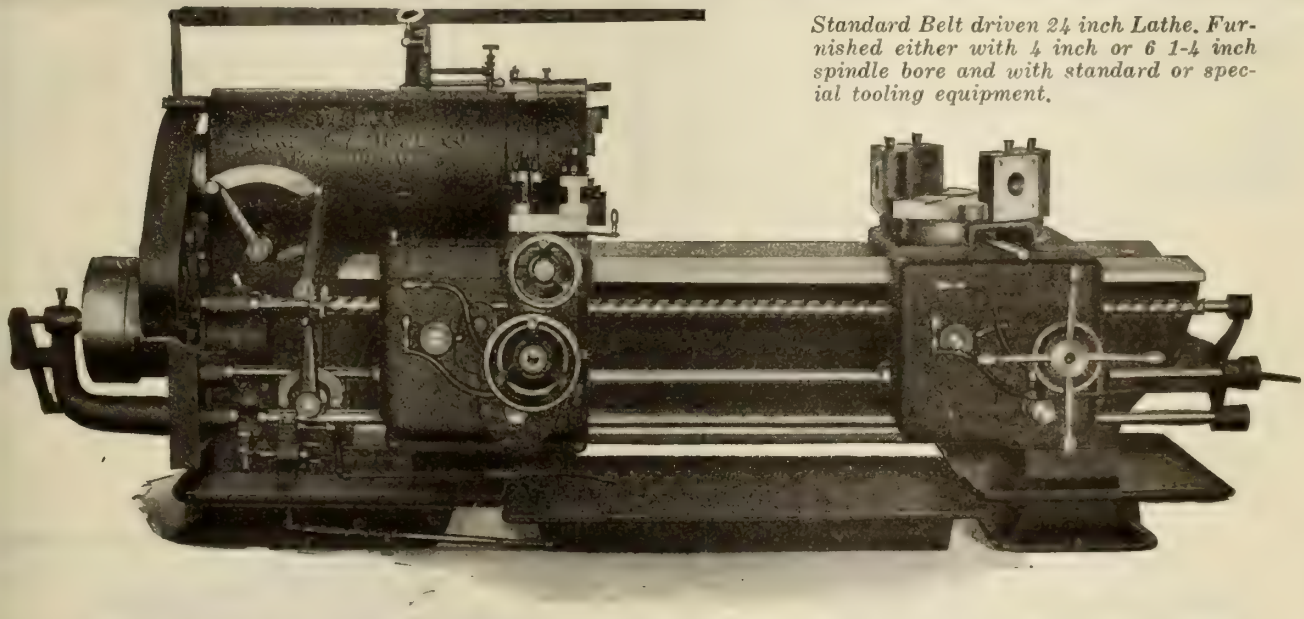
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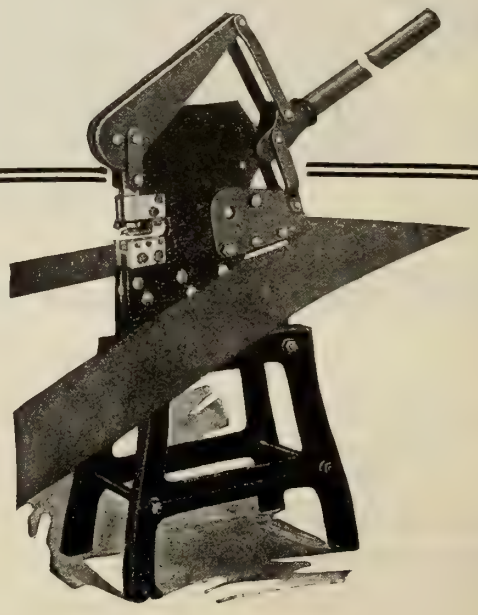
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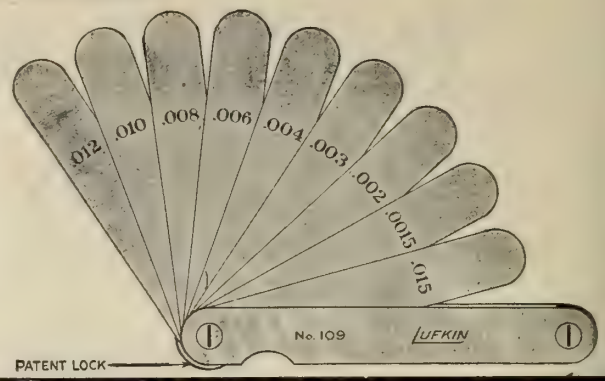
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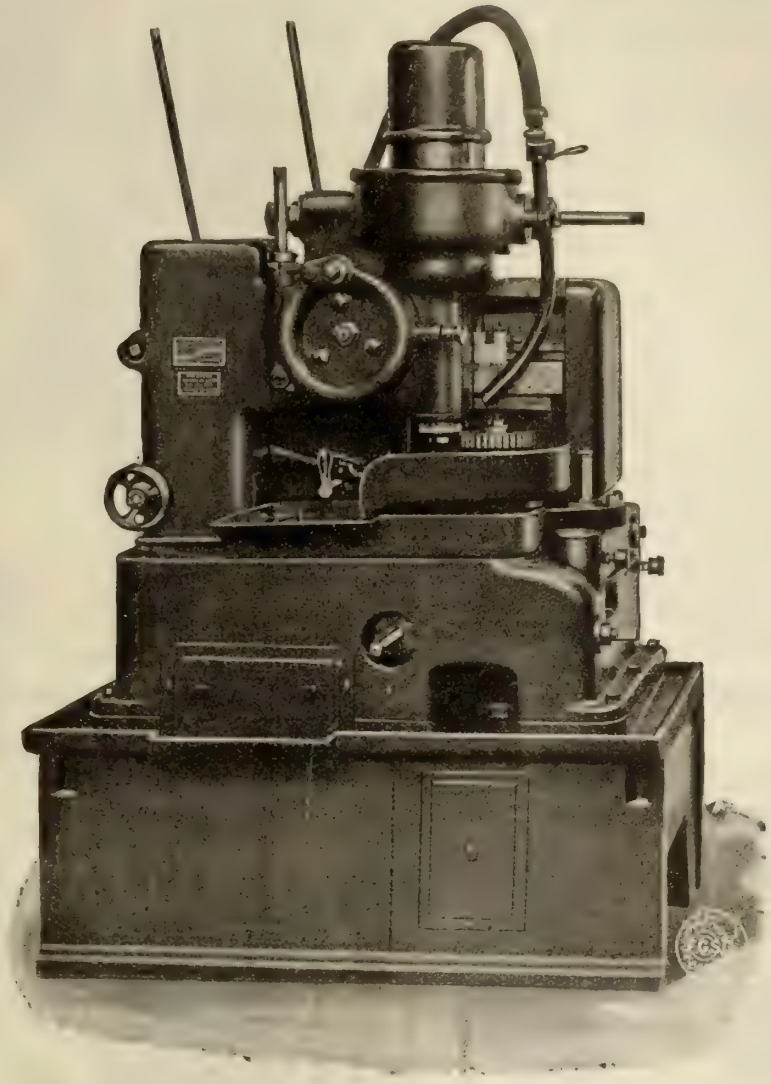
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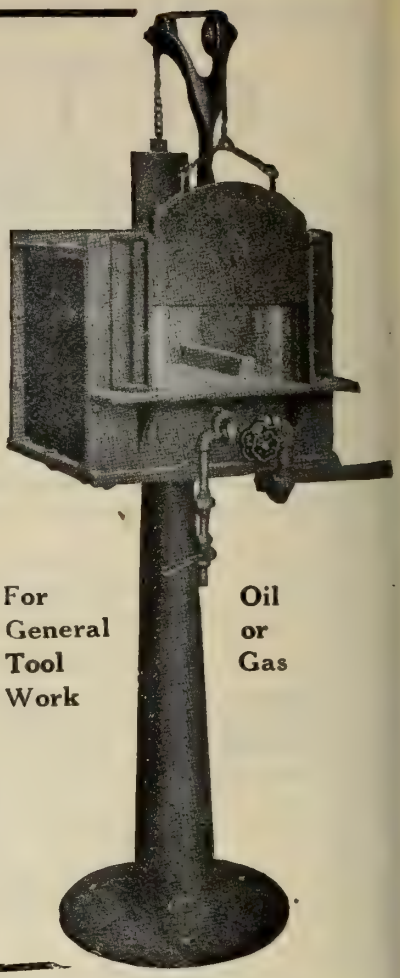
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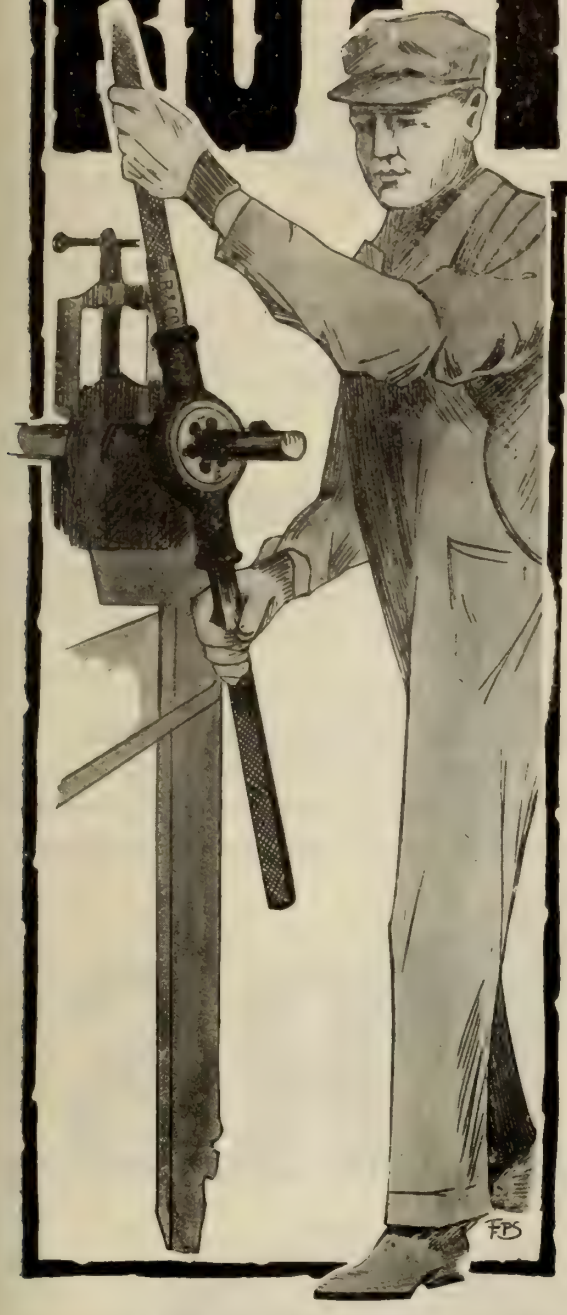
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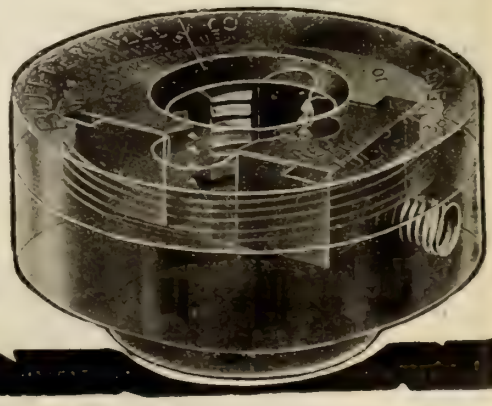
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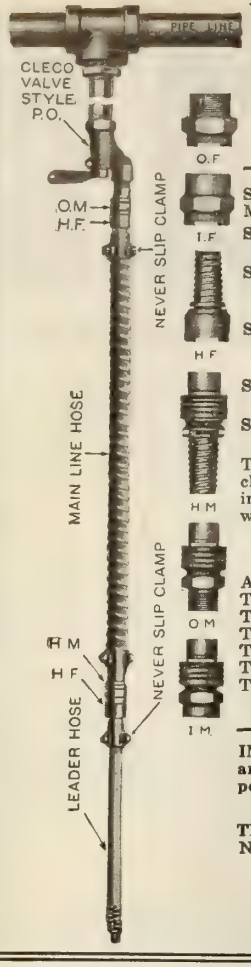
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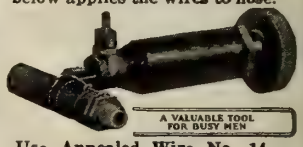
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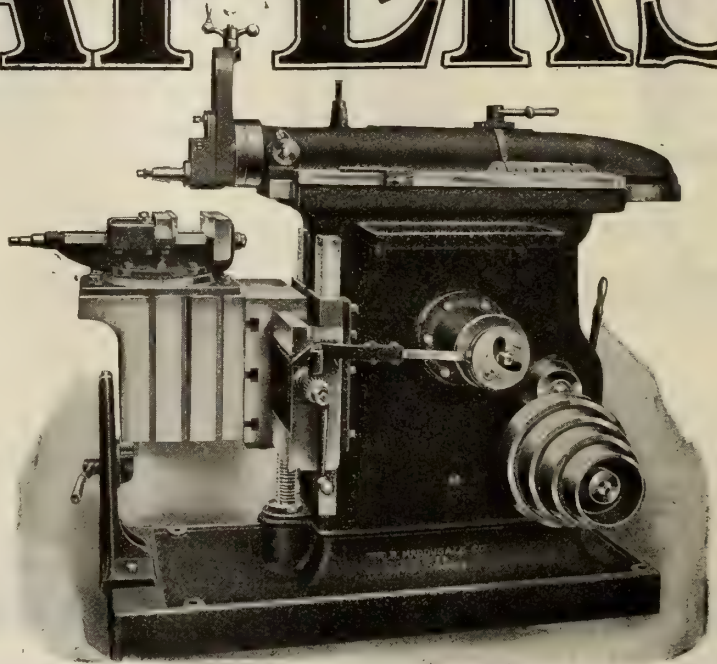
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII. No. 18 MAY 4, 1922

Milling Eight Transmission Covers At One Time

Machining Four Spur Gears Simultaneously—Producing Cluster Gear at High Speed—Method of Machining Piston—Milling Two Thousand Sad Irons Every Ten Hours—Brake Lever Fixture

By J. H. MOORE

THE AUTOMOTIVE industry has done much to advance the development of automatic machinery. Even a casual visitor to a modern automobile plant cannot help but be impressed when he sees the number and variety of automatics used. Skilled labor is dispensed with as much as possible, the machine, rather than the operator, doing the thinking. It is impossible to discuss all types of automatics in one article, and in the present instance we will confine the example of work produced, to one type of automatic lathe and one style of continuous milling machine.

The automatic lathe we are about to discuss is designed for the rapid production of duplicate parts in large quantities. The work is usually either held in a chuck, or mounted on an arbor between centres as in the case of an ordinary lathe. The drive clutch is then thrown in, and the feed worm lifted into position. Both feeds are thus started and continue until the side carriage trips the feed at a predetermined position. Quick return to starting point is taken care of, and the operator throws out the clutch, removes the finished work and completes the process all over again. With this automatic feature, one operator can run two or more machines depending upon the nature of the work produced.

Both the side and right angle carriages of the machine are arranged to carry multiple tools, the side carriages being used for turning diameters, while the right angle carriage is used for facing and slotting. Four or more tools can be used on each carriage at the same time, this feature of course, placing the tool on a high productive basis.

Various speeds and feeds are arranged for, and the feed for the right angle carriages is obtained through a drum driven by rack and pinion Any shape of cam can be mounted on this drum, making it possible to secure feeds on the rear head different to those provided by the feed gears for the turning head. With this brief description of the machine itself, we will pass on to Fig. 1 which shows a cluster gear machined in the following manner.

The first operation is to bore the centre hole, and face both outside ends. Two half-inch holes are then drilled in the face of the largest diameter to be used for driving purposes. The piece is

Figs. 1 to 5 through courtesy of Rockford Machine Co., Rockford, Ill. Figs. 6 to 8 by permission of Becker Milling Machine Co., Hyde Park, Boston, Mass.

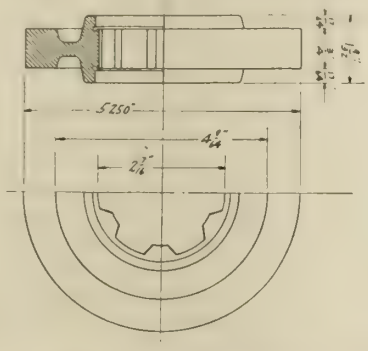


Fig. 3.—Details of spur gear.

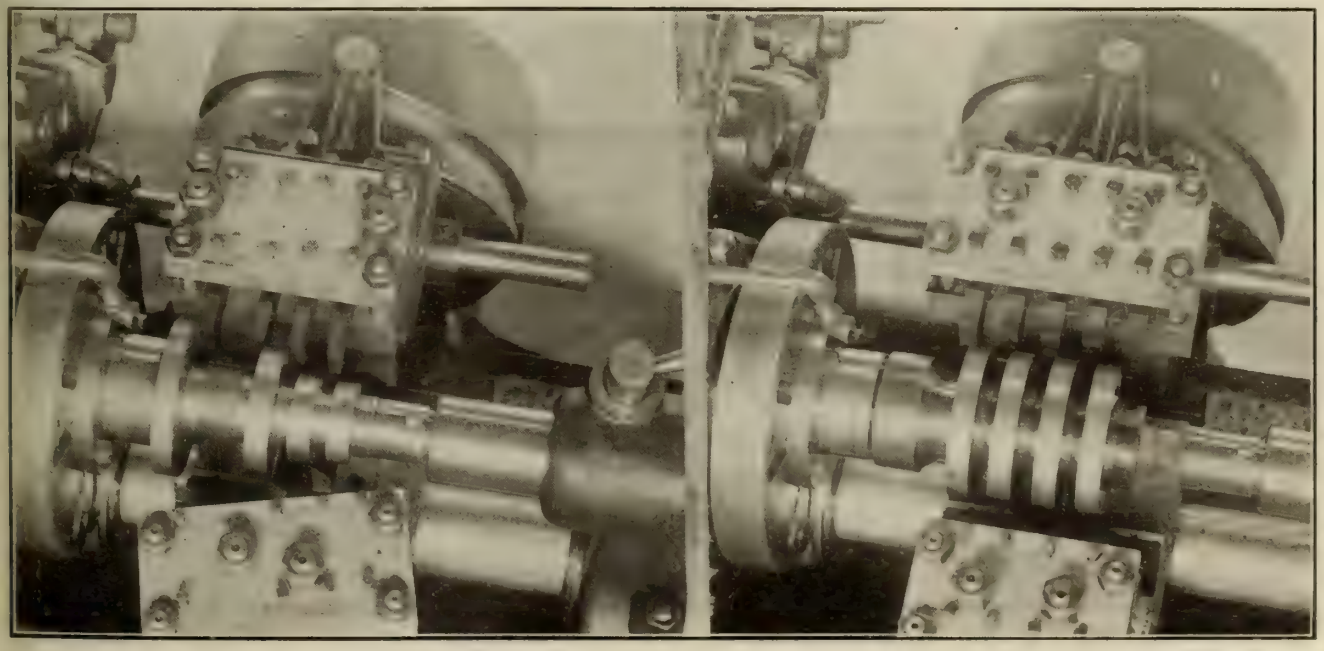


Fig. 2.—Left: Turning outside diameters of cluster gear.

Fig. 4.—Right: Four spur gears being machined at one time.

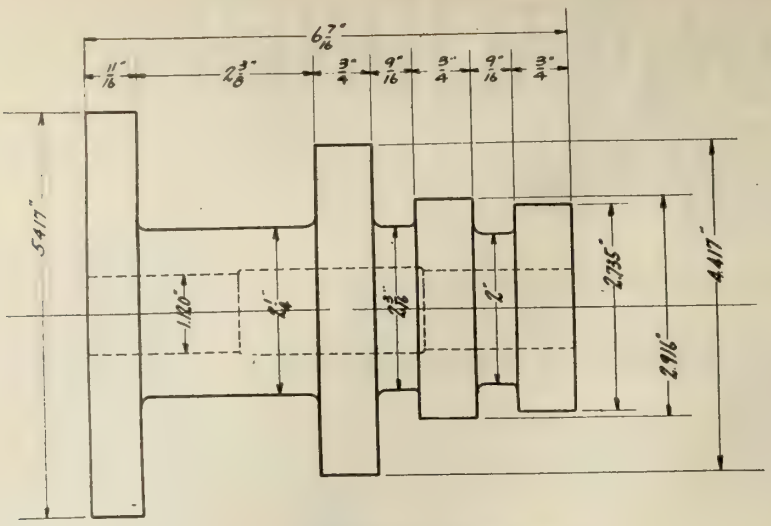


Fig. 1.—Line drawing of cluster gear.

next mounted on an arbor and placed in the lathe as shown at Fig. 2. The outside diameters are turned by four tools in the front carriage, while all sides are faced with tools in the rear carriages.

A special arbor is used on this work with a tapered end which fits into the taper hole of the spindle and the rear end is supported in a special fixture which fits into the tail stock spindle and is bronze bushed, this allowing the arbor to run in the bearing, instead of being supported on the regular center. This makes a more rigid job.

A ball bearing is placed between the rear end of the gear and the tail stock spindle thus avoiding any friction which might take place with the regular collar. The tail stock spindle is provided with a special lead screw, so that the spindle can be returned rapidly thus avoiding loss of time when changing gears. The cluster is finished in two operations, roughing and finishing, and the total production time for one machine is seven minutes. If an operator is handling two machines, the complete gear is made in less than four minutes.

Machine Gear Spurs

Fig. 3 shows a detail view of a spur gear, while Fig. 4 shows four of these gears being machined at one time. The parts are first bored, then the keyways broached and a special splined arbor is provided, this being of sufficient length to accommodate four gears with spacing collars at one time. The gears are finished in one operation, all facing and turning being done at the same time. Four gears are completed every three minutes with this set up.

Fig. 5 shows a sketch of a piston machined on this type of automatic lathe.

In completing these pistons they are first chucked from the inside, and the skirt end bored and faced. They are then taken to a drill press, mounted on a suitable fixture and a cross hole rough bored. They are next placed on the automatic lathe, rough turned, and the slots cut at the rate of forty-five per hour, one operator running two machines thus producing ninety pistons per hour. This type of machine is also adapted for the turning of cone pulleys, or any other work where turning and facing operations can be accomplished at the same time.

Milling Transmission Cover

Continuous milling has proved a very valuable production aid and since its innovation, many improvements have

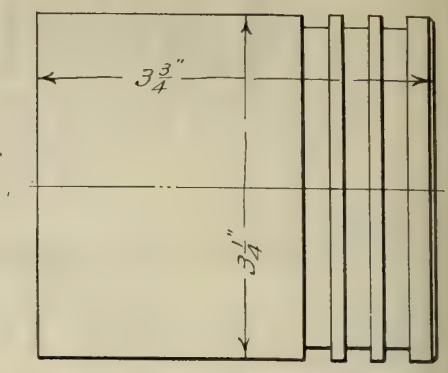


Fig. 5.—Details of machined piston.

taken place. We now have special machines for milling the ends of axles, cam shafts, etc., some of these being of the drum type. The work shown in this article however is completed on vertical spindle machines.

Fig. 6 shows a machine equipped to mill eight transmission case covers at one time. Four of these parts are placed in a position to have the large flat area milled, while the other four are set end up, the boss being milled as shown. This is a good example of careful fixture design and illustrates what can be done by a little thought. Note the simple method of clamping and how the vertical fixture clamps fit into the slot on the locating pin holder.

Fig. 7 shows an interesting shackle torsion fixture. Twenty-four parts are accommodated at one time, and it will be noted that four of the stations are left unfilled for clearness of view. The design of the clamps, how they are quickly released, etc, can be plainly noted in the photograph and attention is drawn to the slot in the bushing behind the clamp which keeps the clamps in proper alignment. A high production rate is obtained with this fixture.

Milling connecting rods by the continuous method is now common practice and the production rate in many cases has more than doubled since its adoption. When six, eight and twelve cylinder cars were developed it meant that more connecting rods were required

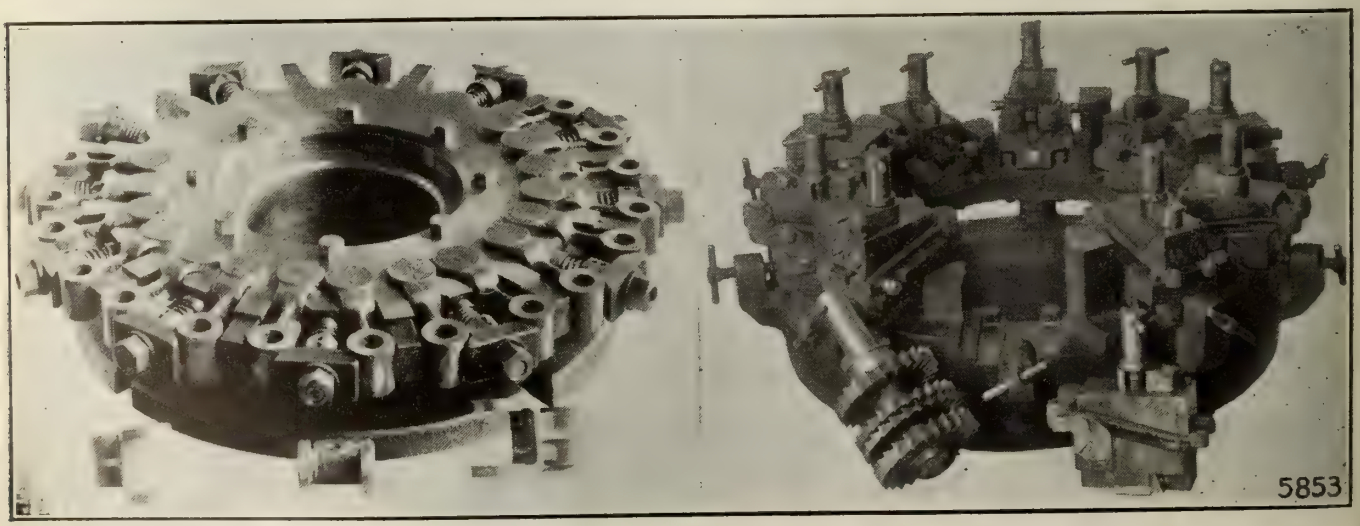


Fig. 7.—Left: Fixture for holding 24 shackle pieces.

Fig. 8.—Right: Fixture for holding brake levers.

every year and by placing these in special continuous milling fixtures, output naturally increased. For example a double spindle vertical miller, together with suitable fixture, can produce 13 in. rods at the rate of 45 per hour, while on smaller sizes, as high as 90 per hour can be completed. The number of rods held at one time varies from 12 to 20 and on the double spindle machines, both ends are finished simultaneously.

In the making of sad irons, a smooth surface must be obtained on the bottom. This is often accomplished by means of a vertical miller and on the type of machine we have already illustrated, two hundred of these irons have been milled per hour. The fixture used to secure this production held 14 parts at one time, in other words two thousand of these castings were completed every ten hours.

The milling of motor frames for automobile starters is another operation that lends itself admirably to continuous milling. On one fixture holding ten frames at one time, a production rate of 80 per hour was secured.

Milling spring seat caps is another good operation. These castings are made of malleable iron, and in a fixture holding twenty caps at one time, a production of 100 per hour or 900 per nine hour day was obtained.

In the manufacture of automobile starters it is necessary to machine both sides of the cover. This is the style of operation peculiarly suited to continuous milling, as long and tedious set ups are avoided. The irregular shape of the covers are well taken care of by a suitable fixture holding 14 pieces at once and in this case production was increased to 400 per ten hour day.

Considering a final example, refer to Fig. 8. The fixture shown is a continuous milling jig to accommodate hand brake levers. These are drop forgings and the operation is straddle milling. Four faces are machined in two operations. The production rate being 80 complete levers per hour.

It will be noticed that each jig is a unit in itself, although mounted in one circular block and that in one case, the small end of the lever is exposed, while in the other, the large end is toward the cutters. This, of course, explains why the cutters on machine arbor are spaced as shown. It means that production can be increased, set ups can be avoided and the levers completed rapidly in two operations.

In work of this nature, the design of the fixture is very important. To get the most out of a continuous milling machine, the fixtures must be made to reduce lost motion to a minimum. The operator should always be kept busy loading and unloading and speeds and feeds should be studied closely. Speed up the machine to the limit and make sure the cutters are of good steel. A case in point. In a certain automotive plant, name censored for obvious reasons, a continuous miller was being used to machine connecting rods. The production was disappointing and some felt the machine was not all it should be. In fact the changing to another method of machining was being contemplated. Eventually the firm decided to have one more try and they made the best cutter they knew how. As they felt the fixture was O. K. they left it alone, with the result that production was more than doubled. The cutter, not the machine, had been at fault. Therefore, make sure of the cutter and fixture used, the capacity of the operator, and the rapidity with which he receives his parts, before you blame the machine.

A 20-page booklet has been published by the Hydraulic Society, New York, entitled "Trade Standards in the Pump Industry." This work explains what is meant by trade pumps, plain fitted pumps, or brass fitted pumps; what is considered standard equipment for trade pump and what are considered extras; typical sizes of trade pumps are shown and definitions are given of terms used in the industry such as static head, total dynamic head, static suction lift, dynamic suction lift, etc. The booklet is recommended by the society as a guide to pump users.

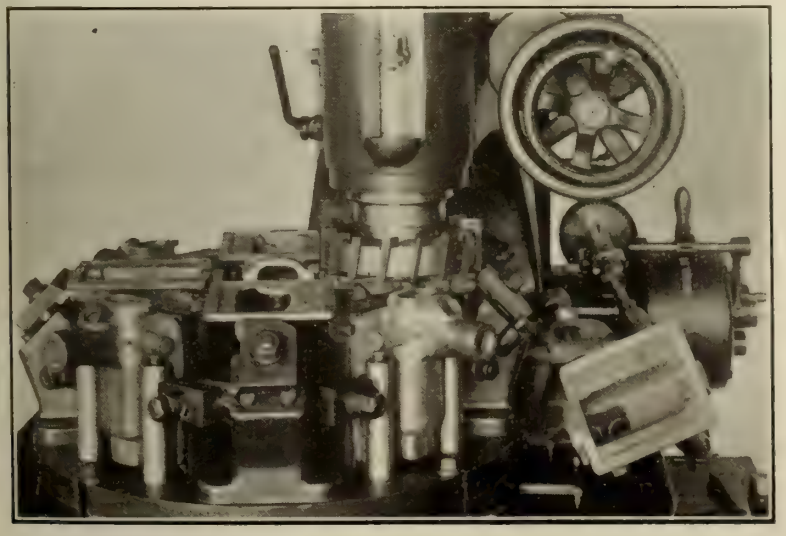


Fig. 6.—Machining eight transmission case covers.

NEW SHAFT COUPLING

An ingenious method of coupling shafts for power transmission has recently been devised by the Coventry Chain Co. of Coventry, England. It comprises a double chain, i.e., two chains side by side, which passes round toothed flanges on shafts which it is desired to couple. The coupling is readily made by a bolt passing through adjacent links connecting up the two ends of the chain in the usual way. The coupling has a very high factor of safety, it is perfectly balanced, being machined all over, and does not require any lubrication.

The facility for disconnecting the shafts will be apparent, and the method gives a large number of possible adjustments by which one shaft may be angularly set relative to the other through the medium of the teeth into which the rollers of the chain are fitted. Although this coupling is not designed to replace universal joints it is obvious that a measure of flexibility is obtained, and it is stated that the coupling can be used to couple shafts with a deviation in angular movements of two degrees.

Relative end movement between the two shafts is also provided for, limited to about 1-16th of the shaft diameter. A special application of this chain coupling is with regard to automobiles, particularly in such cases as that of the magneto shaft where angular adjustment is sometimes required and where a slight flexibility is considered advantageous to avoid transmission of small vibrations. The coupling is manufactured in fifteen sizes which have been completely standardized, the largest type being capable of transmitting 180 h.p. at 100 revolutions per minute.

ARTIFICIAL DAYLIGHT

One of the most interesting problems in illumination is to provide an artificial source of light which will exactly reproduce ordinary daylight. One way of obtaining the desired result is to filter the light of an electric or other lamp through special glasses, but a British inventor recently produced another form in which all the light is reflected from an umbrella shaped reflector on which patches of certain colours are painted. All the light used comes from this reflector and is modified by the colours to give a very exact imitation of daylight. An improved form of this artificial daylight apparatus has just been patented. The reflector consists of two layers of material perforated with holes so that a certain number of spots of the colours are exposed. Radial strips of another colour are placed over the perforated layers, the whole arrangement being mechanically strong and giving the correct areas of the various colours to provide artificial daylight.

E. M. Ashworth, manager of the Toronto Hydro-Electric System, is the new president of the Electric Club.

Mastering The Goggle Problem In Our Plant

Making Every Employee Wear Goggles as a Protecting Measure —Using a Sweat Pad as a Help in Hot Weather—Convincing the Men That it is to Their Advantage to Wear Goggles While at Work

By G. A. KUECHENMEISTER
Personal Manager of The Dominion Forge and Stamping Company.

"GEORGE wants to see you." That was the message I got one day while going through the shop. When I saw George, the superintendent, he told me that he wanted an order put up at once that all men in the hammer shops **must** wear goggles **all the time.** An order like that coming from the superintendent staggered me for a while but I finally "came to" and began to realize that the long hoped for event was about to happen.

Before writing the notice that was to make "safety history" in our shop, we discussed the matter thoroughly and came to several definite conclusions.

First, that we did not need a new order; that the rule in our book needed only to be enforced.

Second, that what had been done in the grinding department, i. e., allowing no man to work in that department without goggles, could be done in all the other departments.

Third, that no man ever began wearing glasses until he had been convinced that it was necessary for him to do so. We determined to provide the incentive and make it necessary for men to wear goggles.

Fourth, that knowing the dangers that the men were exposed to, it was our duty to take a firm stand and prevent the loss of eyes in our shop. With this in mind, we posted the following notice:

NOTICE

During the past few years the company has spent thousands of dollars installing many mechanical guards on machines and rebuilding the plant for the purpose of providing safe working conditions.

There are, however, many hazards that cannot be eliminated by mechanical guards and must be taken care of by the men.

Eye injuries can be stopped by wearing goggles. Many of the men now wear goggles **all the time** and rarely, if ever, get "foreign bodies" in their eyes.

The eye injury sustained by Theophile Tousignant on May 3rd would not have occurred had he been wearing goggles. It was only luck that has kept him from losing one or both eyes, and he says he has learned his lesson and will wear goggles from now on.

In order that this lesson be brought home to all of the men, and to henceforth prevent serious eye injuries, Rule No. 19 which reads as follows:

"GLASSES OR GOGGLES MUST BE WORN BY ALL EMPLOYEES WORKING AT EMERY OR OTHER GRINDING OR POLISHING WHEELS; WHILE CHIPPING STEEL. IRON OR CONCRETE, CUTTING OFF RIVETS, BABBITING, POURING MOLTEN METAL OR ANY OTHER OPERATION LIKELY TO CAUSE EYE INJURIES."

will be considered to mean that every man in the hammer departments must wear approved goggles or glasses **at all times,** and men in other departments must wear them as stated in the rule.

Goggles will be furnished free in the first-aid room as in the past and every man is requested to secure a pair at once.

Foremen will be responsible for the enforcement of this rule.

The notice was posted on the main bulletin board Saturday noon, and we waited anxiously to see what would happen when the men read it Monday morning.

The answer came quickly when the men saw the notice. It was "Huh, this should have been done a long time ago."

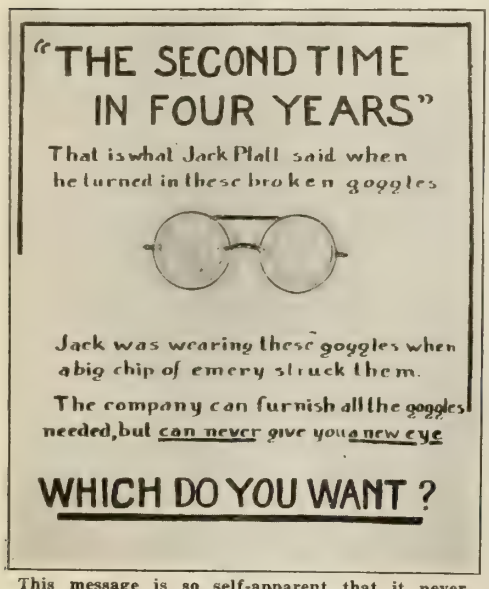
Of course, there were a few of the men who insisted they could not wear goggles but none of them said they would not. When these men complained to the foremen they found in several cases that the foremen were in the same fix; that they, the foremen, found wearing goggles very annoying and in some cases a real hardship until they became accustomed to them.

One of our best foremen faithfully began wearing large glasses the morning he read the order. He was complimented by the manager and replied that if the men had to wear them he would do the same thing. Three days later he came into the office and announced that if he had to continue wearing glasses he would have to quit his job. We laughed at him and told him that he would neither quit his job nor quit wearing glasses; that the order was not intended to force any man out of the shop and surely not him.

He insisted that it could not be done; that he was suffering from unbearable headaches and that he was through right there and then. We only smiled and asked if he knew of a good eye specialist. He said he had a friend who was an eye specialist. In five minutes we had the doctor on the phone and in an hour the foreman was on his way to the office.

That foreman came back in a few hours and told a story that made us wonder how many more like him we had in the plant. He told us that the doctor had proved to him beyond any possibility of doubt that it was his left eye that was causing the trouble. He said that the doctor had asked him when he had the left eye injured and that he had answered "fourteen years ago." According to the doctor this man should have been wearing glasses for the past ten years and it was only the goggle order that had forced him out into the open where he had to submit to an examination that showed a real need for immediate attention.

This man had a reputation for being irritable and peevish, and had to be



This message is so self-apparent that it never fails to get across.



Another type of bulletin used to emphasize the message of safety.

handled with kid gloves. He very often refused to take part in social doings at night because he "wasn't feeling well" and he was considered quite a "crab." When that man had the proper glasses fitted to his eyes he was a changed man. Now he comes in and slaps you on the back, and is as jolly a character as there is in the plant.

We do not believe that a miracle was wrought in a day. We do believe, however, that our persistent efforts covering a number of years did at last bring results. Had we tried to put across an order of that kind without the preliminary work it might have resulted in a young riot.

It has been our aim to prove to the men that the goggles we provided, free of any charge, could be worn without undue discomfort, and that in every case where headaches were complained of the trouble was in the eye and not in the goggle.

We had proved to a dozen men that they not only needed to wear goggles in the shop all day, but that they needed to wear glasses with special lens **all the time.** We proved it by the simple method of taking them down town to our eye specialist, or one of their own selection, and having their eyes tested. In every case they were sent back to the plant with a prescription for a lens that corrected the defect found in the eye.

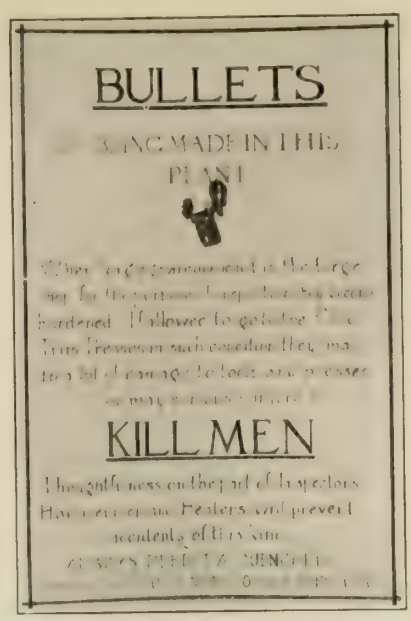
In those cases we then gave the man a goggle frame and had him have a lens made to fit the frame. We paid for the examination and the man paid for the lens. There was never any unwillingness to pay for the lens on the part of the man after we had paid to prove that he needed to wear glasses.

We have men who try to beat the game whenever they think they can get away with it. Those same men will beat the clock and break the rule against smoking in like manner, but they do not last long.

Not long ago a young man was called into the office and was told he was being let out for two reasons; i. e., for being caught without his goggles three times in two days and because he was producing just half of what other men could do on the same machine. Two very good reasons and of equal importance in the plant since the goggle order went into effect.

A colored boy came in the other day and cursed the goggles and vowed he could not and would not wear them any more. We laughed at him and jollied him, and he became serious and said he simply could not wear them because "they made him sweat." Nothing we could say would convince him. Solicitation about his losing one of his beautiful brown eyes only made him say that he did not care what happened to his eyes —he couldn't wear goggles.

After such a positive statement there was nothing to do but tell him that, although we were very sorry to know that he did not care whether he lost an eye or two, we would be sorry to hear about



it when it happened and that we were dead sure of one thing—that it would not be lost in our plant.

While going through the motions of getting his "clearance" papers so that he could get his pay in full, we incidentally handed him a broken, blue, glass eye and told him to take it; we told him we knew he would some day need it and we wanted to show him our hearts were in the right place and save him ten or twelve dollars. The old story worked. He is wearing goggles and says he needs no "sweat pad" because **he does not sweat!**

We feel that merely putting up an order that goggles must be worn will



Showing how the respiration pad fits over the forehead.

not instantly cause the men to madly scramble for goggles and faithfully wear them. It is too serious a matter to handle in such an abrupt manner. We have proved, to our own satisfaction, that men can be induced to wear goggles while at work and that an order compelling them to wear them all the time, after the preliminary work has been done, provides a good starting point for an intensive campaign. It takes the whole matter from a "do it if you like" affair and puts it in position where it can be handled as any other shop ruling that requires discipline to maintain.

C. O. Hurlbut, shoe manufacturers at St. Mary's, Ont., will erect a new shoe factory shortly. It is expected that the town will vote on guarantee bonds amounting to $20,000.

HOW TO LUBRICATE DRIVING CHAINS

WE HAVE read with interest your short article on page 68, Feb. 2 issue, on the subject of "Lubrication of Driving Chains," says H. A. Weston, of the Canadian Link Belt Co. "As manufacturers of roller chain for power transmission on trucks and tractors," continues Mr. Weston, "we have had considerable experience in the care and operation of these chains and believe that suggestions outlined in your article are good ones.

"We have also found that the use of a lubricant the grade of an extra heavy engine oil is superior in many cases to greases or graphite compounds, as an oil which will flow readily has a tendency to form a film around the bearing surfaces on the pins and bushings. The wear which takes place in a roller chain, and which allows the chain to become elongated takes place between the bushings and rollers, and although these parts are case-hardened a film of oil is necessary to reduce wear and prevent cutting and burning. A hard grease or graphite sometimes will not form this lubricating film.

"Among the large users of chain driven trucks and tractors we find that those who keep their chains in the best condition apply some sort of extra heavy engine oil to the chains with a brush every morning before leaving the garage. This fairly light oil will not retain grit to any great extent, and, flowing freely, it has a tendency to wash out the chains when in operation.

"We feel that the only really successful lubrication for roller chains is by the use of a tight casing, giving the chain an automatic oil bath and washing out any dirt which might accumulate and causing to be formed constantly the highly important film oil on the bearing parts."

EXPRESS GOODS SERVICE BY AIR

In spite of the depression in the world of aviation, the organisation of aeroplane services between London and the continent continues to develop. The lighting arrangements, which will enable regular flying at night to be carried on across the channel, have been completed, and several machines have been equipped with the necessary instruments for these night flights which will be carried out under practically all conditions of weather. What the British organisers are aiming at is a reliable and constant goods service between London and Paris, so that parcels consigned from the provinces to London or to Paris on one day will be delivered at the other capital on the following morning. As soon as this regular service is established it is expected to be largely patronised owing to the fact that the aeroplane can beat the ordinary means of transport by many hours.

Careful Tool Set-up Assures Better Production

Automatic Machines Should be Kept in Good Condition—Operator Must See That All Settings Are Properly Made Before Starting Machine—Effective Feeding Mechanism Reduces Unproductive Time

By DONALD A. HAMPSON

THE AUTOMATIC screw machine is the oldest and best known of the automatic machine tools. Only a few weeks ago occurred the death of the inventor of the Spencer automatic, which is the prototype of the single spindle automatic now in widespread use, the exception being the Brown and Sharpe machine.

There are full automatic millers, drills, and turning machines, but these are employed mostly in great production plants such as those in the automatic field. Even these are seldom "full automatic" as an attendant must load and unload each work piece. A few classes of work can be loaded into a hopper or magazine and then the machine really becomes automatic.

But the automatic screw machine has become so much of a necessity in manufacturing, machine and repair shops and in general manufacturing plants, that it must be included with the lathe and the drill as all-necessary machine tools. Practically every small plant has one or more automatics; in pocket knife shops, they may be seen making little shoulder pins—in corset factories, they are quietly at work dropping off tiny studs; while the general machine shop finds them a paying investment for so small an order as 500 pieces.

It is to be admitted that some of the work turned out in private plants is not as well done as that from specialists in screw machine work, nor is it always as economical, but there is the undeniable advantage of being able to get what you want from it, of having the work right under your own roof, and of being able to make changes at any time. The latter is of much value—after a few pieces are turned out, an assembly can be made and if this shows that more or less fit is required and that some minor change will expedite further work, it i a short matter to adjust the automatic to suit.

Quality and quantity of work depend on three factors, i. e., the condition of the machine, ability of the operator, and skilfulness of the overhead, the latter, including the supervisor, tool designer, and planning department. Thousands of machines are in use that are not new but which are doing the work or can be made to do good work by the replacement of a few vital parts at a nominal cost. In shops where but a few automatics are employed, the operator is frequently his own set-up man or he does the setting up under the direction of a foreman or a machinist of experience. The present article should prove of particular interest to men in such plants—men who have to work out their own salvation, never visited by a road man from the automatic plants, often working hundreds of miles from another shop or another man in the same line.

Feeding the Stock

Setting up is the most important part of screw machine work. It includes the proper lay-out of tools, sizing the cuts, starting up, and various preliminaries. A good careful set-up assures production, even if ordinary intelligent help runs the machine afterwards. Selection and preparation of the stock helps wonderfully. It pays to have the bars chamfered at both ends: if this is not done, much time is spent in hammering the two ends through the shells and very likely the latter will get broken as bar stock is sheared to length and thus is left with a swelled or burred end. In buying stock from the mill, it is possible to get the bars chamfered on one end at an advance of only a few cents per 100 lbs.—it pays to do this for such stock is cut off in a cutting-off machine which leaves both ends in good shape, beside one with a bevel.

Crooked bars produce innumerable delays through interference with feeding. If the crooked bars cannot be used in some other department, it is best to throw them out altogether or else to cut out the bent sections, using the rest when a lot of short bars are being worked up. Cold drawn stock is superior to hot drawn for small work and will save its additional cost in time saved on feed troubles.

Feed shells, or feed "fingers", lose their tension after a time and need to be sprung together with wire, heated, and re-tempered in the closed up position. When stock up to the machine's capacity is being run, there is apt to be trouble in feeding the bars because the shell is not strong enough. Fig. 1 shows how this weakness may be overcome. A thin band of steel is slipped over the shell as shown and in its position it stiffens because the effective length of the slot is decreased.

Increasing Machine Range

Fig. 2 shows how small stock can be handled in a large machine. Some machines are not regularly supplied with master collets and shells and interchangeable pads to go with them. If a job comes up suddenly or but a small quantity of some odd size is required, it may be advisable to resort to shop made equipment and this can be produced very reasonably as shown. A threaded bushing is made for the front end of the feed tube and in it is screwed a new shell which is simply produced from a straight piece of tool steel. The small collet is turned with a narrow hub at one end to fit inside the rear of the master collet or any suitable collet that is large enough; the rest of its length is straight and when it is split and expanded, it functions through the medium of the larger collet. The writer has turned out many thousands of pieces with parts as illustrated and found them extremely satisfactory.

Regardless of circumstances and notions, it is bad practice to alter machines from the way they are built. And yet two or three cases have come to notice where better results were secured by rethreading the feeding tube left hand and making the shells left to fit. All these cases were in connection with machines having an "increased to" capacity which of course, necessitated the use of a thin walled feed tube and rather light sectioned collet feed shell. The fine thread that had to be used then to join the two pieces was none too substantial and soon

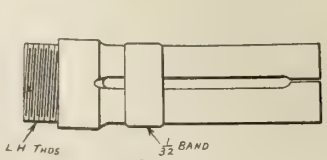


Fig. 1

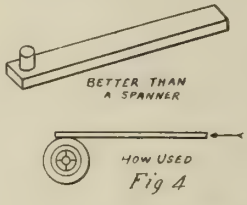


Fig 4

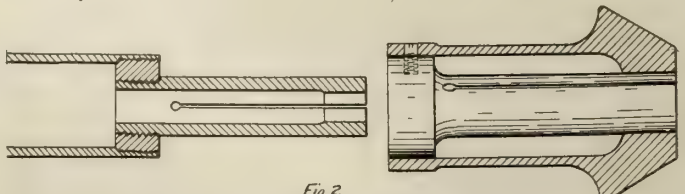

Fig. 2

Fig. 1.—Strengthening shell with steel band.
Fig. 2.—Increasing range of machine.
Fig. 4.—Device used in removing tight chucks.

troubles with the shell unscrewing would occur. This unscrewing of shells puzzles operators until they consider that in most machines there is a period during feeding when the feed tube stands still and during which time the surrounding members may be in frictional contact with the shell and have a tendency to unscrew the latter as they are turning right handed. Where the threads and the shoulders are too frail to withstand much pressure, left hand threads will prevent unscrewing troubles.

An aid to feeding small stock in a large machine is a bushing in the rear end of the feed tube. For instance, suppose ⅞ in. bars are being run in a 2½ in. machine, which is by no means the extreme that is met with in small screw machine departments. After the bar leaves the stock tube there is an overhanging piece several feet long and weighing from six to ten pounds that is supported by the collet and shell at the far end; the leverage is too great for everyday conditions and naturally the feed does not work well. Place a bushing somewhere inside the feed tube and the trouble will be eliminated—bushing should have a hole 1/16 in. larger than the stock.

Provide Plenty of Room

There are also many details to be attended to in setting up and in operating automatics that access to all parts of the machines should be made easy. It does not pay to crowd the machines in a department. Ends and back of machines should be as accessible as the front and there should be room for the workman to squat down without bumping himself. An operator or set up man who has to work all day, taking little mincing steps ("one-stepping") about the machines, squeezing between bars and machines, and ducking under stock tubes, and so forth is tired at quitting time and his work for the last couple of hours has not been of the most productive kind. Hence, it is money saved to give automatics plenty of room, even at the expense of crowding other types of tools.

Silencing Gears

Noise in a plant may give it a "prosperity hustle" tone to the visitor but it is more or less wearing to the nerves of sensitive workmen. Very little has been done to reduce the noise from automatics; analyzed, this noise consists of the sound of running gears and belts—which cannot be lessened much—and of the rattle of bars in the stock tubes—which can be toned down considerably if tried. Multiple spindle machines are the most prolific noise makers. It is customary to supply the stock tubes considerably larger than the maximum capacity of the machine—for instance, on a ¾ in. Acme automatic, the stock tubes will admit bars nearly twice that size; this makes for easy feeding but it adds to the jingle.

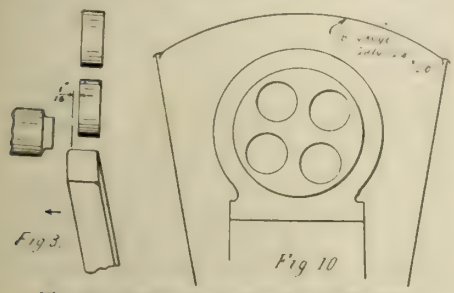


Fig. 10.—Guard for preventing oil splash.
Fig. 3.—Relation of rollers to cutting tool.

Smaller stock tubes will help some but not enough to justify a change—the metal to metal contact is there just the same. It seems to be considered better to put up with the noise than resort to fussy means to reduce it. In special cases, however, much can be done to quiet an automatic department. One superintendent who was willing to go to elaborate means took practically all the noise out of his rapidly revolving bars. His machines were working month after month on the same size bars (about 1 in.) and he put bushings in each end of his stock tubes, about an eighth larger than the bars. Then at each end of each tube was a thick felt ring held between caps as in the best automobile practice.

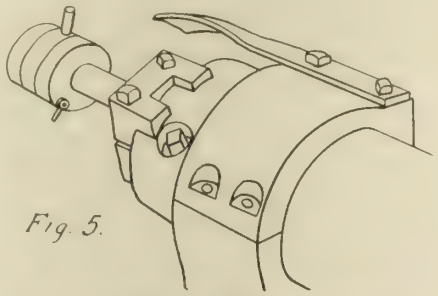


Fig. 5.—Keeping die head in position.

The felts had to be renewed from time to time but they effectually pocketed the noise. They also served as wipers for the bars.

The writer once had several automatics running on C. D. S. bars of 9/16 and 5/8 size. The machines were set up and and left from year to year on these same sizes. It was thus possible to do something with the noise and distribute the cost over a vast amount of work. Cheap ball bearings—of the so-called "commercial type"—were fitted into each end of the stock tubes. Their bore was 1/16 in. over the bar sizes and their cost for a four spindle machine less than $2. With them in place and the bars revolving at about 1000 r. p. m., a four spindle machine emitted hardly more than a purr. Three months of steady running was the minimum life of the bearings with a maximum of quiet.

Regulating Feed

To have the stock feed regularly and be held so there is no slipping under the various cuts is to relieve the operator of half of his troubles. The successful operator thinks ahead of his machines and by so doing increases his production immensely. When bars cut without slipping back but do not feed uniformly, it is evident that there is a drag on the bars somewhere or that the feed shell is loose or weak or that the collet does not open far enough—the operator knows that the trouble is somewhere in the head-stock assembly and, by checking one unit at a time, he remedies the trouble speedily.

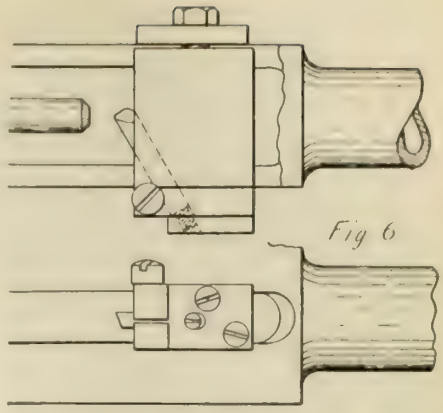


Fig. 6.—Pointing ends of shafts.

On the other hand, if the bars feed all right but push back when the turret tools are working, the indications point more strongly to dull or improperly set tools than to lack of grip. Fig. 3 shows in development a detail of the common turning tool with roller stock supports which many operators fail to grasp. Rollers must either precede the tool and ride on the original far diameter or they must be set far enough in the rear to escape positively any part of the cut but the newly milled size. If the rollers ride upon any part of the reduction but these two, they are just wearing their way along, because rollers cannot cut. The position shown is 1/16 in. to the rear of the desired diameter, which is none too much for clearance, tool wear, and possible slippage.

A source of trouble results from rehardening shells and collets and from shop made parts. Unless the contract faces of these parts are glass hard, they gather small particles of steel from the bars as shoved through and these same particles become "diggers" that scratch the bar and retard its free feeding. Longitudinal scratches on the bars themselves are the tell-tales of this trouble. Sometimes these impediments are so hard that they have to be ground or stoned to remove. Small in themselves, they give considerable trouble when there is only a small allowance for opening and closing in the gripping members.

Chips entering the slots in the collets work themselves between the outside and the nose piece, fill up the slots, and sometimes get farther back to the feed. Some operators fill the slots with rubber—and this works well for a time but in the long run it is far better not to tinker but rather to take out the chuck parts, say once a week, and rinse them in kerosene. The same is true of the spindle bore, the chuck closing tube, and the feed tube; an occasional dissecting and washing will free up these snugly assembled parts and work wonders with feeding.

Setting Up

Excepting very long runs, the cost of setting up is a major item in the cost of a given part. Anything which will

maintain that set-up intact is important. And nothing will completely derange the entire set-up quicker than a stoppage of the oil or coolant. On a job that is permanently set up, absence of pipe fittings is helpful. Where it can be done, as in the case of most single spindle machines, the writer prefers to go to the expense of a special piping outfit built entirely of bent pipes. Screens or not, chips will get into the pump and be carried into the delivery line, there to lodge in elbows and valves and necessitating cleaning out every so often. Practically all single spindle jobs can be arranged with a single piece of pipe or, at most, two pieces with one elbow and one cap. A valve in the overflow is all that is necessary to regulate the supply on the tools—and even an overflow line from the pump may be omitted. Any executive, who knows how attendants are given to fussing with a maze of pipes and valves in the oil line, and how much a cessation of supply costs, will bless the bent pipe system.

Careful Planning Needed

The cost of screw machine products in any factory "making their own" may be considerably reduced by careful planning. Suppose, for example, that there are five automatics in the department and that each machine must supply approximately 10,000 pieces each of fifteen different parts per year. That means seventy-five different set-ups in the year, which will keep one man fairly busy. Critics will immediately arise to say that a set-up is a matter of but a few hours time. However, the wise ones will agree with the author when he says that under average conditions very few machines are changed from one job to another and are ready to run without further testing out in a day's time—the simplest of jobs or a change in length can be made in less, while complicated parts will take much more. And so it is that the planning of this kind of work demands good judgment and broad experience.

First, the number of parts or designs should be studied in their relation to the sizes and styles of the automatics. It may be found that some designs could be produced so much cheaper on another machine that it will pay to buy a new one and get rid of the one which did the work so slowly with frail tools working beyond their range. Secondly, the parts should be apportioned to the different machines according to their capacity and to the demands of the assembling department so there will be no delay in subsequent operations. Thirdly, great quantities of parts should be made at one setting—and this is especially true of those which are hard to set up because of the number of tools involved and intricacy of shape. Any such part which will be used year after year should be made in, say, five year lots. Where quantities such as have been named are used yearly, the saving by this practice will often, in effect, supply two years' parts free. Fourthly, the work should be so apportioned that parts of similar design follow each other on the same machine in order that as much as possible of a previous set-up may be utilized.

The first year that this system is followed will be the most trying. Some delays will occur. At times, additional equipment may seem necessary. But all the time the unit cost will be going down. The second year there will be no hitch. In all probability, the work will be going through so smoothly that it will be possible to get it all out on four machines instead of five and then it is possible to have one machine in reserve—this had better be the most universal, the one most readily changed, which can then be held in readiness for those inevitable specials that come up and for setting up in emergencies.

Get More Out of Belts

Motor driven is an ideal arrangement for automatics but the plant that has belt driven machines only has no cause for regret. Some work demands belt driven machines in order to get the required speed and direction changes for particular work. On the older machines, and some of the later models too, the pulleys for these belt-shifting drives are straight face. Hard pulling with a straight faced pulley always causes the belt to slip sideways and this side movement causes wear on the edge of the belt, especially at joints. If these pulleys are crowned, the belts will shift fully as well and, moreover, wear from the forks is almost entirely prevented. The belts pull better on crowned pulleys.

During the war, the price of leather belting rose to such a high level that manufactured belts of many kinds came into extensive use. No one claimed that these woven and impregnated belts were as efficient as leather—they are not—but the price was so much lower that other considerations were overlooked. A good many plants will continue to use these belts. The ordinary screw machine fork is hard on manufactured belts; abrasion starts at the joints and unraveling follows, with loosening of the plies, and then the joint-fastening gives way. Meanwhile both edges have suffered throughout their entire length from constant crowding of the forks. Crowned pulleys are the salvation of belts in this application. A kink practised on these belts with marked success was to dip the ends in glue, leaving the work of making a joint until the next morning—the several ills grouped under the name of unraveling were largely reduced by this practice and a good deal of time saved.

Setting up For Threading

Screw machine jobs may be divided into two great classes—those with threads and those without. The former are more complicated and more interesting. Plain pieces can be made faster than threaded ones; not that threading is a slow process—for it is not, it is usually the fastest one and on multiple spindle machines it is done while other tools are performing slower operations—but because the nature and exactness of threads and thread tools involve more fitting, adjustments, breakage, and "hang-ups" and all these cut into the production rate.

Setting up for a threading job involves more work whether it is an internal or an external thread, cut or rolled. When setting-up for a threading job, the best plan is to do everything else first—get the machine running and making proper dimensions at full speed—and then apply the threading tools. Time will be saved by so doing and repetition of other work. This plan, naturally, presupposes that sufficient time and ample cam space have been allowed for or laid out.

A skillful man can save a good deal of money in a threading set-up. He will carefully measure every part concerned and every movement. He will set the cam or the dogs to give a little less travel than may be required, in order that the tap may not strike the bottom of a hole or dies wedge against a shoulder. Many men—far too many—will disregard these simple things and, putting in a new tap or set of chasers, will smash the outfit first time around. The same men will run a tap in a small hole and force dies over a blank much too large. After they have caused this wreckage, they measure things up and come out all right the second time. There is absolutely no excuse for breaking anything the first time; the skillful man (which is the same thing as saying the "thoughtful man") puts in an old tap and uses old chasers first off, even though he knows he is on the safe side. Such a man is highly valuable.

Care of Machines

When a job has been set up and dried out, it is not quite ready to be turned over to operator. Every bolt and screw ought to be gone over systematically first and tightened up—tried, at least. Half an hour spent in this will save hours later in rebuilding the set-up. A few minutes spent every day on bolts and screws is also time well spent. Automatics run so fast that a loosened screw can do hours of damage in a very few seconds.

The Acme screw machine is the most universally used of the four-spindle machines. Its features are therefore known to a legion of machinists. Because of the number of bars and of tool positions, the operator and the set-up man cannot see everything from the operating side. Many times he would like to be able to feed the machine by hand while watching the work in third and fourth positions. To enable him to do this, the author has made a connection on the rear so that the hand crank may be applied. In addition, a sheet steel guard has been put over the revolving ends of the turret spindles so that a man, in reaching over to apply the power is in no danger of getting his arm caught. These two little additions have saved their cost a hundred times over.

Someone has said in connection with the operation of Acme automatics, "Watch the cutting off tool and you're all right." There is a world of truth in that unstudied phrase.

(To be continued)

Selection of Doctor *Most* Important Matter

Various Questions Under Discussion at Present Regarding Workmen's Compensation—Should Employees Contribute to Insurance Premiums?—Better Statistical Methods Should be Adopted—Individual Experiences Would be Valuable

HOW many realize that no less a sum that $162,858,091.20 has been estimated to represent the value of product loss by one year's cripples in the Province of Ontario for their life time, while the total wage loss of these cripples for the same period has been estimated at $32,190,400.00? It is only by such figures that the full significance of this economic waste can be properly appreciated, remarks our informant who has made a close study of the situation.

The Ontario Workmen's Compensation Board says that since the present Act came into effect seven years ago, 271,807 claims have been dealt with and $27,947,655.45 has been awarded in compensation and medical aid benefits. Nearly 500 cheques are despatched daily carrying support and relief to the recipients. Cases are settled promptly without litigation or expense to either the employers or beneficiaries. The employer is immune from action in the courts of the Province and more than ninety-eight out of every one hundred dollars that is paid for compensation goes directly into the hands of the injured workmen or their dependents. The rates of assessment in general are not high in comparison with those in other places.

The principle of State controlled Compensation Boards is undoubtedly sound. It eliminates litigation, particularly when one considers that by method of private insurance as much as 40 to 60 per cent. of the premiums paid by employers is absorbed in expenses and profits, while in Ontario less than 2 per cent of the assessment paid by employers goes toward expenses. The Joint Safety Convention held at the King Edward Hotel, Toronto on April 4th and 5th went a long way toward bringing to light certain facts which probably had been a matter of conjecture or perhaps ignored altogether. Following are some interesting facts. The particular items under discussion at the present time are:—Contributory insurance by employees; exclusion of clerical staff; medical matters; contractors and statistical information. We will deal with these in order named.

Contributory Insurance by employees

If one pays insurance premiums it is because something is expected in return. I believe this would increase malingering. It is felt that a fair compensation should be paid by the company, unless accident is due to deliberate carelessness and disobedience of shop rules, in which case employee should not receive any compensation unless accident of a very serious nature when special consideration should be given. The act provides that no compensation be paid to injured in the event of wilful misconduct, and this should be strictly enforced by the board.

Another feature about contributory insurance is that it would entail a great deal of clerical work collecting the premiums. For instance, supposing an employer's rate per $100.00 is $1.50 on the maximum wage of $2,000 the assessment would be $30.00 per year. It has been suggested that the employee pay 10 per cent. of this. This would mean a contribution of $3.00 per year or 25c per month. Supposing a firm employed 1,000 employees, this would mean $1,500.-00, deduct from this the cost of clerical work, then figure out whether the end justifies the means.

Exclusion of Clerical Staff

From a group standpoint the inclusion of clerical staff has no bearing on the ultimate result. In other words, it simply means that the assessment is raised and the rate is lowered. A firm having a large amount included for clerical staff would be reimbursed on the merit rating system by the fact of the low accident cost, but only up to 30 per cent. The firm without a large clerical staff would have the advantage of not paying out the orginal assessment. The object of the board in not making any exclusions, we are told, is due to their inability to properly check up those that should be excluded and included.

It is neither just nor equitable to employers, and there would appear to be no justification for assessments being levied on wages of clerks working in general and branch offices remotely situated from the works simply to suit an auditor's convenience in checking. The speaker who termed this "all bosh," at the safety convention, was pretty nearly correct, in fact, it is downright preposterous that a board should have the power to cause such absurd legislation to be effected.

Medical Matters

Too much importance cannot be attached to the selection of efficient doctors. While it is not the intention to pass reflection on medical practitioners, it would seem to be a tendency for some doctors to prolong period of recovery in order to receive medical fees. This means additional expense to the employer in two ways—medical fees and unnecessary compensation. Where practicable the company should select its own doctor, pay him a certain amount per year, based on what has been paid by the compensation board for medical fees for a period of years, arrange with doctor to turn over the cheques received from the board to the company. His only interest then would be to get the men back to work, and in our opinion this would be the most effective way of curtailing any malingering which might exist.

Furthermore, it might be added that the amount of medical fees paid, compared with compensation payments, ranges anywhere from 10 to 90 per cent. In other words for every $100.00 of compensation paid, it has been established that the doctor has received as high as $90.00.

Contractors

According to an amendment to the act, employers are made responsible for the proper reporting of pay roll of employees of any contractors working on their premises. In the event of such employees having an accident while on such premises, and the contractor not having made a report to the board, the compensation for such accident is charged to the manufacturer employing the contractor. In other words an employer who complies with the regulations of the law is made responsible for those who do not.

Statistical Information

It must be realized that the workmen's compensation board is appointed for the proper administration of the act. Its business is to pay compensation. but we must also realize that in the formation of that act, provision was made for the organization of accident prevention associations, the cost of which is borne by the board and paid for by the various industries.

To these safety associations the board hands out data for every accident which is reported. It furthermore supplies these associations with the net assessments and costs for various classes and groups. The pay roll being obtained, the cost rate of accidents per $100.00 of pay roll can be ascertained for the group from which individual experience can be compared.

If all employers in a group were to supply the cost of accidents and rate to Mr. Morley, manager of the Industrial Accident Prevention Association, he could no doubt, compile and publish a comparative exhibit showing the cost rates for the respective employers, so that all members of that group might ascertain their respective status.

Unfortunately the cost figures referred to, which are supplied the Industrial Accident Prevention Association by the Board, may be given somewhat late to be of value. For instance 1920 figures were only provided, we believe, in 1922. What might possibly prove of

better value would be for the Industrial Accident Prevention Association to establish a statistical department whose function would be to tabulate and analyze reports they receive daily from the Board. A standard unit of measure should be adopted so that comparisons could be made on a basis representing similar conditions. Frequency rates should be expressed in terms of 300 day workers, severity rates in terms of time lost to time worked, with an estimated time loss of man power by death and permanent disability.

The publication and distribution of monthly reports giving the above information would undoubtedly create a competitive spirit between members of the group, and we believe would tend to materially reduce compensation costs. Mr. Morley has made a great many improvements since he was made general manager of the Industrial Accident Prevention Association less than one year ago, and it is safe to assume that this need for statistical data has received some consideration at his hands. It is a big undertaking and one which would naturally involve some expense.

Incidentally, there would appear to be no reason why the workmen's compensation board should not publish individual experience. These figures must of necessity be compiled for merit rating purposes and with a little more effort a classified report might easily be compiled and published. In conclusion, the writer was interested to note that mention was made by several speakers, of the play "Fixing the Responsibility for an Accident" which was staged by three Hamilton firms—The International Harvester Co., The Canadian Westinghouse Co. and the Steel Company of Canada.

The object of this play was to impress upon the employer the importance of properly training new employees. The first act depicts a modern shop with an up-to-date foreman who is courteous to his men and is anxious for their safety. The second acts depicts an old timer who is a foreman having no regard for "Safety First" principles. On the contrary he bullies his men and even the loss of an eye seems to have no special effect on him. In the third act the responsibility for this accident is placed with the final discharge of the foreman.

It has been admitted that no amount of talking or writing by the Ontario Safety League or others could bring home with more telling effect the object lesson contained in this play. These performances were given at the Memorial School, Hamilton, Massey Hall, Toronto, and the Cathedral Lyceum, Hamilton, with full houses at every performance. This was given under the auspices of the Hamilton Chamber of Commerce and the Ontario Safety League. The fact that such firms as those mentioned see fit to allow their employees full time while taking part in these performances is admittedly an indication that they at least recognize that accident prevention is a universal problem.

New Design of Radial Drill

IN THE operation of machine tools an item of extreme importance is the minimizing of unproductive time. To obtain the maximum efficiency from the operator it is necessary to place control levers within easy reach of his normal position when operating the machine.

Another essential factor is to incorporate features that will offset any possible neglect or oversight on the part of the workman to keep all functional parts well lubricated.

On the construction of the 4 ft. radial drill, here shown, special attention has been given by the builders, The Canadian Machinery Corporation, to two important considerations in the operation of machines of this type. First, the time wasted moving around that has been necessary in order to make adjustments for speeds and feeds, and secondly, the lack of power in most drills on slow speeds when the greatest power is required. To overcome the former, the carriage has been so designed that all contro's are centralized under the operater's hand. Gear boxes and countershafts are eliminated, all the speed changes being obtained by the manipulation of four levers through seventeen gears only, which are of nickel chrome steel, heat treated and running in a bath of oil. Thirty-six speeds are thus obtained without the operator leaving his position to shift a belt or adjust a detached gear box.

Ample Driving Power

To secure ample power, the initial speed of the transmission is maintained until after passing through the frictions in the reversing attachment, so that the speed in the frictions is exactly the same whether working at high or low speed. In many drills, this has been a weak point, for with low speed in the frictions, much less power is transmitted, causing slipping of the frictions.

Particular attention has been paid to the oiling system, and a central reservoir has been provided, thus eliminating the danger of the workman missing an oil hole. A circulating system of lubrication is maintained on the rear of the carriage and a large reservoir on the top of the speed changing gear box supplies oil to the bearings and transmission gears, and after performing its mission, is pumped back to the reservoir.



New design of radial drill.

It is a well known fact that under conditions of large "labor turnover" firms spending time and money on safety education usually result in some competitor deriving the benefit and it is hoped that such organizations as the Industrial Accident Prevention Association and the Ontario Safety League may see their way clear to promote such enterprises.

Correct Understanding of Mechanical Views

Mechanics Should Be Able to Read Drawings—Projection of Surfaces—Third Angle Method Generally Used—Transparent Box Simplifies Instruction

By JOHN HOMEWOOD

IF the projection of views was correctly understood among draftsmen and machinists, the draftsman would not be looked upon by a great majority of mechanics as one who delighted in putting puzzles upon paper. It is just as important for the man reading the blueprint to understand the fundamentals of projection as it is for him to know his multiplication tables in order to do division. The majority of mechanics have, in the past, acquired the art of reading drawings strictly from experience gained from each succeeding drawing that they came in contact with.

That experience may have covered a period of years, among which a great many drawings have come within their reach that were made by draftsmen who did not know their business when it came to giving the proper projection. It is surprising to know that a great percentage of men now in industry do not know the difference between third angle and first angle projection. This often results in spoiled work and great loss of time. I see no reason why a mechanic, when he is hired, should not be put through a short examination that would determine whether he does or does not understand the views on a drawing and their relation to each other.

There are hundreds of text books that cover the fundamentals of mechanical drawing, but there are very few that go into the elements sufficiently to give a practical man the information he wants in his own terms of understanding. While the following is widely known among draftsmen in general, as well as a great number of mechanics, it is incumbent upon the writer to plead for pardon from the "wiseacres" for bringing the subject up again. If it will be the means of making one man see the daylight in reading blueprints, it will have fulfilled its mission.

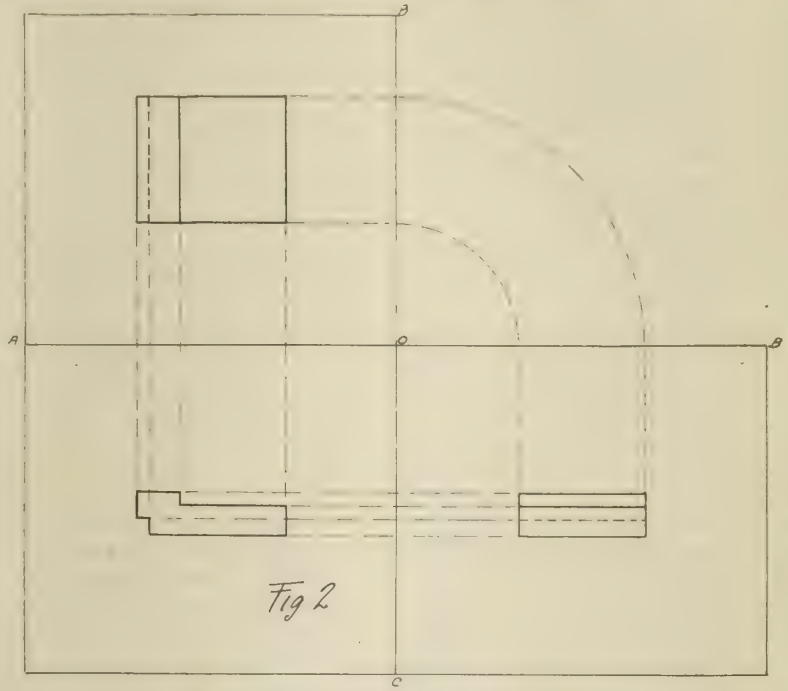


Fig. 2.—Surfaces projected on drawing board.

The type of drawing used in mechanical work is the art of representing objects that are to be made, by showing them in one or more views. The relation of these views to each other are governed by the rules covering Orthographic Projection. There are two kinds of Orthographic Projection; they are known as first angle and third angle. In this country we use the third angle projection. The first angle projection is used in some foreign countries and is also adopted in a few schools here simply to make the art of learning projection easier, by having the object revolve in one angle of 90 deg. If the object represented on the blueprint could be pictured as being within an imaginary box surrounding it, and its image transferred to the face of the box, and the box developed to be on one plane, the object will be represented in third angle projection.

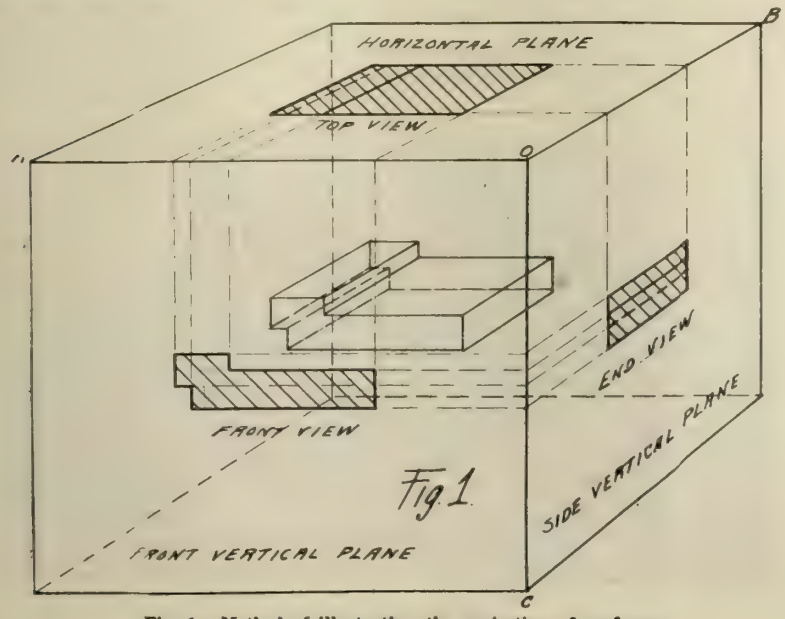


Fig. 1.—Method of illustrating the projection of surfaces.

In Figure 1 is shown, in perspective, a box constructed in transparent material. The top is hinged on the corner "AO," the side to the right is hinged on the corner "OC." This box is made to open on the top and end by swinging on the front side. The top is known as the horizontal plane; the front is the front vertical plane and the side is the side vertical plane.

The horizontal plane revolves on its axis "AO" which is known as the horizontal axis.

The side vertical plane revolves on its axis, which is known as the vertical axis.

This box referred to is primarily only imaginary, upon which the views of the

(Continued on page 52)

Gears Classified By Shaft Arrangement

Study of the Worm Wheel, Helical, Spiral and Skew Type — Peculiarities of the Hindley Worm—Method of Hobbing Teeth—Tangential Feed System.

By CHESTER B. HAMILTON, Jr., B.A.Sc., M.E.

THE THIRD group of gears, classified as to shaft arrangement, is those with axes in different planes, but not paralle . A layout of these gears is made upon a plane which contains one axis and is either parallel or perpendicular to the other, so that its projection on the plane of the first may be considered.

This group includes worms and worm gears, helical gears commonly called spiral, and the hyperboloid gear called the skew bevel, from its superficial resemblance to a true conical bevel gear. There is still some confusion of terminology even among engineers intimately connected with the gear business, but the American Gear Manufacturers' Association is trying to straighten out the difficulties that lie in the way of uniformity, in connection with its extensive scheme of standardization.

The sub-classification in the present group is based principally on the form of the pitch surface of the gear in question. The difference is seen in the axial cross section. The common worm has a cylindrical pitch surface, while the Hindley, a special form of worm, has a concaved or hour-glass form which embraces the worm wheel which it mates around a considerable arc of a circle. This arc of course must subtend at the centre of the wheel a lesser angle than twice the pressure angle of the teeth, or it would not be possible to place the worm and gear in mesh. This is on account of the inherent peculiarity of the Hindley worm, that its teeth always point directly towards the centre of the wheel, those at the ends of the worm converging. There is therefore no rolling motion between worm and wheel, and the teeth of each completely fill the space of the other, and bear over practically the whole surface. Thus the area is so great over which the pressure is distributed that a perfect oil film is practically always assured, and with such perfect lubrication the efficiency and durability are high, in spite of the hundred per cent. sliding action of the teeth.

In considering this whole class of gear the words "teeth" and "threads" will be used almost interchangeably, for in the last analysis the worm is a gear of few teeth, and the helical gear a worm with many threads.

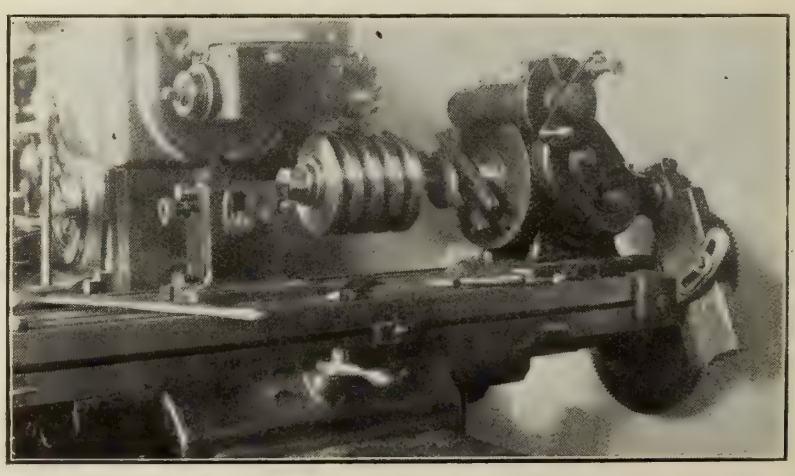
Reverting to the sub-classification by form of pitch surface, it is seen that the worm wheels all have concave pitch surfaces, which embrace an arc of the ordinary worm pitch surface at the centre. The Hindley worm wheel embraces an arc of constant chordal length from end to end of the worm. Worm wheels blanks are frequently turned with a cylindrical periphery, and it is likely that the new standard worm wheel form to be brought out by the American Gear Manufacturers' Strandardization Committee will be a somewhat modified cylinder so far as outside is concerned, but the pitch surface is none the less concave. This is essential in order to obtain contact along a line on the tooth surface. A helical gear of the same normal pitch as the worm will mesh with it and act like a worm wheel so far as transmission of motion is concerned, but it is not a worm wheel, and the difference lies in the fact that there is no line contact between the teeth but only contact. The result is very evident when it is attempted to use such gears for considerable loads or speeds, on account of their low efficiency and lack of durability. They are really a helical pair.

Worms are commonly made either by a turning tool in a lathe, by milling with a rotary cutter of disc form, or by end milling with a cutter shaped like a truncated cone. The first and last produce a thread form that corresponds with the tool used, but the disc cutter will not reproduce its own form on account of the drag of the side against the helically curving flank of the thread. This peculiarity is well known in milling machine practice. This may be corrected by using a cutter of altered form which will produce the shape of tooth desired. This interference decreases as the pressure angle increases, and does not occur in milling worms with large pressure angles. Modern high efficiency worms are hardened and ground all over, and are multiple thread, high helix angle and high pressure angle, in both cases well over thirty degrees, and some have been very successful at forty-five degrees.

Worm wheels always have the teeth cut by the generating process. Usually a hob is used, which resembles the worm in form of thread and helix angle, but exceeds it in diameter by twice the clearance at the bottom of the teeth. In addition to being fluted to give cutting edges, the hob when being finish-turned has its surface relieved between cutting edge in spiral fashion so that the face of the teeth, in the flute, may be ground in sharpening without change of tooth form. This sharpening does change the diameter slightly and also the helix angle, which depends on the diameter. In fine work this can be taken care of by setting the axis of a new hob or an old one at a slightly different angle from the average standard.

In hobbing worm wheels the hob is usually fed into the work radially till it reaches the desired depth, but a method of more recent development which has several advantages, is to fix the centre distance of axes with the hob off to one side, and feed it along its own arbor tangentially to the work. A correction in the table ratio gearing is necessary on machines using this process, which is accomplished by impressing the added tangential motion onto the table motion through a differential gear to the table gear drive. The hob in this process is made with its outside diameter conical at the entering end so as to distribute the starting of the cut over a number of teeth. The pitch line and root remain cylindrical.

A machine geared up in this way can, by taking time, generate a perfect worm wheel without any hob at all, by using in its place a slotted cut-



Milling a large worm.

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ter arbor and a fly tooth which represents one tooth of an imaginary hob. The rate of production with this fly tooth is of course quite low, but the quality approaches the ideal, for there is no warping of the hob in hardening. The tooth can be ground all over to perfect form. There are no flats—the bane of all hob generating processes—because of the longitudinal feed, which can be made as slow as the refinements of the job require. The longitudinally fed hob, if ground all over would have the same advantages except as to losing form and size as its teeth are ground back with age for tangential feed machines are not generally adjustable for changing helix angle.

Hindley worm wheels cannot be hobbed by the tangential feed system on account of the shape of the hob, which follows the worm form. The same reason indicates one of the principal advantages of the Hindley system.

The worm must be located very accurately in longitudinal position, and special care taken with its thrust bearings to maintain it so, or the perfection of tooth action will be quickly lost. This does not apply to all the cylindrical worm, which requires to be located accurately in two directions only and, fortunately, not in the direction of thrust and wear.

The efficiency of worm gears and all helical gears depends very largely on the helix angle. It increases very rapidly as the helix angle increases, then more slowly as the angle approaches forty-five degrees and again falls off, at first slowly, then more rapidly as the angle approaches ninety degrees. The curve being flattened at the middle, any angle between thirty and sixty degrees can be considered to give first class results. Such a worm and gear are of course reversible in action and for work that requires an irreversible combination, as hoists and the like, a helix angle must be chosen below the angle or fricton, of say twelve degrees.

Helical gears, sometimes called spiral, always have cylindrical pitch surfaces, and, when considered in pairs, always have point contact between the tooth surfaces. Aside from these two definite characteristics, the helical gear may be just about anything, for it occupies middle ground between a number of other more special classes. If a helical gear has few teeth it is a worm, the limit of the definition of the word being about 45 degrees helix angle. If the lead is equal to the pitch, it is a single thread worm, if twice the pitch then a double thread worm. If the lead is zero, that is, the helix angle is zero, then the subject is a cylindrical rack, as is used in some gear shifting apparatus. This is sometimes called a circular rack, but as that term is also loosely applied to crown bevel gears, it leads to confusion. Or another example would be the thrust shaft of a steamship. If the helix angle of the helical gear is 90 degrees, then the gear becomes a spur gear, which is a special case of the helical at one limit of its range.

The angle of the axis may also vary through wide limits. If the shafts are parallel the pair may be spurs or helicals according to their tooth helix angle, this special case coming under a separate section above. For any other shaft angle there is a wide range of possible helix angle of the teeth of each gear of the pair. The limit in one direction is marked by a single thread construction, and in the other by the angle of sliding friction. An impossible case arises when the shafts differ from parallel by twice or less than twice the angle of sliding friction, and the gears are required to rotate in the same sense. They cannot because the teeth will not slide at this low angle. It is a similar case to the irreversible or self-locking worm gear, only that in this case the pair are self-locking in both directions.

Another limit which applies to all cases and must be held constantly in mind in calculating or laying out helical gears is that there must be a whole number of teeth of some standard pitch for which cutters are available. With fixed centre distances and fixed pitches as in the rotary cutter method of forming the teeth, this often leads to impossible cases. The solution is to use the hobbing generating method, select the next smaller whole numbers of teeth, turn the blanks over size by an amount sufficient to make up the difference between the desired centre distance and that given by tooth numbers selected, dividing this increment between the two gears in proportion to their pitch diameters, then generate the teeth by hobbing to the correct working depth. The same method of compensating for fractional tooth numbers can be applied in spur gears or herringbones with the added advantage of being able to use the Fellows gear shaper as an alternative to hobbing.

The most direct way of getting an understanding of the action of a pair of helicals is by laying out a development of their pitch surfaces as they would be unrolled on a plane. Even when the solution of a problem is purely trigonometrical, as it usually is, a skeleton lay-out is an advisable safeguard against confusion of plus and minus complimentary angles, and right and left hand rotation. It is well for any one not continually laying out gears to stick to the fundamentals of geometry and trigonometry, and avoid short cuts.

The disadvantages of helical gears due to point contact, and the resultant lack of capacity and durability have been referred to above. This is serious and prevents this very flexible form of gearing being of nearly the use it would be if it could carry loads efficiently. It is therefore principally used to transmit motion, with relatively light loads, at various odd ratios and in awkward locations, for which work it is well adapted if kept well lubricated. There is a second serious disadvantage of this form of gear, and that is the end thrust that is always present when the helix angle is appreciable, and becomes serious when it is above the angle of sliding friction. Thrust washers, etc., are used for low angles, but roller or ball bearing must be used for low angles, but roller or ball bearings must be used for satisfactory results and constant operation at the higher angles.

The skew bevel gear or hyperboloid is not a true bevel, for the pitch surface is not a cone but a hyperboloid of revolution. This is the surface that is swept out in space by the revolution of a line about another line to which it is not parallel and which it does no intersect. This figure is somewhat of an hour-glass form with narrow throat and flaring ends. Supposing we have two of these hyperboloids, the surface of each of which is made up of straight line elements, it will be possible, in any except some special cases, to lay them against or across one another with their surfaces tangent throughout the full length of a line, which will be one of the generating elements common to the two. The pair of skew bevels then would correspond to two conjugate transverse sections or frustra of the hyperboloids. Their common tangent would correspond to the pitch line contact of a pair of teeth just as in bevel gears. If the transverse sections were selected at the narrow middle portion or throat of the hyperboloid, the two gears would superficially resemble a helical pair, but would differ in having concave pitch surfaces and line contact. The angle of axis of the two gears depends upon the angle between the describing elements and its axis and their distance apart, or throat radius. Of these two quantities for the two gears, three must be known or assumed to determine th fourth geometrically. The right angle pair is a special case. For convenience in manufacture the throat radius of gear and pinion are usually made equal, that is, the line of action of the tool is a contant distance above (or below) the work arbor axis on the machine.

There is another special chase sometimes used to simplify the work, which is to make the throat radius of the pinion zero, which reduces it to a common bevel. The pinion cone centre then lies on the throat circle of the hyperboloid which contains the gear. This class of gear is so difficult to calculate and make that it is practically never used where it can be avoided. Shaft positions might sometimes compel its adoption, but it would be better to re-design the whole machine and avoid freak constructions.

(To be continued)

Mill scale and adverse weather conditions promote corrosion of steel. Mill scale and all rust must be removed before any paint is designed to protect the clean steel surface. The second coat of paint protects the first coat from the weather and this second coat must, therefore, be impervious to moisture and frost.

Soldering Fluxes for Machine Construction

Formation of Oxide Should be Avoided—Methods of Preparing the Various Fluxes—Preventing Corrosion—Uniting Dissimilar Metals by Soldering

By W. S. STANDIFORD

THE MAINTENANCE forces in all shops and factories have to face many difficulties when machines break down, as it is the rule to restore them to normal working conditions as soon as possible and "in a jiffy," as delays in production costs money the result being that a machinist or millwright has to work at his highest speed with a chance of mistakes in measurements made and good metal and time wasted. Soldering coppers (called soldering irons or bits) are used to a more or less extent in repairs and machine construction work, the craftsmen having to deal with such metals as wrought iron, cast-iron, steel, copper and aluminum, each one requiring a different kind of flux so that firm joints can be made.

Removal of Oxide

The necessity for using fluxes in soldering exists in the fact that an oxide that always forms upon all brightened surfaces of metals, has to be removed by this flux, the latter by thus preventing formation of oxides, allows the solder to stick directly to a metal's body, instead of an oxide film which, sooner or later, allows the joints to come apart. Having stated the reasons for use of fluxes; their formulas will now be gone into. As most all of the copper soldered joints consists of electric wires on dynamos, motors and commutator risers, etc.; extreme care will have to be taken in order to avoid corrosion at the junction caused by the electric current going through the wire. A most excellent flux for all electric as well as for other copper work, is made by carefully melting 2 ounces of rosin and 2 ounces of vaseline. The mixture should be well stirred and poured into an empty baking powder can. This flux should (when cold) be of the consistency of butter, so that a small particle will stay on a joint. As rosin varies in density a little more of it may have to be added.

A liquid flux for copper electric wires is composed of 5 parts of a saturated solution of zinc chloride, 4 parts alcohol and glycerine 2 parts. The saturated solution of zinc chloride is made by filling a bottle half full of hydrochloric acid, then adding small strips of sheet zinc, a few at a time, until the acid will dissolve no more. Mix alcohol and glycerine together and add to the acid mixture. The operation of dissolving zinc strips in the acid should be done in the open air on account of the suffocating fumes generated which are injurious to the health.

Iron and Steel Flux

A fine flux for uniting wrought iron and steel articles is made by dissolving sheet zinc in muriatic acid until it will dissolve no more; then diluting this mixture with twice its amount of water and next adding a small lump of sal-ammoniac. The latter assists the solder in adhering, and is excellent in protecting the soldering iron from corrosion. The chemical action of the above flux depends upon the fact, that muriatic acid unites with iron or steel and in doing so, it deposits a film of zinc on the article to which the solder will most readily adhere. In using any acid flux all joints should be well washed and dried to prevent corrosion. An excellent flux for steel parts which will not blacken or rust the work, is made of alcohol 6 ounces, 2 ounces glycerine and 1 ounce of oxide of zinc. Cast iron a difficult metal to solder so as to make the parts hold together, but this can be easily remedied by brightening both surfaces and coating them with a film of copper. Copper solution is made by putting a few crystals of copper sulphate in a small bottle of water; shaking until dissolved. Put on with a brush and the joints will turn copper colored. Copper sulphate is a poison and should be handled with care.

Soldering Aluminum

Aluminum is a difficult metal to solder but if the work is done with a solder and flux of formula given, it may be soldered with the least amount of trouble.

Aluminum Solder Formula

84 per cent tin.
16 per cent aluminum.
3 per cent copper.

Melt copper first, add aluminum a little at a time, stirring constantly with an iron rod. Then add the tin and also a small piece of tallow the size of a penny. Stand a dry grooved board upright, stopping groove ends with wooden plugs and pour the hot metal into groove thus making the solder into sticks as thick as a lead pencil. Use a soldering iron made of aluminum. The flux is composed of equal parts of tallow and rosin, after melting, add half the quantity of zinc chloride to this mixture. Two other aluminum solders that will prove useful for uniting sheet aluminum or rods are as follows:

Number 1 Formula

80 per cent tin.
20 per cent zinc.
1 per cent aluminum.

As a flux, use a bar of common yellow laundry soap. Heat the metal parts to be united with a blow torch to about 650 deg. Fahr. Then quickly rub the hot surface with bar of soap and tin well with the solder, pushing the latter backwards and forwards which removes the oxide. When both sheets are "tinned" with solder, heat and apply pressure on joint until it is cold. An aluminum soldering bit will be found to work better than a copper one, although the latter can be used successfully for aluminum work. Both can be "tinned" with either of the solders listed, using their fluxes.

Number 2 Formula

72 per cent tin.
23 per cent zinc.
3 per cent aluminum.
2 per cent phosphor tin.

As a flux, use either stearic acid or yellow soap. Both solders will give a strength to a joint nearly equal to the metal itself. The only thing to avoid in soldered aluminum joints is corrosion, where it is exposed to dampness.

Preventing Corrosion

Corrosion can be prevented by varnishing the joint with several coats of spar varnish. In ordinary locations these solders will be found to resist corrosion, on account of the large amount of tin contained in them. In constructing new and repairing old machines, it is often found desirable to combine steel or iron parts with brass ones, and thus obviate the necessity of using screws, bolts or rivets for fastening them together. The main drawback heretofore, has been due to the unequal expansion of the combined metals; brass expanding double in amount to that of iron or steel and preventing all adhesion between their surfaces. The following alloy, however, sticks firmly to iron and steel pieces and will be found to give satisfaction. Melt 39½ parts copper, then add 3 parts of tin and also 7½ parts of zinc. Stir well and cast into sticks or narrow strips as preferred.

Uniting Dissimilar Metals

To use, heat the iron or steel pieces sufficiently hot to melt borax, brighten surface with a file and put enough borax on it to preserve its brightness. Treat the brass surface to be united, the same way, using borax. Put your strip of alloy metal between the brass and steel parts, tieing with wire if necessary to keep them in place; then heat until the alloy melts; hammer the sections together and let cool slowly. When cold any machining operations may be proceeded with. This combination flux and borax can also be used to unite pieces of high-carbon tool steel to a shank of cheaper soft machine steel, for lathe or planer

(Continued on page 52)

News From the Welding Field

Automatic Seam Welding in Making of Tubes

Material Must be of Suitable Composition—Finger Arrangement Prevents All Twist or Curl When Strip Stock is Entering Rolls—Compressing the Metal After Weld is Made

By J. L. ANDERSON

THE success of an automatic operation of whatever nature, requires the utmost care in the construction of the mechanism, the preparation of the work, and the uniformity of the motion required. Automatic welding is no exception, and in fact requires even more care because the welding operation is autogenous (self produced) and is the result of a combination of temperature, exterior pneumatic force, speed and mechanical pressure; a variation in degree of any one of these may be fatal to the success of the operation.

In order to be assured of final success, it is essential that material must be provided which is of suitable composition, reasonably accurate in thickness, and within much closer limits as to width in addition to having absolutely square edges. Some manufacturers use only strip stock in coils, others use in addition considerable sheet stock, while a few use sheets entirely. The advantage in using sheet stock being the ability to produce tubes of any usual diameter promptly, by slitting the sheets in a gang slitter. There is, however, more waste in meeting the requirements as to the length of tubes.

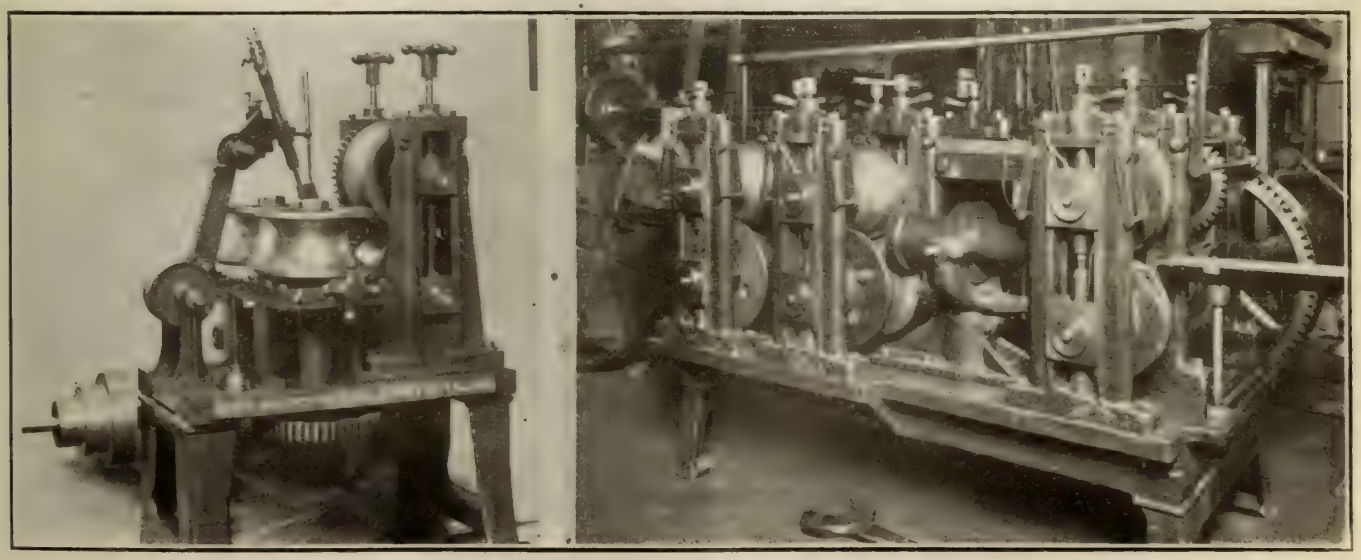
Paper read before the Schenectady, N.Y., section of the American Welding Society, February 8, by the author, who is welding engineer of the Air Reduction Co.

When preparing to manufacture welded tubing of any size or nature, consideration must be given to the purpose for which the tube will be used, the finish required and the temper or hardness desired or permissible, and from this point work backward to arrive at the proper width of strip and the gauge necessary to meet these requirements, the characteristics of the steel being known. In explanation, we will assume that a tube is required which must be accurate as to internal and external diameter; to meet this requirement it must be cold drawn with triblet inside. When drawing is required, it is customary to produce a tube approximately 1/32 in. over finished size, and in order to make a tube hold its shape when rolled it is necessary to have a strip of metal which is from 1/32 to 1/16 in. wider than actually necessary to form a circle of the required size, this excess metal is apparently lost in the compression of the tube while being formed, resulting usually in a slight increase in length of tube over that of the flat strip. From these remarks it will be readily understood that it is essential to be prepared with a full compliment of spacers for the slitting machine and rolls for the tube forming mills, with variations in size to meet any requirements as to the finished tube.

The gang slitter is of the usual type with the exception that the cutter shafts are of heavy alloy steel, with keys fitted the entire working length, with gearing arranged so that simultaneous adjustment of the bearings is provided, thereby maintaining accurate alignment and making possible the adjustment of the over-lap of the cutters to suit various thicknesses of metal. On these shafts are placed forged cutters ground to extreme accuracy and of such form that resharpening is done by grinding the face, thereby maintaining the original accuracy throughout the life of the cutter. Between the cutters are placed spacers alternating with a wide and narrow spacer on each shaft in order to bring the cutters in such a position that the cutting section action is identical on each edge of the metal, thereby preventing curling of the strip. When the spacers and cutters are all assembled on the shaft in sufficient number to cut the entire sheet, they are then locked by the adjusting nuts at the extreme end of the shaft.

Elimination of Curl

A unique feature in connection with the slitting of sheets is the finger arrangement, which prevents the strips while being cut from wedging between the cutters and are adjustable so that all tendency to twist or curl is eliminated. In order to make possible the changing of cutters and spacers, the end housing is arranged to withdraw and swing on



Left—Tube welding machine for large diameter, thin wall tubing.
Right—Tube forming mill, with three sets of rolls and conical conductor.

a table provided for this purpose. For supporting the strips and sheets there is provided at each end a table which is usually of a length approximately that of the longest sheets which are to be cut. On the feeding table, guides are provided which position the sheet in relation to the cutters so that there is always a trimming taken off each edge in order to produce equal conditions on all strips. The machine most commonly used cuts an entire 36 in. wide sheet into strips at one pass, the speed being about 50 lineal feet of sheet per minute.

Tube Forming Mill

The most popular type of forming mill for the production of open seam tubing is of the two-stand type, comprising one set of break-down rolls, conductors for guiding the tube from the break-down rolls to the finishing rolls. In order to properly position a strip, there is provided an adjustable guide in advance of the break-down rolls which when set up in perfect alignment with the center line of the rods, guides the strip through the break-down rolls so that both edges are brought to the same degree of curvature, after which the strip enters the conductor, being propelled through the conductor by the break-down rolls, and while passing through the conductor being changed gradually in form from a section of a large diameter circle to that of an imperfectly formed "U" of the size approaching that of the finished tube; the real object of the break-down rolls being to produce a form of strip which will have sufficient rigidity to withstand the resistance to the deforming operation without buckling, and at the same time be presented to the finishing rolls in proper position for compressing to a perfect circle with edges in close abutment.

If you can visualize the gradual formation taken by a flat strip approximately 30 in. long in changing from a flat section to a circle you will realize what takes place in the formation of a tube in the tube forming mill. The natural tendency in the formation of a tube from a flat strip is to curve downward, the seam being on top due to the stretching of the edges, which is unavoidable, and must be counteracted while the strip is passing through the machine. This is accomplished by the adjustment of the conductor in relation to the center of the finishing rolls, the operation being that of depressing the nozzle of the conductor below the center line of the rolls in order to produce a compressing action on the edges of the strip. This action occurs previous to the final formation of the tube in the finishing rolls, and therefore corrects stretching and allows the tube to leave the machine perfectly straight.

Preventing Wind

There is another difficulty which must be corrected, and that is the unequal stretching of the edges causing the seam of a tube to wind. This tendency is corrected by two methods, one is the adjustment of the guide previous to the strip entering the break-down rolls, the other is the adjustment of the conductor, latterly, or sometimes a combination of both adjustments.

When it is desired to use strip stock in coils, a support for the coil is provided and a swinging cut-off saw is mounted on the delivery end of the machine. This is used in conjunction with an automatic stop which makes possible the production of formed tubes cut to length. The automatic stop is actuated by the tube when it has reached a certain length; this stop throws out the clutch and at the same time causes a braking action, stopping the mill instantly. At this time the operator moves the motor driven swing saw by hand, thereby severing the tubes. The variation in length will seldom exceed 1/2 in. by this method. The maximum hourly production of a machine forming and cutting tubes to length will seldom exceed 2,000 feet, whereas with the use of strips previously cut to length the machine runs continuously without stopping, and will usually average 3,000 feet per hour.

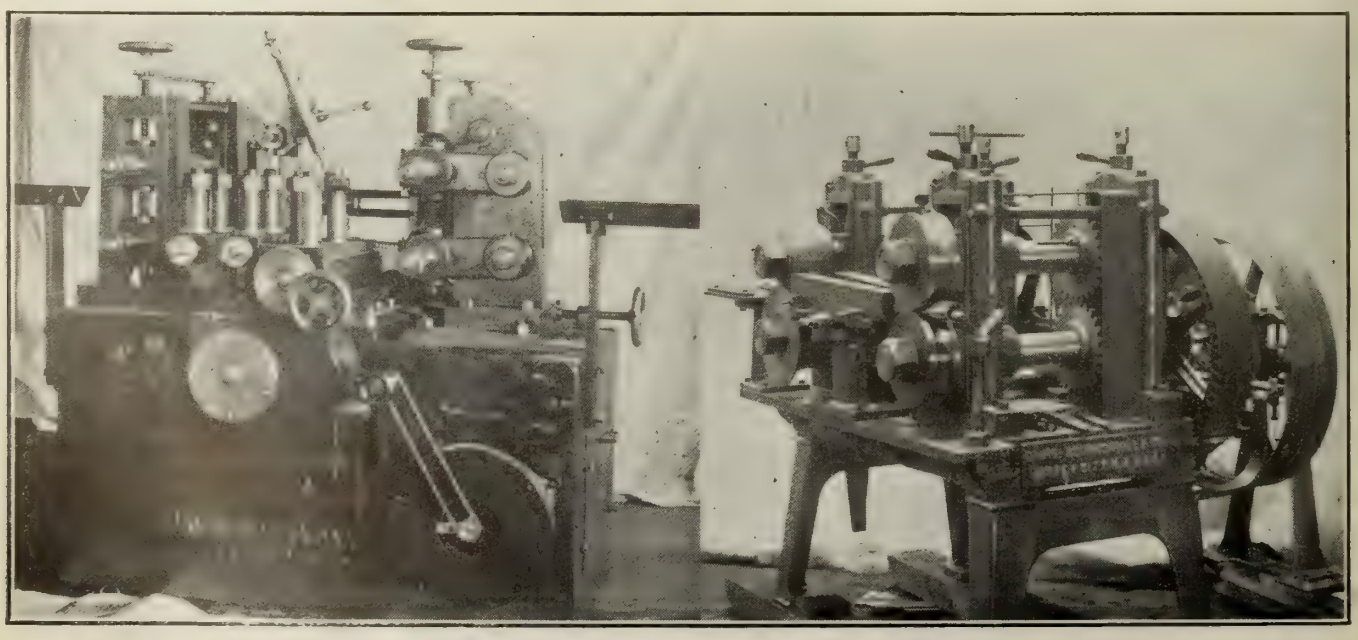
It is of the utmost importance that the roll and tube equipment of the forming mill be extremely accurate, and the machine adjusted to produce accurately-formed straight tubing without twist, in order to make possible automatic operation of the tube welding machines.

The tube welding machine is in reality a mechanism for propelling an open seam tube at relatively slow speed by means of accurately machined rolls driven through reduction gearing. This reduction minimizes the slight fluctuations in speed of the driving mechanism due to various causes, and makes possible the maintenance of a puddle of molten metal of considerable area, extending entirely through the thickness of the metal at the desired point.

Counteracting Strains

There is another function of the machine not usually apparent, which is the compression of the fused metal after solidifying. It is this compression, or working of the heated metal, which assists in the production of the exceptionally strong ductile welds produced by mechanical welding. Still another feature of the machine is the mechanical means of counteracting the contraction strains set up by the welding and compressing operation, combined with the rounding and sizing of the tube as it leaves the machine. This is accomplished by an adjustment of the rolls in relation to each other so as to cause a bending action on the tube, while hot.

In order to be assured of perfect tubing, the roll equipment must be very accurate and it is by no means uncommon to produce tubes on the welding machine within a variation of .005 from size and mainly on the cheaper grades of tubing,



Left:—Tube welding machine with overhung rolls.
Right.—Tube forming machine, with two-piece adjustable conductor between rolls.

roundness. Strange as it may sound, accuracy of this degree is practised and for the purpose of eliminating subsequent finishing and sizing operations.

The tube welding machines are usually made right and left hand, in order to allow the grouping of the machines so that when possible one operator can take care of two machines. The accepted method of driving machines of this type is by means of adjustable speed direct current motors, with field rheostat and push-button station mounted on the machine, the magnetic control panel used for operation in connection with this equipment may be placed at a distance, if desired. This equipment provides for forward and reverse motions, together with dynamic breaking, which relieves the operator of the necessity of throwing switches—a simple touch of the correct button automatically taking care of the operation of the machine. The rolls are individually adjustable for alignment, while the welding or compression rolls are in addition adjustable vertically.

On account of usual high speed of the driver, a reduction is made through worm gearing running in oil, and from this point through beveled gearing to the spur gearing, driving the roll equipment. For light gauge tubing, the rolls are placed between housings, the machine being of light construction yet ample for welding tubing much heavier than usually encountered. For changing the rolls equipment from one size to another, it is customary to remove one housing, which is arranged with slots for this purpose.

Wide Range of Machine

A very important feature is embodied in these machines, in order to make possible the welding of all diameters and gauges under the best possible conditions, that is, the adjustability of the guide roll and housings in relation to the welding rolls; the rapid absorption of heat in light gauge large diameter and small diameter tubes causing more or less distortion in passing from one set of rolls to the other, unless this distance is adjusted to counteract this tendency. The speed of welding the ordinary diameters and gauges of steel tubing is usually performed between 3 and 6 feet per minute; the speed varies as the thickness of metal varies, and to some extent in order to secure particular types of welds. It is the attention to small details, such as mentioned in the manufacture of machines of this type which makes possible real automatic welding.

For welding large diameters and heavier gauges, a tube welding machine is provided which is of a very much heavier construction, arranged with all rolls over-hung, making possible the changing of rolls from one size to another by simply removing the holding nuts. The same features of adjustability are incorporated in the larger machine; all bearings subjected to heat, however are watercooled, it being essential to use torches and tips of much larger capacity in welding at higher speed, or heavier walled tubing. While the large machine is primarily intended for welding large diameter heavy gauge tubes, medium diameter light gauge tubes can also be welded at a very much higher speed than possible on the machine previously described.

In addition to the roll equipment usually found on tube welding machine, there are added two additional pairs of compression rolls whose function is to prevent the rupture of the seam and recompress the metal, which, at higher speed, requires a longer interval of time to drop below the critical temperature due to the greater absorption of heat.

A feature common to both machines, and which is particularly necessary when welding at the higher speeds, is a universal torch adjusting arm which makes possible instantaneous movement of the torch in any direction, as well as movements controlled by thumb screws vertically and radially, together with provision for throwing the torch to a horizontal position for lighting and inspection.

Adequate Supply of Gas

Having a machine which embodies all the essential features and the required accuracy in construction, it is even more important to have an adequate supply of gases at absolutely unvarying pressures, also apparatus for burning the gases with flames so positioned as to take advantage of the physical changes in the tube while undergoing the welding and compressing operation. All other conditions being constant, the position of the flames in relation to the seam, and particularly the welding rolls, has a decided influence on the character of weld produced.

It is important that an interval sufficient for the solidification of the metal be allowed before the compression occurs, in order to prevent cracking while passing through the machine, therefore the final flame of the torch must be in advance of the center line of the two compression rolls. Any advance beyond a certain point requires more compression and tends to produce heavy welds which are usually undesirable on account of the cost of removing the excess metal.

Almost all tube and mechanical welding operations to-day employ the multiple flame welding tip. These tips may have any number of flames within the capacity (of the machine and work) to absorb the heat produced, to say nothing of the endurance of the person who must operate the machine.

Wave Formation

A person who has witnessed a welding machine in operation having a single flame tip in use, undoubtedly noticed the wave formation of the molten metal, seemingly traveling ahead of and around the flame, finally solidifying in the rear of the flame, and if the motion was unsteady, leaving wave marks indicating a long tapered wedge shaped puddle. The wave formation with a multi-flame tip is more pronounced due to the fact that every flame (which is the result of the combustion of gases under pressure), causes a series of waves, the depth of the hollow and the height of the wave above the actual surface of the metal increasing as the heat is absorbed, and the metal acted upon by each succeeding flame.

The remarks regarding the agitation of the metal due to the velocity of the gases, discloses the reason for the accuracy required in tool equipmen used in the production and welding of the tubing, together with the necessity for absolutely uniform speed and constant gas pressures. Welded steel tubing made from suitable material with the proper amount of care exercised in its manufacture as outlined, will go through the usual crushings, flanging, expanding, bending, and other tests usually performed on seamless and lap welded tubing in order to indicate its qualities.

Grinding the Weld

Welded tubing is usually finished by grinding to remove all evidence of the weld and produce a tube of uniform contour, this grinding operation being performed preferably on a motor-driven grinding machine, arranged for two operators working simultaneously, and with foot treadles controlling the pressure placed upon the tube necessary to quickly remove the surplus metal. The usual practice is to have the machine equipped with flexible buffs, coated with abrasive, and with the periphery curved so that when a tube is placed in the machine at an angle of approximately 30 deg., the wheel covers a considerable portion of the space and thereby prevents the grinding of flat and irregular spots on the surface of the tube; the operation being that of moving the tube backward and forward so that the operator can continually see the condition of the tube he is working on. When the tubing is welded with the idea of producing a strong weld with the least possible amount of finishing required, it is not uncommon for an operator to grind 4,000 or 5,000 feet of tubing per day. After grinding, the tube is ready for the finishing operation, which may be either swaging or drawing.

Swaging Operation

The swaging machine is of the rotary type which embodies a hardened steel ring pressed into the head of the machine inside of which there are a number of rolls, usually ten or twelve, these rolls being mounted in a steel cage which is free to rotate, while inside of the rolls there is the arbor of the machine which, at this end, is slotted in order to accommodate the dies and the hammers which are machined to the proper form so that when thrown out by centrifugal force are brought into contact with the rolls, and due to their form pass from one roll to the other with a smooth rolling action, thereby producing on the dies which are between these hammers a squeezing action, rather than a hammer blow, each contact with the rolls producing a slight rotation of the cage carrying the rolls.

(To be continued)

Practical Ideas for Shop Executives

SELECTION OF MATERIAL FOR GAUGES

By Henry James

The selection of material for gauges, depends largely on the gauge to be made, and its use. For flat gauges, such as profile or templates a good grade of low carbon or machine steel can be used with very good results, as it can be more readily worked and is not so easily affected by temperature changes. Plug and ring gauges require a higher grade of tool steel, and care should be taken to select steel that is free from pipes. This is, perhaps, one of the most difficult points to discover, as the piping in a bar of steel cannot be seen until the work has reached the hardening process. Steel for thread gauges should be selected with great care. A fine, close grained steel, which, when hardened and tempered, will show least distortion, should be selected. A test piece should be taken from the bar and machined and carefully measured, then hardened and tempered and again carefully measured to determine the effect heating has had upon it.

SUGGESTIONS FOR WOODWORKING DEPARTMENT

By Donald A. Hampson

The woodworking department that forms an adjunct to many machine shops often furnishes some difficult problems for the upkeep gang. This branch may have from one to a dozen machines in it—an equipment to do the patternmaking, packing, boxes and special containers, and general woodwork about the plant. Loose pulley repairs and rebabbitting are always a part of the maintenance work. Then there are mandrels to be straightened, machine heads to balance, etc. In recent years, safety requirements have necessitated extensive alterations and these alterations, after some years of trial, have proven themselves good from the production standpoint as well. One of the most noticeable is the round head for planers and jointers.

Shops that do not have these round heads are urged to change for their own good. They are much simpler to make than the old fashioned square heads—they may be turned out of a round bar and after turning there is no milling to do but for the two cutter slots. The improved static and running balance (and its continuance,) is one of the good features. A good many shops have saved the expense of new knives by milling down the old ones: the square head knives were, say, 7-16 in. by 3½ in. when new, of composite steel; these have most of the soft back cut off and make ideal safety head knives 3-16 in. by 1½ in. leaving all the good tool steel portion intact. These round, or safety, heads do smoother work than the square ones because of the better balance, if for no other reason. And they please the factory inspectors immensely. Then, because the blades set out from the head so little, there is less splitting of the wood as it is run through.

The old argument comes up—whether to put in two, three or four knives. Every shop has had workmen who advocated more than two knives—every shop has had salesmen come along and try to get it to buy new planer or jointer heads with three or more knives in them. But the very best advice that can be offered is, "Never Use More Than Two Knives." It is possible to make any number of knives cut alike but it is not commercially possible and any shop that fusses with them is wasting money. The time spent by the average man in trying to set three or four knives alike is time wasted—why, examine any head that has but two knives in it and the chances are that one knife will show plainly that it has been doing most of the work!

The only practical way to make more than two knives cut is to grind them, with one of the portable attachments, right in place on the head; and even then the conditions of running unbalance are more than likely to throw the work on one, two, or three of the knives. One of the most skilful wood working men in the section scorns to use more than two knives: "Why waste my time on something that don't show for it?" is his motto. And when it comes to a special job on the shaper or variety machine, he makes up only one knife, or blade, and puts a dummy in the head opposite, to balance up.

A case came up not long ago that will bear repeating. We had a big planer and it required frequent re-babbitting and dressing of the shaft. Everything seemed to balance all right on the ways and the repair gang certainly did good work on their part. Finally, it was conjectured that the driving pulley might be the cause of the trouble; accordingly, this 35 lb. pulley was removed and a wood pulley substituted. The planer has now run four times as long as previously between pourings and is still going well. This proof seems to show that the cast iron pulley was pounding out the bearing, vibration being set up under the belt stresses and speed.

PUTTING A BAND ON A BAR

By F. Scriber

A fixture having but four major parts that performs a rather important function is shown by the accompanying drawings. The purpose of this fixture is to bend the steel clip over a brass rod of rectangular shape, this rod is recessed as will be noticed from the assembly drawing Fig. 1. The clip is made in U shape by a punch and die. This clip A with both ends sticking up is placed by hand in the recess of the bar B, it is then held by one hand while the operator moves lever C first to the right and then to the left. This lever which is attached by a stud D to a formed piece E having two curved extensions thereon pushes down first one side of the clip and then the other side of the clip, the lever being down in its extreme left position with the clip forced down. The body of the fixture F is held to the punch by screws through holes G, it simply being made to support the work and the operative members.

Fig. 2 shows a detail of this block F which is made of cold rolled steel having an extension thereon at the 1¼ inch dimension over which the part shown below in the same illustration operates.

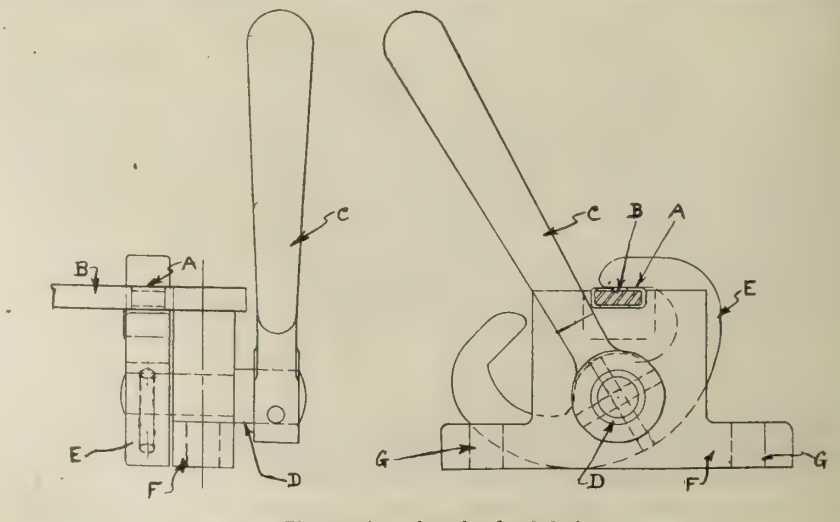


Fig. 1.—Assembly sketch of device.

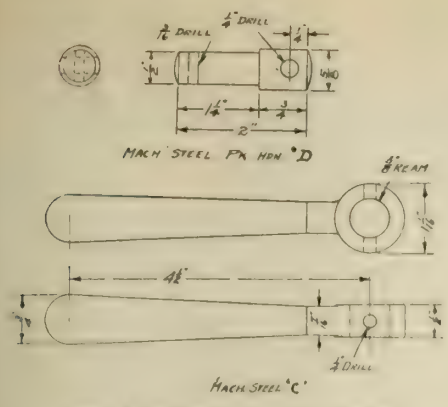


Fig. 3.—Details of lever and stud.

In Fig. 3 are shown details of the lever and stud which are pinned together by means of the quarter inch holes which have a pin driven through them, a pin is likewise driven through the piece E (having the curved extensions) to hold it to the stud D. The simple nature of this fixture for performing such an important function is one that has a very strong appeal.

HOW TO FIGURE BELTING

By W. F. Schaphorst M. E.

The question is often asked: "How can I figure fabric and Balata belts? I see all kinds of rules for leather belts but I seldom see anything about fabric belts."

In reply I have the following to offer. I have avoided the use of formulas and tables entirely in order to simplify the method as much as possible. Formulas and tables are often very vexing.

Balata Belts:—Let us suppose that you want to figure that width of a Balata belt necessary to transmit a given horse power. Proceed this way: Subtract one from the number of plies, multiply by the diameter of the pulley in inches, multiply by the number of revolutions the pulley makes per minute, then multiply by 0.000158 and then divide the result into the horse power to be transmitted. The answer is the width of the belt in inches. If you get 1.8 inches for the answer you will very likely decide on a two-inch belt in order to be safe, which is the right thing to do. If you get 2.01 for an answer you will decide that a two inch belt will do the work very capably and you will be right because these rules allow for an ample factor of safety. This rule is usable for Balata belts of 3, 4, 5, 6, 7, 8, 9, or 10 ply.

Fabric Belts.—Now for fabric belts. The rules as ordinarily given for fabric belts made up in plies are something like this—"A 4-ply stitched canvas belt is equivalent to a single leather belt. 8-ply is equivalent to a double leather belt." And so forth. Then after knowing the equivalent we have to hunt up our rules of thumb for leather belts before being able to decide on a width necessary for a given drive. Here is a rule which gives the direct answer without even thinking of leather. The rule applies to most ordinary belts made up in plies such as rubber and stitched canvas. Divide 2,640 by number of plies and to the quotient add 136; then divide the result into the speed of the belt in feet per minute; and then multiply that result by the width of the belt in inches. The answer is the number of horse power that the belt will transmit. For example, what horse power may be transmitted by a 10-ply canvas belt whose width is 6 inches and whose speed is 4,000 feet per minute? Substitute in the rule just given above and you will find the answer to be 60 horse power.

To find the width of a stitched canvas or rubber belt, proceed this way: Divide 2,640 by the number of plies and add 136 to the result, then multiply by the horse power to be transmitted and then divide by the speed of the belt in feet per minute. The answer is the width in inches. To find the speed at which a stitched canvas belt may be run, knowing the horsepower and width, proceed in this way: Divide 2,640 by the number of plies as before and add 136; then multiply by the horse power to be transmitted; and then divide by the width of the belt in inches. The answer is the speed in feet per minute. To find the number of plies to specify, knowing all other factors, proceed in this way: Multiply the width of the belt in inches by the speed of the belt in feet per minute and divide by the horse power to be transmitted; then subtract from that the number 136; then divide the result into 2,640. The answer is the number of plies.

Speed:—To find the speed of a belt, knowing the diameter of the pulley and the revolutions per minute—Multiply the diameter of the pulley in inches by 0.262 and the result by the number of revolutions per minute of the pulley. The answer is the speed of the belt in feet per minute. To find the number of revolutions per minute that will be made by a given pulley, knowing the speed of belt and diameter of pulley, proceed in this way: Multiply the diameter of the pulley in inches by 0.262 and divide the result into the speed of the belt in feet per minute. The answer is the number of revolutions per minute. To find the diameter of pulley, knowing the speed of belt and the revolutions per minute, proceed in this way: Multiply the number of revolutions per minute of the pulley by 0.262 and divide the result into the speed of the belt in feet per minute. The answer is the diameter of the pulley in inches.

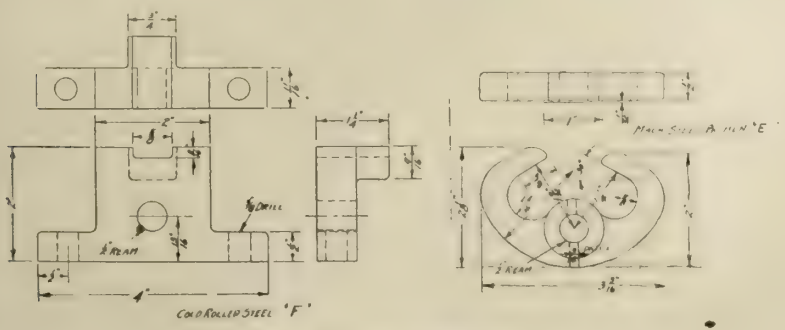


Fig. 2.—Details of block F.

CLEANING OILY MACHINE PARTS

One of the most troublesome of the minor problems in the repair and overhauling of motor cars and other machinery is the perfect cleaning of parts which have been thoroughly soaked in oil. This problem is very ingeniously handled in the new central repair works in connection with London's great motor omnibus service. The parts to be cleaned are placed on wire trays mounted on a conveyor which moves very slowly through a cylindrical casing inside which are mounted on a number of pipes perforated with holes ⅛ of an inch in diameter. Hot caustic solution is forced through the pipes by a pump, and the multitude of jets reach every part of the gear wheels and other portions of machinery passing through. When the parts emerge from the cylinder they are practically free from oil. In this way a process which generally is most prolonged and laborious is perfectly carried out in a minute or two.

AUTOMATIC CONTROL FOR HYDRAULIC PRESSES

The hydraulic press is a very ancient as well a very widely used machine, and it finds one of its most profitable applications in the seed-crushing industry. In order to secure the highest economy in seed crushing, the first part of the operation should be done at low pressure and the final stages at high pressure. Hitherto various mechanical arrangements have been employed to effect the control of pressure, but a British firm has just introduced a special valve by which the pressure is automatically controlled without the use of any mechanical details. From beginning to end the device operates without supervision and does its work much more accurately than with the old type where the change in pressure was carried out at the discretion of workmen. The arrangement is extremely simple, and tests made on it go to show that its use will increase the oil yield from linseed by one half to one per cent. while making a 50 per cent. reduction in the fluid which can be squeezed out of the cake.

The plant of the Snider Flour Milling Co., at St. Jacobs, Ont., was destroyed by fire recently, with an approximate loss of $100,000.

CORRECT UNDERSTANDING OF MECHANICAL VIEWS

(Continued from page 43)

object within are drawn. It is necessary to construct our understanding of planes and axes with a concrete example, even though it is imaginative. This gives us a base to proceed from and establish the different planes and axes from which views are supposed to have revolved.

The object that we wish to draw is assumed to be placed within this transparent box and the views drawn upon the surfaces facing the different views. (These have been shown shaded to stand out clearly.) The top or plan view is made on top of box, and we say it is drawn on the horizontal plane. This plane is revolved 90 degrees on the horizontal axis until it lies on the same plane as the front view which is drawn on the front vertical plane. This front vertical plane is assumed to be stationary.

The end view is drawn on the side vertical plane and that plane is revolved so that it is on the same plane as the front vertical plane. This plane revolves on the vertical axis.

The drawing depicted in Figure 2 shows the three planes as they would be represented on a drawing, the points on the side view are traced around from the top view by swinging arcs from the intersection of the horizontal and vertical axes and projecting down to the end view.

A thorough understanding of the different relations existing between the views should assist in eliminating unnecessary mistakes and loss of time in interpreting the draftsman's meaning; that is if he knows himself how to put his proper views on the paper.

Editor's Note:—The author seem to be taking a sly dig at draftsmen in general when he says at the conclusion of his article "that is if he knows himself how to put his proper views on the paper." From personal contact with draftsmen in Canada we find that it is only in exceptional cases the maker of the drawing projects his views other than third angle. Usually English or Scotch draftsmen are inclined to use first angle style until they become used to the new conditions in this country.

SOLDERING FLUXES FOR MACHINE CONSTRUCTION

(Continued from page 46)

use. It is fine for machine parts where heavy friction is encountered. For fastening hard and soft steel parts, it is much better to use strips of sheet copper and borax between them; heating both metals in a blacksmith's fire until the copper is melted and hammering both pieces of steel to effect a junction. They should then be plunged into a hardening bath of salt water. Do not quench the entire surface of tool, but leave some heat in the shank to allow drawing to a proper color of the hard steel cutting edges.

The above method of working saves time by not requiring reheating of the hard tip to draw to the desired tempering color, that quenching of shank and tip in the hardening bath would make necessary. When the desired color is reached, this salt water hardening bath is most excellent to dip the tool into to prevent any further extension of the colors, as it removes all oxide scale and imparts a silvery whiteness to a cutting edge. In the repairing of various kinds of machinery, the use of welded sections containing a steel having a carbon content of somewhat lower amount than tool steel, such as 0.88 per cent. will prove of value in places on machinery exposed to heavy wear as it allows of hardening and tempering the rubbing parts to such an extent, that it will make them continue in action for a longer time than would be the case if their wearing surfaces are made of a softer metal and casehardened.

The 0.88 per cent, carbon metal has the great advantage in repair work, that it can be welded to a wrought iron part of any machine very quickly and easily in a blacksmith's fire, only borax being needed. This results in much time being saved in getting machines into action after a breakdown occurs. Steel can be used for machine parts, but where there is heavy vibration, it is better to use wrought iron with a hard steel welded piece on its wearing surface, as wrought iron does not crystallize by vibration.

CHARGING HOIST FOR FOUNDRY CUPOLAS

The P. H. & F. M. Roots Co., Connersville, Indiana, have designed a charging hoist to reduce fatiguing manual labor, with its accompanying cost. In addition, they have developed this machine to save much in maintenance of refractory linings of cupolas. Many losses are directly traceable to faulty methods of charging, which result in expensive delays very often overlooked. The hoist is operated by electrical power, either from overhead or floor, and is designed to pick up pig iron or scrap on an electric magnet and deposit same in an iron melting cupola by means of a cantilever charging arm, attached to the hoist frame. Magnet is interchangeable by means of an automatic hook with a drop bottom bucket for the charging of fuel and flux in cupola.

By charging with a hoist with cantilever arm, all materials to be charged are deposited in cupola concentric with the center line of cupola, which evenly distributes each charge. The materials being charged on the center line do not come in contact with the refractory brick lining in cupola, consequently materials do not cut away this lining. This is impossible where charges of materials are fed by hand, dumped from cars or charged by chutes through charging doors of cupola. If such means are employed, materials bank on one side of cupola and as such a charge works down melting becomes uneven, because the air blast seeks the line of least resistance until the materials on the low side of bank are all melted, thus giving a direct outlet for the air blast, which in turn will help cut the refractory lining in cupola. In addition to this the materials which are banked on the high side become slightly chilled because insufficient air is supplied for proper combustion. This condition often necessitates, at the end of a long heat, the dropping of the bottom with a large amount of material not melted.

By mechanical charging with a magnet on the center line of cupola, the great volume or weight of iron charged at one time will help pack the bed down and keep forcing materials into the melting zone without arching or bridging over. Under the present charging system, the tendency of arching or bridging in the melting zone is always present, and this arch or bridge holds until a sufficient amount of materials has been added to force it down. During this period of arching very little iron is melted, which sometimes causes long delays in securing molten metal and many times requires a shutdown until this arch or bridge is broken.

An extremely simple, quick change, automatic hook on magnet and bucket enables the operator to lower hoist ropes with "U" bolt into funnel-shaped hook, which by gravity slides down incline to center line of hook, and when hoist ropes are reversed upward "U" bolt automatically engages with hook. This hook also forms a guard for ropes and magnet cable when hoisted and telescoped into charging arm, preventing damage from heat and swinging while depositing charges in cupola. To release hook operator has only to lower and travel hoist back until ropes are on an angle; then the hoist ropes and "U" bolt disengage the hook and slide up the incline and out of the hook casting.

WELDING BY CLOCKWORK

In shipbuilding and in many engineering operations, it is necessary to fix brass studs and other small parts to iron plates. This operation is usually performed by drilling holes in the plate, each hole being drilled separately. By means of an ingenious invention recently perfected by a British firm, the process is carried out in a few seconds by electric welding. The working of the machine is almost entirely automatic from the moment the stud is placed in position. Each size of stud requires a different time for welding it to the plate, and the machine can be set to give exactly the period required to make a perfect weld. The tests which have been made proved that the machine is able to weld 120 brass studs within an hour. It might be thought that welding does not give such a firm arrangement as screwing the stud into a hole in the plate, but when the welded stud is hammered the brass will break before the weld yields. Another advantage of the machine is that work can be satisfactorily carried out by semi-skilled labor.—*100-ton Booster.*

New Things in Shop Equipment

AMPLIFYING GAUGE

Two smaller sizes of a well known amplifying gauge have recently been placed on the market. The smaller gauges are limited in range and do not have all the attachments of the larger gauge. It is made in two sizes, one of which is intended for work from ¼ in. to 2in. in diameter, and the other for work from 2 to 4in. in diameter. The firm manufacturing these gauges is the American Gauge Co. of Dayton, Ohio.

MOTOR DRIVEN DISC SANDER

A very useful electric disc sander has recently been placed on the market. It is particularly adapted for accurately sanding segments, angular sections, coreprints, and circular and taper work. It can also be used in machine shops for medium and light metal work. The steel disc plate is fifteen in. in diameter, and is easily removable for renewing the sandpaper or emery cloth on its face. The speed of the disc is 1725 r. p. m. The table has a groove to receive angle and circle segments, and duplicating gauges. The table tilts 45 deg. downward from the horizontal plane and 25 deg. upward. A graduated index is provided to show the angle at which the table is tilted. A vertical table adjustment of six inches provides for handling a variety of work. The angle gauge is graduated from 0 to 45 deg. both to the right and left to permit of accurate settings. Alternating or direct current motors are provided. The motor is coupled to the disc shaft in such a manner that it does not receive thrusts from the latter. A push button control switch is located on the column. The machine is portable and electricity can be taken from any light socket. The manufacturers are the Oliver Machinery Co. of Grand Rapids, Mich.

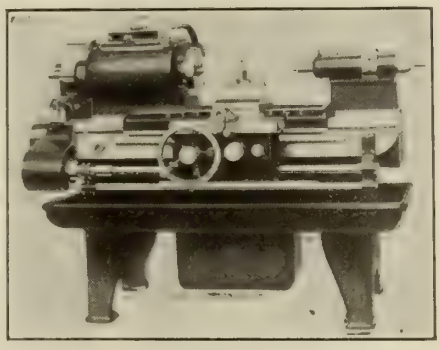
REAMER DRIVING MACHINE

To facilitate the reaming of finished holes to size in the assembly of machines or mechanical units, a device for driving hand reamers has been placed on the market. It is capable of driving hand and machine reamers up to 1½in. in diameter. The mechanism is mounted on a pedestal and power is supplied by a motor mounted on bracket about half way up the pedestal. The motor is a 1/6 h. p. machine that can be used on either direct or alternating current. The power is transmitted to the horizontal spindle in the mechanism by means of a round belt. A three-step cone pulley provides three specific spindle speeds, of ten, twenty, and thirty r. p. m. respectively. The operator stands directly in front of the machine and feeds the work on the slowly revolving reamer. The reamer centres itself. The spindle is fitted with a 5in. Cushman geared scroll chuck. The end thrust of the machine is taken up by ball bearings. The gears in the gear case run in oil. The control switch is of the self-contained tumbler type. It is claimed that work is reamed much more quickly than if it were done by hand and that the finish is much better. The distance from the floor to the centre of the spindle is 38 inches. The machine is portable and weighs about 145 pounds. It is manufactured by the George H. Blettner Co. of Chicago, Ill.

12 IN. MANUFACTURING LATHE

The lathe here shown has recently been placed on the market. It is designed primarily for manufacturing purposes, but if it is desired for thread cutting this can be arranged by substituting a lead screw in place of the feed rod.

The general design of the lathe is the same as the 9 in. machine. The headstock is of selective speed, the drive single pulley type with a very powerful friction clutch to the large driving pulley. The same movement that disengages the clutch automatically applies a brake which stops the spindle instantly. For attaching air cylinder, draw-in



12 in. Sundstrand lathe.

attachment, expansion chucking device, etc., an extension is provided at the outer end of the spindle. Main spindle taper bearings are made from high grade bronze bearing metal, adjustable for wear by means of a single nut at the rear end of spindle, providing an instantaneous adjustment. A special feature on the carriage is the multiple stop collar which makes a positive stop for the cross slide when turning shafts with shoulders and different diameters. The carriage which has exceptionally long bearing surfaces on the ways and is arranged with slide block for taper attachment, has lugs on top, drilled and tapped to permit the mounting of extra cross slides, special tool holder blocks, etc. The apron is of improved double wall type, very simple with a minimum number of working parts and gears. A feed reverse box, of bevel gear and clutch type, very simple in construction with steel gears and bronze shaft bearings, is regularly furnished. A quick acting tailstock is supplied as standard equipment. Taper attachment, draw-in attachment and rear tool block can be furnished. The machine is manufactured by the Rockford Tool Co. of Rockford, Ill.

EXPANDING CYLINDER REAMER

One of the recent tools that have been placed on the market is a reamer or boring head intended for refinishing automobile cylinders and having an expansion of approximately ⅜ of an inch. The head may be screwed on to the end of a boring bar and then used on machines of different types. The adjustable members of the head are concealed and protected within the head itself. Thus dirt and all foreign matter is excluded, and cannot interfere with the making of adjustments. During an adjustment the blades remain in the same relation to one another, therefore do not require regrinding to true them up. To adjust the tool eight screws on the face of the head must be loosened. These screws hold the front plate firmly and when held tightly in place, the plate acts as a lock for the individual cutters. As the screws are loosened the plate is pressed outward by four coil springs in the body. When the plate has been pressed out sufficiently the blades are then free to move in the radial slots in which they are contained. A centre adjusting screw on the face forces the blades outward or inward as desired. After an adjustment has been made the eight screws are tightened and the plate locks the blades in place again. The reamer is made in different sizes up to 4½in. in diameter. It has been widely used in turret lathes and other machines used in quantity production. The reamer is manufactured by the Campbell Auto Works of Stockton, Cal.

POWER PRESS PULL OR PUSH FEED

There has been placed on the market recently an attachment for power presses that provides for the automatic feeding of stock of various widths. The fixture can be applied to any make of power press. The casting on which the members of the mechanism are mounted, is attached to the bolster plate of the press by means of four cap screws which pass through slots in the casting. This method of attaching permits of the shifting of the cap screws to suit the holes in the bolster plate. Power for the

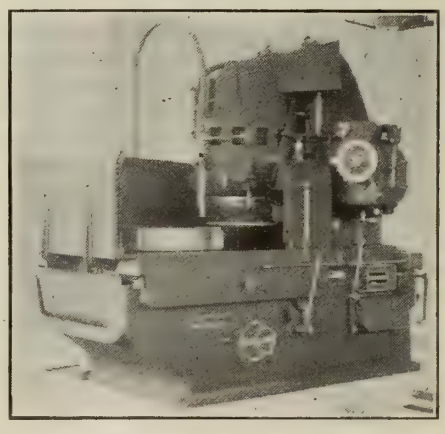
mechanism was obtained by placing an eccentric crank on the main shaft. By means of a gripper, the stock is moved forward. When the stock has advanced to the required position over the die a trip on the gripper comes into contact with an adjustable dog and releases the hold of the gripper on the stock. A rod then pulls the gripper back and while this movement is taking place an adjustable retaining pawl prevents the stock from moving. When the gripper has returned to the desired point the trip engages a second adjustable dog which re-engages the stock for the next operation. A handle on the gripper provides for releasing its hold on the stock at intermediate points when necessary. The operation of the device is positive, and by adjusting the position of the dogs the stock may be fed to the die without unnecessary waste of material. The apparatus can be arranged to either push the stock to the die or to pull it, as is desired. The manufacturers are the Walsh Press and Die Co., of Chicago, Ill.

CHAMFER GRINDING FIXTURE

A fixture has recently appeared on the market which is intended to be used in grinding thread chasers in such a way as have all chamfers exactly alike. When the chamfer on a set of chasers is not the same on all the individual chasers, the burden of cutting comes on one or two chasers with the result that threads are cut out of lead, tapered, or with other irregularities. The fixture is principally designed to grind chamfers on the milled form of chasers made by the manufacturers of the fixture, but it may also be used for grinding chasers of the tapped form. With chasers of the latter form the grinding is straight and does not conform to the contour of the chaser threads. The table of the fixture is graduated and may be set for grinding long or short chamfers. A narrow key engages the keyway of the chaser and acts as a guide while grinding. An adjustable stop governs the position of the chaser with respect to the grinding wheel. The side of the fixture is also graduated to enable the table to be tilted accurately to the desired angle of the chamfer clearance. One table accommodates all sizes of chasers both right and left hand. The fixture is bolted to the table of a grinding machine and the chaser is slid forward by hand to the wheel, and against the stop provided on the fixture. However, on those machines that permit of so doing, the chaser may be fed forward by means of a machine hand-wheel or lever to a stop arranged on the machine. The fixture may also be mounted on a machine slide and the chaser ground by passing it back and forth across the edge of the grinding wheel. The manufacturers are the Geometric Tool Co. of Bridgeport, Conn.

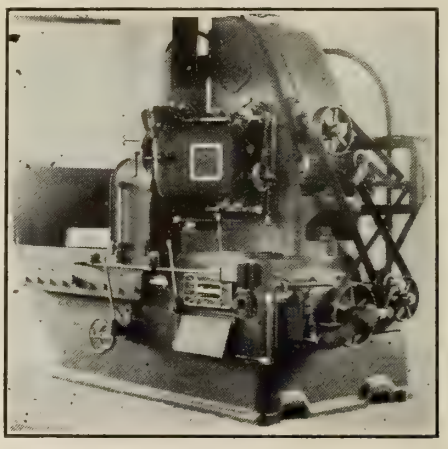
HEAVY DUTY VERTICAL GRINDING MACHINE

There has recently been placed on the market an exceptionally large machine for surface grinding. The general dimensions are 12 ft. 6 in. long, 7 ft. 6 in. wide, and 10 ft. high, with a weight of 30,000 lbs.



Blanchard High-Power Grinding Machine.

The work is carried on a rotary magnetic chuck, 48 inches diameter which is moved horizontally from the loading to the grinding position, and there rotated continuously while the wheel is gradually fed downward. Owing to its size and weight the chuck and table is traversed by power. In other respects the operation is like smaller sizes of the same make although the mechanism is different. The grinding wheel is 27 in. diameter, 7 in. deep, with rim either 2 in. or 3 in. thick. It is sulphur mounted in a cast iron retaining ring, attached to the faceplate by six screws, and is wire-banded. The wheel head weighs 3 tons and has built into it a 60 horsepower, 600 r. p. m. induction motor. The rotor is directly on the wheel spindle, which is 5½ in. diameter and is carried on two large radio-thrust ball bearings. A spring take up at the upper end exerts an upward pull on the spindle which exceeds the weight of the rotating parts by 1,000 pounds. This initial load on the lower or main thrust bearing eliminates all play or backlash. The main bearing has a rated thrust load capacity of over 25,000 pounds.



Rear view of Blanchard grinding machine.

The wheel safety guard is of 5/16 in. steel plate, carried on three heavy steel rods, and has a convenient rack and pinion mechanism for vertical adjustment. A wheel dresser attached to the head provides for dressing or sharpening the face of the wheel while grinding. There is the usual water supply to inside of wheel through a 2 in.-pipe and to the outside nozzle through a 1½ in. pipe. The head is mounted to slide vertically on a massive column. The usual three point support is used to fasten the column to the base, thus making it easy to secure and maintain proper alignment.

The vertical motion of the wheel head is controlled by a heavy feed screw, 4½ in. dia., carried in a ball bearing in the column. This screw is driven through a gear box mounted in the column, receiving its power from the upper pulley. Double friction clutches provide for rapid raising or lowering of the wheel head. Both hand and power feeds are provided by means of the box on the front side of the column. The power feed has an automatic stop, also a convenient adjustment, giving feeds from .0005 to .005 inches per revolution of the chuck. A single lever controls the engagement of the power feed, and the raising and lowering clutches, and is arranged so they cannot be simultaneously engaged.

The chuck is driven through a four speed sliding-gear box, with friction clutch for starting and stopping, interlocked with the gear shift. Power for all purposes, except driving the wheel, is supplied by a 5 horsepower motor. The rotary magnetic chuck for holding the work is 48 in. dia. and is of the Blanchard one piece steel type. It has closely spaced poles suitable for holding either small or large work. The face is of brass and steel and is absolutely waterproof. The chuck is carried on a substantial table, sliding on the base on one flat and one V way. This table spans the base like a bridge and all water and metal from the work fall directly into the first part of the water tank in the base, where most of the solid material settles to the bottom. From here the water overflows into the rear part, under the column, where any remaining material can settle. The water then flows under a skimmer, which holds back floating dirt, and over another dam into the pump tank. The first part of the main tank is cleaned from the left end, and the second part has a large clean-out opening near the right hand end on the front. Both parts are so arranged that the entire bottom can be reached with the hoe provided, and an inclined end leading to an overhanging drip edge makes it easy to remove the mud into any receptacle. The pump tank is accessible for cleaning but rarely requires it. The total water capacity is 425 gallons. The machine is made by the Blanchard Machine Co. of Cambridge, Mass.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Important Machine Development

THE ADVANCEMENT made in machine tool design during the last decade has been phenomenal. Every industry could at least show one case where machinery has taken the place of hand labor, with resultant saving in time, energy and money. Take for example the travelling crane, the mechanical piler, the gravity conveyor, the air hoist, and hundreds of other mechanical devices which have almost eliminated hand labor in some industries.

Trucks and other forms of commercial vehicles would never have reached the present state of development had it not been for machine tool and gasoline engine designers, and the same holds true in other lines of manufacture. Even in road building and track laying, the machine supersedes to a large extent the laborer. The modern method of laying a street car intersection, is to start late in the evening with a gang of men, supplemented with modern machinery, and have the cars running over the new intersection the following morning. Instead of using the old time pick axe, we now have the steam driven pavement breaker, and air tools for varied purposes. The air compressor is usually self contained, and in addition we have the electric welder busily engaged making rail connections. To get his power, he merely connects a pole to the trolley wire overhead.

The latest to feel the benefit of modern machinery is the cotton industry. Human labor has played an important part in this trade for over 4,000 years, but now hand picking of cotton will soon be a thing of the past on the modern plantation, as an electrically operated picker has recently been perfected and placed in operation. With the new machine, it is possible for one person to gather from 400 to 700 pounds of cotton per day, as compared with 70 to 150 by hand. This solves the greatest problem of the cotton grower for it allows him to harvest all his crop before the rains and frost damage the plants. It will allow the cotton to be picked when ripe, thus improving the grade and adding about $10 to the value of every bale.

One of these days, someone is going to start a movement to erect in the capital city of each country, a monument to machine tool designers, for without their help and advice, the world would never have reached its present stage of development. More and more, the art of machine tool design is becoming specialized, engineers devoting their entire time to some particular branch of industry. The result is that these men become experts in that particular branch, and produce machines of the highest efficiency.

* * * *

Interest in Workmen's Compensation

THE QUESTION of workmen's compensation has aroused great interest among manufacturers, so that the article on this subject, appearing on another page, is both timely and interesting. Our contributor desires to remain in the background, but he holds an important executive position, and has made a close study of the subject for several years. His object in presenting the article is two-fold. He wishes to give readers information, but also desires to start discussion, therefore every manufacturer should write us his opinions on the subject.

No one will question for a moment the benefits derived from the act during the past seven years. It has helped the employee, saved employers undesirable litigation, and has resulted in every employee getting full benefit from any payments made. The expense of running the board is low, being only two per cent. of assessment made, so there can be no criticism on that score.

No matter how well an organization is run, there is always room for improvement, and the points brought out in the article deserve careful consideration. If employees are forced to contribute to the fund, by means of premiums, they will, no doubt, try to get as much out of the fund as they put into it. This will undoubtedly increase malingering, and those in authority should weigh the matter carefully before proceeding with the premium suggestion. There is also the question of additional clerical expense involved in collecting these premiums. Considering every angle of the situation it is very doubtful if the hoped for benefits would justify the means.

We have already emphasized on this editorial page the importance of selecting only the best type of doctor available for treatment of injured employees. As we mentioned in our April 20 issue, inefficient doctors are a menance to industry and should be eliminated as soon as possible.

So far as statistical information is concerned, there is a great need for some quicker method of supplying manufacturers with figures showing individual records. Once start the practice and a competitive spirit will be automatically aroused which will tend to materially reduce not only compensation costs, but the number of accidents.

With such reports coming in, every manager would be anxious to show the best record in his own particular group, and would do all in his power to make his plant safe. A quicker return of figures would entail additional clerical expense, but would pay in the end. Those responsible for the compiling of accident records should do all in their power to speed up the service. Monthly reports are necessary and would fill the bill admirably. We cannot expect the improvement to be sensational in character, but the sooner the present methods are improved the better. When a manufacturer receives 1920 figures in 1922 it shows conclusively that the present system is poor and of little worth in checking the cause of the trouble.

* * * *

DO YOU believe in the use of "Goggles?" If you don't, read the article on page 36 of this issue which shows how the goggle problem was licked in one plant. If you do believe in their use, read the article anyhow, for it makes mighty interesting reading.

Everything the author has said is absolutely true, and if other plants were to adopt a similar policy, less eye accidents would occur. There are some industries where the element of danger is greater than in others, but in practically every industry, the danger of flying chips or particles is existent, resulting in many cases in the loss of an eye.

Prices Remain Firm In Iron and Steel Lines

April Demand Slackened Off Slightly in Some Lines—Better Business Expected This Month—Building is Active—Coal Strike Has Not Restricted Steel Production up to Present Time

GALVANIZED SHEETS ARE LOWER IN PRICE

CANADIAN markets show a slightly better tone. Although nothing outstanding has occurred during the week, a spirt of confidence exists, in spite of the fact that April business in some lines was not as good as March. This is easily understood when we figure that there were only 21 actual working days in April, owing to holidays and Sundays.

Iron and steel continue in fairly good demand, prices being firm in bars, small shapes, etc. The price of 28 gauge galvanized sheets is under fire, some claiming $5.55 to be the market figure. Anyone knowing the market closely can purchase at $5.35, and the same is true of Premier No. 28 sheets. No advance s been made in steel prices of any kind, competition being too keen to allow merchants to take a chance.

The non-ferrous market shows a slight improvement, consumers displaying added interest. Prices, however, remain the same.

The demand for pig iron has tapered off, but during the past few weeks, many consumers have been able to get under cover. In fact, although the present price of pig iron is now up $2 a ton since April 20, the mills are chiefly working on orders at the old figure. This shows how well consumers protected themselves.

Machine tools are doing a little better, new tools making a better showing than for some time past. No large orders have been closed, but the total volume of business is not disappointing. Second hand tools are still moving, but not as briskly.

Scrap metals are firm, but as the demand is not very great, the firm price means very little. Oils and waste are moving at a fair rate, the latter showing a ten per cent. increase in April over March.

Small tools and supplies are quieter, at least so the majority find it, although one large merchant reports a 35 per cent. increase in orders during April, over the previous month. This, however, is the exception, rather than the rule. The automotive industry is very busy, this helping the small tool field.

Building activities are proceeding nicely, and Montreal especially reports that materials of this nature are in good demand. Steel pipe shows added strength, deliveries longer than ever, owing to the demand. In fact, some business in certain sizes is being turned down.

The steel market in the United States has now assumed the aspect of a sellers' market. The mills decide what orders they will accept, and price cutting is practically non-existent, even on very desirable orders. Instead of hindering, the coal strike has really been a good thing for the steel industry.

The production of steel ingots at present is between 36,000,000 and 38,000,000 tons a year. This is about a million tons more than the March average. Distributors and manufacturing consumers are less active on the finished steel market, but a fair amount of orders are still coming in. The complete steel market can be said to be moderately active, but not quite as lively as at the end of March.

Production at the mills is about 70 per cent., and in all products, the regular market prices are being rigidly adhered to. Bars, shapes and plates are selling at 1.50c, bands, hoops and hot rolled strips at 2.00c, and blue annealed sheets at 2.40c.

The pig iron market has practically disappeared. Several furnaces have had to bank owing to coke shortage. A recent sale of basic was made at $24, and the market may be quoted as $24 valley, against $19.50 for Bessemer, $18 for basic and $19 for foundry on April 1. There is little enquiry for foundry coke as foundries have already stocked up quite freely.

Toronto

May 3rd.

THERE is no question but what general conditions are improving on the local market. A few dealers complain about the rate of recovery, but the majority of merchants are content to see the slow but gradual improvement, feeling that after all, a slow steady recovery is better than a sensational rise, only to experience a further set back at a later date.

Iron and Steel.—This market was somewhat of a disappointment in April, because compared with March it just breaks even. In fact, some claim that April business was less than March, but when one considers that there were only 21 actual working days in the month, the reason is self apparent. Last week, the demand, while general, was not very large, this helping to show a poor total for the month.

Dealers and merchants generally expect good business this month, and the consensus of opinion seems to be that small shapes and blue annealed sheets will be the active members. May is usually a good month, and present indications point that way. Prices remain unchanged, and until Canadian mills advance their quotations, dealers will not take a chance, competition being too keen. Existing prices are firm in bars, and the quotations noted below are being strictly adhered to.

Quite a bit of argument is going on regarding galvanized sheets 28 gauge. Some claim $5.55 is the nominal price. Don't believe it, for the man who knows his market can secure all he wants at $5.35. The same holds good regarding Premier No. 28 U. S. sheets. Should dealers use the argument that $5.35 is given only in good sized orders, lose interest, and see how quick they will meet the lower figure. At present no particular line is featured, and the coming week is being watched carefully by all merchants.

Other dealers look for increased activity in boiler tubes this month, as several plants are contemplating boiler repairs. Following are existing quotations:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—The $2 increase which came into effect April 20, is now a settled fact. The demand is slightly better than a month ago, but has tapered off from the volume of two weeks ago, when every consumer was rushing for cover. In fact, so many managed to get in at the old price, that the mills are still producing at the low figure.

Foundries have a fair stock on hand, and unless the coal strike assumes a more dangerous aspect, it is unlikely that any further rush for material will take place. The local price is $29.15 and recent buyers find that no concession is allowed on this figure.

Non-Ferrous Metals.—Red brass and copper shows a little added strength this week, but nothing of great importance. Prices remain the same, but consumers show more interest. Following are present quotations:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	0 8
Aluminum	26 00

Scrap Metals.—Prices remain stationary on this market, but improvement in demand is noted. There is a little better tone throughout this section, and red brass shows the best strength of all. White metal is weak, steel scrap is fairly strong but the mills are only in the market for a limited tonnage. Cast iron is firm, but in no line is a heavy volume of business moving. Following are present prices:

Copper, light ..... per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools. — A fair amount of business is being closed on this market and although the rate of selling is far from normal it is encouraging. Buyers are showing a keener interest, and new tools are selling at a better rate. One dealer says that 60 per cent. of his business last month was in new tools, this being quite a change from his March experience, when second hand tools were in chief demand. No orders have been closed, but the total volume of business in April shows a slight improvement over March.

Small Tools and Supplies.—A peculiar condition exists on this market. With one exception, dealers claim that April was a disappointment, the volume of business being less last month than in the previous one. The exception, however, states that his small tool and supply business increased 35 per cent. in April, and proved his statement by showing us figures for the different sections. Pumps showed themselves to be the feature, valves and steam goods, transmission equipment, and general supplies, following in order. In fact, this particular dealer finds business so good that he is sending two more men on the road, although he has eleven travelers busy at present. According to his statement, last week reminded him of the old war days, so great was the demand during that period. This does not apply to the complete market locally, but only to this merchant who is out very aggressively after business.

Steel Pipe.—The demand for steel pipe continues, and in some cases orders are being refused, where sizes are not in stock. Consumers are afraid of the coal strike, and are trying to cover their requirements. Delivery rests with the mills, and they are doing the dictating. Prices remain the same, but should there be any change it would be upward.

Waste and Oils.—The demand for waste and oils shows a slight increase. April business in waste denotes a 10 per cent. increase over March, but oils are about the same in April, as in the previous month. Following are existing quotations:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal.	1 35
Linseed oil, raw, single bbls.	1 00
Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bls.	1 00

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

Montreal

May 3, 1922.

BUSINESS has not changed during the week. Activity in building operations continues, this being largely made up of residential buildings, apartments, and stores with living quarters above. A few office buildings are under construction, also a limited number of industrial extensions. Building materials are in better demand than they have been for several years.

Iron and Steel.—From practically all quarters there comes the statement that the coal strike will have a great influence on the iron and steel markets, although up to the present no advance in quotations has been made.

If an increase does come it may not be directly caused by the strike. The small volume of business passing has not drawn on the supplies of jobbers, or of the mills to any extent. Conditions in the States are continually becoming brighter and it is only a matter of time before the better tone will be felt locally. It has been suggested that as British quotations on steel and iron products are not much higher than the American quotations, if the strike lasts, perhaps some steel might be imported. This is hardly likely to be carried out, as before the steel could be delivered, the strike might be settled.

Structural shapes continue to move fairly well, and merchant bars are also in nominal demand. Plates are very quiet. Galvanized and blue annealed sheets are in fair demand, but are not moving as well as they were a short time ago. Spikes, nails, and small steel products are in somewhat better demand, and local quotations remain the same in all lines. These are as follows;—

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron:—No. 1 pig iron is still quoted at $31.80 locally, with a tendency to stiffen. Up to the present, producers were quoting until the end of June, but it is stated on good authority that in the near future pig will not be quoted beyond thirty days. This decision is being made because it is thought practically certain that higher quotations will prevail in the coming months. Locally, many of the small foundries have come into the market recently for car lots, and this together with some larger orders have swelled the tonnage up to a point where business may be said to be fairly active.

Machine and Tool Supplies:—No increased activity can be reported in the machine tool field. Sales for last week have been rather limited, and consisted mostly of small tools. Woodworking tools are removing somewhat better, but business is still spotty in this line. No price changes have been made, and as far as can be ascertained, none are contemplated. The supply market has been somewhat better during the week as jobbing shops are getting more business, and in some instances are pretty busy.

Non-Ferrous Metals.—In spite of the fact that in the United States and British markets the volume of business passing in non-ferrous metals has been steadily improving for the past two weeks, there has been very little change in the small volume of business passing locally. Prices have stiffened somewhat in sympathy with foreign quotations, but aside from this no change has occurred. Lead and spelter are both very firm, and the local quotations are as follows.—

Lake Copper	16 75
Electric Copper	16 50
Castings, Copper	16 25
Tin	35 00
Lead	6 75
Spelter	7 50
Antimony	6 50
Aluminum	23 50

Scrap Metals:—The volume of business in this market is about the same as last week. Prices have stiffened a little due to the demand for this class of material in the States. The market has been extremely quiet for months and the present turn for the better has been very welcome to dealers. Local stocks are not heavy, as very little effort has been made to collect the material. Quotations are as follows:—

Copper, light ..... per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 25
Yellow brass turnings	4 75
Light brass	3 00
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	7 00
Heavy melting steel	9 00
Axles (wrought iron)	17 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	18 00
Pipe, wrought	7 00
Car wheel	17 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	3 00

Pittsburg

May 3rd.

THE COAL strike has not restricted steel production, for the rate is slightly heavier than a month ago, and the market is stronger than ever. It is strictly a sellers' market, in that the mills decide what orders they will accept, instead of cutting prices to get almost any kind of an order. On the whole, the coal strike has proved a very good thing for the steel industry.

Of course there is the superficial showing that at some points steel production would be greater if production of Connellsville coal and coke were not restricted, but then it might be too great, and if there had been no coal strike, or expectation of one, steel demand might not have been as heavy during the past three months, as it has been.

Production in the Connellsville region is about one-third what it was in March, and has been approximately stationary for the past ten days. It is quite unlikely these non-union strikes will extend farther, but it is improbable that the men will drift back to work in large numbers in the very near future. They must do so eventually, for the Connellsville region has always been non-union, and it is absurd to think of its becoming union, under the control of the United Mine Workers, in the very year in which the U. M. W. so prosperous and powerful in the past quarter century, is likely to lose its chief foundation, the check-off. The check-off may be described briefly as automatic unionism, the dues, fines and initiation fee being deducted by the payroll clerk and remitted in a lump sum to the district office of the U. M. W. The union operators are determined never to agree to the check-off again, and the non-union operators are not going to become union at a time like this.

Iron and Steel.—Only a part of the iron and steel industry depends on the Connellsville region, where these non-union strikes occurred. The union strike was fully expected, and ample provision was made for it. The Connellsville strikes, however, were not expected, and there has been striking in some other non-union districts, but not enough to have much influence on the general coal situation. The Connellsville strikes are important.

The iron and steel industry has now had a month to adjust itself to this unexpected condition, and is lined up for a very fair production indefinitely. The Steel Corporation uses Connellsville coke almost exclusively in its Pittsburg district and valley mills, having other sources of supply for Cleveland, Lorain, Chicago, etc. The corporation has bought coal freely on 30, 60 and 90 day contracts, much of this being West Virginia and Kentucky coal for the Clairton by-products coke plant, the largest of its kind in the world. The corporation's production in the affected district is slightly reduced, but production in other districts is increased. Much the same condition obtains as to independents.

Production of steel ingots at the present time may be estimated roughly at between 36,000,000 and 38,000,000 tons a year, against rates of 35,000,000 tons at the end of March, 30,000,000 tons at the end of February and 20,000,000 tons during December. Thus, if there should be a material reduction in output later, on account of the coal strike, which is improbable, the rate would be set back only a few weeks and would remain much heavier than a few months ago.

Many distributors and manufacturing consumers bought finished steel products heavily in February and March, in anticipation of possible trouble in deliveries on account of the coal strike set for April 1. They are now less active in the market, but buying from other motives has arisen. Some of this is attributed to the fact that mills have got back to their normal gait, and are scheduling rollings two or three weeks in advance, whereby one cannot depend upon instant mill shipment on a new specification and must round out stocks. Then there is no doubt some increase in actual consumption, while the railroads week by week are somewhat better buyers. Thus the steel market is moderately active, though probably not as active as at the end of March.

The steel mills are comfortably filled with business for the next two or three months at their present rate of operation, production being about 70 per cent. capacity, and having little margin in which to increase production, on account of the coal strike, they are in a very independent position. A few are showing their attitude by announcing to the newspapers "advances" in their prices. There are some mills that are conspicuously free in cutting prices when the market is weak and asking extra prices when the market is strong. The majority try to peg along with as few changes as possible.

In all products the regular market prices are being quite rigidly observed, concessions to secure particularly desirable orders having disappeared so far as can be seen. The market is quotable as follows: Bars, shapes and plates, 1.50c; bands, hoops and hot rolled strips 2.00c; standard steel pipe, 71 per cent. basing discount; blue annealed sheets, 2.40c; black sheets, 3.15c; galvanized sheets, 4.15c; automobile sheets, 4.50c; tin plate, $4.75. Wire nails show a divergence, as the independents are adhering to their recently advanced price, $2.50, while the Steel Corporation retains the old price of $2.40. Mills are well sold up on nails.

The pig iron market has practically disappeared. Only a few of the merchant furnaces in this general territory were running on April 1, and on account of the stringency in Connellsville coke, on which they depend so largely, some have had to bank. The furnaces have practically withdrawn from the market and there is little inquiry, so that there are hardly even nominal prices. However, a sale of basic iron was made a few days ago at $24, so that is considered the market, and Bessemer and foundry would not sell at less than basic, so that the market may be quoted nominal at $24, valley, against $19.50 for Bessemer, $18 for basic, and $19 for foundry on April 1.

There is little bidding for Connellsville furnace coke as merchant furnaces could not afford to pay the prices which would be asked. A little buying by steel interests has made a market of $6.00, against not over $3.50 at the end of March and $2.75 to $3.00 in January. There is little inquiry for foundry coke, foundries having stocked up freely, but there is some buying here and there, by which a market of $6.50 has been developed, against $4.25 to $4.75 in March.

SCHEME TO DEVELOP BRITISH TRADE

Under the auspices of the British World Trade Expedition, the 9,000 ton steamship known as British Trade will sail in June from the port of London on a cruise around the world with an exhibition of representative British manufactures and industries. It was originally intended that this ship should leave on May 1, but the engineering dispute caused a postponement of the sailing, and the actual date has not yet been definitely fixed

The cruise will occupy 267 days, of which 119 will be exhibition days at the various ports. In a voyage of 38,000 miles the steamer will visit thirty ports, including Rio de Janeiro, Montevidio, Buenos Aires, and the chief ports in South Africa, Australia, Tasmania, the South Sea Islands, Japan, The Straits Settlements, India, Egypt and the Mediterranean.

It is expected that upwards of 150 British firms will be represented in the exhibition ship, which will contain every convenience for carrying on business, such as a secretariat, a reference library, writing rooms, in addition to first-class passenger accommodation for exhibitors' representatives. Cinematograph films depicting exhibitors' works and specialties will be shown at every port of call.

The proposed merger between several large and established machine tool houses in the United States has not gone through. The Lodge and Shipley Machine Tool Co., Cincinnati, Ohio, has made an announcement that it is not in any merger or combination, but will be operated independently as in the past, under the management of J. Wallace Carrel, vice-president and general manager. A similar announcement has been made by the Carlton Machine Tool Co., of Cincinnati. This company will continue to be operated independently under the management of Jack C. Carlton, president and general manager.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 2 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 00
Castings, copper	16 25	17 00
Tin	35 00	34 50
Spelter	7 50	7 25
Lead	6 75	6 75
Antimony	6 50	6 75
Aluminum	23 50	26 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.81	8.98
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 8 00	$8 00
Copper, crucible	10 50	10 50
Copper, heavy	10 50	10 50
Copper wire	10 50	10 50
No. 1 machine composition	8 50	8 50
New brass cuttings	6 00	6 00
Red brass turnings	6 25	6 00
Yellow brass turnings	1 75	4 75
Light brass	3 00	3 50
Medium brass	**4 50**	**4 50**
Scrap zinc	3 25	4 00
Heavy lead	4 00	4 00
Tea lead	3 00	3 00
Aluminum	10 00	10 00

	Per Ton	Gross
Boiler plate	$7 00	$7 00
Heavy melting steel	9 00	10 00
Axles (wrought iron)	17 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	18 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 40
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 25	...
Galvanized sheets, No. 28		5 35
Queen's Head, 28 B.W.G.	7 00	....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 35
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 30
Linseed oil, raw, single bbls.	1 05

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	24
Brass sheets. 24 gauge and heavier, base	26
Brass tubing, seamless	30

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored.13

Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$31 00	$34 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	33 00	38 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	42 00
Copper sheet, planished, 16 oz. base	42 00	48 00
Braziers', in sheets, 6 x 4 base	35 00	41 00
Copper tubing, seamless		32

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute).	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated



Machinery that "Stays Sold"

The fact that we carry the largest stock in Canada of new and re-manufactured machinery and supplies is an assurance that, whatever your need, we can fill it—promptly and exactly.

The fact that we handle only products of concerns of national standing; that our re-manufactured tools are not listed until they have been thoroughly re-fitted equal to new for all practical purposes, is an assurance of satisfaction.

The fact that our personal guarantee backs every sale and that we do not consider any transaction concluded until you are completely satisfied, is an assurance that you will "Stay Sold."

Our regular monthly Machinery List is full of bargains. Shall we put your name on our mailing list?

The A.R. Williams Machinery Co. Ltd.

64 Front Street W., Toronto

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

Do You Read These Advertisements?

Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force can not replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every week will keep you posted on the latest developments for machinery equipment.

News From the Industrial Field

The contract for the $100,000 Church of the Sacred Heart to be built in Petite Cote, Ont., has been awarded to Benjamin Bondy of Chatham.

The Canadian Crocker Wheeler Co., St. Catharines, are in the market for a 7-ft. radial drill. Further details as to the style, type, etc., can be secured by writing direct.

Plans for the new St. Luke's Anglican Church to be erected at a cost of $40,000 are nearing completion. Tenders for the work of construction will be called May 15.

R. B. Crossby has been appointed superintendent of the Pembroke Woollen Mills. He comes from Scotland and has had considerable mill experience both in Canada and the old land.

The Sowards Coal Co. has purchased the steamer Brantford from Montreal parties and the vessel will be used in the coal carrying trade between Kingston and Oswego.

Anthony Morrison, a Bridgeport, N.S. young man, now claims, after several years of experimenting, to have succeeded in inventing an improved type of mining machine of great capabilities and a patent is now pending.

The Hydro Electric Power Co., of Ontario has commenced work on its new line on the St. Lawrence system between Morrisburg and Brockville. Work contemplated for this season includes also extension of the line from St. Mary's college to the village of Maitland.

A startling example of the high cost of freight is reported by J. C. Scofield of the Windsor, Ont., Lumber Co. This company paid $165.82 for a carload of lumber f.o.b. British Columbia. They paid the railroad $516.84 freight, over three times the value of the cargo.

C. H. Wothers, who was associated with the Canadian activities of Escher Wyss and Co., for nine years, and latterly with the General Supply Co. of Canada, will sail shortly for England, where he will join the London staff of Escher Wyss & Co.

Considerable damage was caused to the plant of Crowe's Iron Works at Guelph, Ont., last week, when fire wrecked one section of the main foundry building. No serious delay, however, will take place in the company's activities and repairs will be effected at once.

The possibility of a rate-war in regard to Trans-Atlantic shipping is expected in some quarters as a consequence to that now in effect in South American waters. Trans-Atlantic shipowners declare they were not anticipating reductions this spring, but may find it necessary to do so.

The Navy League reports encouraging progress in their drive to raise funds to establish a naval training station in Windsor, Ont. The station will be located at the foot of Bruce avenue on the Detroit River and will require about $5,000 to equip.

Opening of the Davidson lumber mill at Coulonge, Ont., has been delayed by the floods. Owing to the fact that about half of the year's cut was lost when the boom of logs broke on the Coulonge river last week the mill will run only three months this year instead of six as in normal years.

The cost of the new dairy school to be erected at Kingston, Ont., is estimated at between $80,000 and $90,000. The new building will be two stories in height and larger than the old school. It will be of modern construction and include an ice making plant.

Two churches of Windsor, Ont., are planning to build new edifices this summer. The Bruce Ave. Baptist church has purchased a site on Victoria ave. on which to erect a $125,000 building. The Knox Presbyterian Church has had preliminary plans drawn for a building to cost about $75,000.

Announcement is made of the appointment of C. D. Gleason to the position of Canadian sales manager for the Durant Motor Co., with headquarters at the Leaside plant at Toronto. Mr. Gleason, for some years has been associated with the Chevrolet Co. both in Canada and the United States.

The contract for construction of the intake and ship channel in connection with the Chippawa-Queenston power development has been let to the firm of Tomlinson, Macaw and McDonald of Winnipeg by the Hydro-Electric commission. It stipulates that the work must be completed by December 1st.

It has been stated that the directors of the recently organized Dominion Alloy Steel Co., have decided to enlarge their program to provide for the erection of a plant of $5,000,000 instead of the project originally contemplated, where the figure of $3.000,000 was mentioned. It is intimated that building operations will commence within two months.

The council of Ford City, Ont., at its last meeting voted unanimously for the amalgamation of their town with Walkerville, the chief object being economy and facility in installing town improvements. If Walkerville adds the industries of Ford, such as the Ford Motor Co., the Fisher Body and Studebaker Corporations, etc., to those already there, which include the General Motors Ltd., Canadian Bridge Co., and Hiram Walker and Sons, it will be one of the principal industrial centers of Ontario.

A construction engineer of the Imperial Oil Co., is now at Sydney, N.S. to proceed with the construction of the Company's new plant at Battery Point. Some difference in the company's and the government survey of the lands deeded resulted in slight delay, but the difference has been adjusted.

Tenders are being received by the N. S. Provincial Highways Board up to May 4th for the establishment of a steam ferry service across the Strait of Canso between Port Mulgrave and Port Hawkesbury, capable of carrying not less than four large motor cars, and other traffic, with the necessary docking facilities.

Dr. H. Deslauriers, (Member for St. Marys, Montreal), has given notice that he will bring before the Commons a resolution which would have the effect of prohibiting export of electrical power to the United States. The resolution will declare that "it is advisable to place a prohibitive duty on this anti-national commerce."

The Wettlaufer Co., machinery manufacturers, have started building operations on a site in the lower Kingston harbor, in accordance with their agreement with the corporation of the city of Kingston. Particulars as to general details of the building have not yet been issued. The work is at present under the charge of J. W. Lytton, contractor, of Kingston.

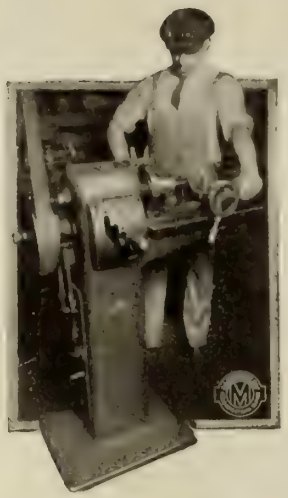
The Doran Construction Co. has been awarded three contracts by the Provincial Highways Commission. They will construct a large section of the new provincial highway near Cornwall. In addition, two contracts for bridges have been received for the Township of North Elmsley and Perth vicinity. Plans for the work have been completed and it will be started immediately.

The Halifax City Council has received the tenders for the contract of installation of new street electric lighting system. The city engineer, reporting on the tenders received, has recommended that of the Northern Electric Co., at $85,750.72. The contract under consideration is for lamps, standards, etc., and installation thereof, wiring already in use being utilized to a great extent, though in some districts underground cables are anticipated.

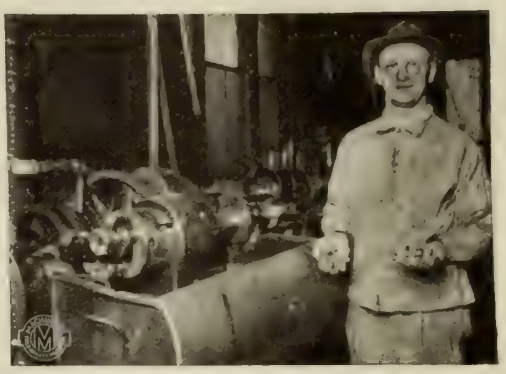
Peter O'Carroll, of Pictou, N. S., has devised a new pattern of ship's anchor and is having it patented. It is claimed that no matter how the anchor is cast it is bound to catch with both flukes. The bar through the top of the old style anchor is eliminated altogether and another feature claimed for the new pattern is that it is always easy to break the hold on bottom when the anchored craft is ready to move.

GEOMETRIC





and all's well



A Geometric Suggestion will be Worth While

Checking up information with us may give you some valuable information in return.

We have had many kinds of weeks and d ays — Thrift Week, Spend Week, Save Week, Smile Week, Everybody-to- Church Sunday, Prayer Sunday Old Clothes Week,—month, season—(an d for some of us old clothes most of the time.)

Let us have a Screw Cutting Time of our own now. Let us check up the Screw Cutting. Fill in the coupon, and the canvass will be complete. We may be able to give you some information that will give you unmatched production.

It will cost you nothing to make the check-up, and if it appears that there might be a more profitable way for you to do your Screw Thread Cutting, we will not annoy you with advice. We will make the suggestion and leave it with you.

The Geometric Tool Company

New Haven, Conn.

The Geometric Tool Company

New Haven, Connecticut

Below we give you specifications of our Screw Cutting, and shall be interested to learn what you would suggest as a possible means to greater production.

Make of Machine.....

Diameter of Turret Holes.....

Distance from center of Turret Hole to top of Slide.....

Thread to be cut: Diameter..... Pitch.....

Length..... Form.....

Present method used.....

Number of pieces threaded per hour.....

Difficulties experienced (if any).....

Have one of your Service Men call when he is in our vicinity. Have him see Mr.....

Signed ..... Address .....

(Street)

....

(Post Office) (Province)

Considerable interest is centered in the progress of the new central heating plant for Queen's University and the Kingston General Hospital, which is being constructed on Kingston's beautiful harbor front on the site of the former Kingston Hosiery Co. mill. H. W. Watts, of Kingston, has the contract for the masonry. The large boilers have been placed in position and the first story is almost completed.

A request to alter the method of computing the tax on company earnings has been made to the Dominion Government by the Border Chamber of Commerce of Windsor, Ont. This body asks that the tax be figured on earnings over three year periods as it is done in the United States. By this method if a firm makes $100,000 one year and loses $50,000 during the next two it would be taxed on $50,000 only.

The Walsh Plate and Structural Works of Drummondville, Que., have secured the following contracts:—Structural steel for $500,000 factory for the Dominion Silk Dyeing & Finishing Co. of Drummondville; structural steel for new warehouse of Butterfly Hosiery Co. of Drummondville; new steel penstock for Rolland Paper Co., at St. Adele, Que.; steel for new theatre at Valleyfield, Que.; structural steel for new store on St. Denis St., Montreal.

At a meeting held on the evening of April 28, at the University of Toronto, Prof. McLennan gave an interesting talk on the metric system of weights and measures. Considerable interest was shown by the small number present, and at the close of the meeting initial steps were taken to form a Canadian Association for the purpose of studying the possibilities of the system and the advisability of promoting its adoption in Canadian commercial and industrial enterprise.

Capt. T. York, of Rockland, Ont., in conjunction with Russell J. Reaney, has perfected a machine that will revolutionize motive power. This is the claim of Earl York, son of the former. He states that the machine has been patented in Canada and the United States and that successful experiments have been made with it, power being generated from the air by some means which he further states will be demonstrated in Ottawa shortly. It is proposed to run a motor car here by this new force.

The plant and equipment of the Welland Machine and Foundries, at Welland, has been purchased by the Lackawanna Tubes, Ltd., and it will be remodeled to conform to the requirements of the new company. The principal activities carried on will be the manufacture of boiler tubes, and this will be a pioneer firm to produce seamless steel tubes in Canada. A new building, 80 by 400 feet, is now under construction. The old foundry, at present, will be utilized for general repair and foundry job work. The company is capitalized at $525,000.

C. V. Grantham of the Wallace Barnes Co., Hamilton, Ont., discussing conditions recently stated that he had found business to be improving. When asked in what particular industry he had noted most improvement, he stated that all industry with which he came in touch seemed to be brighter and this was borne out by the amount of orders actually received by his company.

Among the tenders for Halifax city supplies for the year recommended by the City Works Committee to the City Council for acceptance are the following: Six inch valves, T. McAvity & Son, St. John, N. B.; drain pipe, contract to be divided between Brookfield Bros. and Edgar Coombes & Co.; lead pipe, Geo. T. Hatfield and Wm. Stairs Son & Morrow, in five ton lots; corporation cocks, Empire Brass Manufacturing Co., Ont.; brick, Piercey Supply Co.; castings, Fleming Bros.; hardware, Lawrence Hardware Co. Ltd.; oils, Canadian Oil Co.; sand and gravel, Hendry & Co., Ltd.

At the coming conference of technical officers of the Empire Patent Office, to be held in London, Eng., in June, William J. Lynch, chief of the Canadian Patent Office, has been appointed to represent Canada. The suggestion for holding the conference was made in a memorandum prepared by the British Board of Trade on the desirability of instituting a patent which would be valid throughout the Empire. The late Government approved of the holding of the conference, subject to the provision that "while co-operation and uniformity are desirable, each constituent part of the Empire should retain within its own jurisdiction the control of the patent laws affecting it, and of their administration." The patent offices of Australia, New Zealand, South Africa, India and Great Britain, will be represented at the conference.

CANADIAN TRADE IMPROVES

The Wall Street Journal of April 28, in a general review of the exchange situation as it affects Canadian funds says: "Rise in value of Canadian funds during the past 15 months is due to several reasons. Rise of sterling exchange, and consequent increase of English buying in Canada has had a notable influence. England and the United States are Canada's two best customers and the relations of the three countries have been fast approaching normal. Canadian trade has shown distinct improvement. For 1921 there was a small export balance, which was unexpected at the beginning of the year. Since January Canada has had an import balance, although a small one. It has been estimated that April trade figures will show an export balance as grain shipments have been exceptionally large. The factor which has had probably the greatest influence has been Canada's capital imports. In 1921, out of financing which totalled about $400,000,000, about $182,000,000 was floated in United States, and $16,500,000 in England. Loans floated in the United States in 1919 and 1920, were even greater than in 1921. So far this year Canadian financing here has been in good volume, although Canadian bonds held here which mature this year total about $62,000,000, most of them are expected to be refunded."

FAVORABLE EXCHANGE RATE

While the discount on the Canadian dollar in the New York money market is not expected to hold at one and a fraction per cent. for any length of time, it is freely predicted that owing to the favorable position shown by Canadian finance, it will remain below three and one half per cent. for a considerable time. Canadian funds last week were at a discount of one per cent. in New York, the lowest rate touched since January 10, 1918, before which Canadian funds had sold at a premium in the market for a considerable period. The rate had risen as high as 17½ per cent. in February, 1920. During the remainder of 1920 the rate fluctuated between eight per cent. and 15 per cent. with the average nearer the later, but early in 1921 improvement in Canadian affairs and finances began, which has culminated in the present value. Since turn of the year the rate has at no time gone beyond 6½ per cent., and since February 1 the highest has been 4½ per cent. During the past five or six weeks there has been a narrow market. The $100,000,000 Dominion loan floated in the States recently was the direct cause of the new high Canadian funds.

C. P. R. DEDICATES WAR MEMORIALS

Simultaneously in several leading Canadian cities, and also in London, England, imposing and impressive ceremonies marked the unveiling of memorial tablets dedicated to the memory of employees of the C.P.R. company who were killed in the great war. At Windsor Station in Montreal, His Excellency Lord Byng, E. W. Beatty, president of the company, and many other officials were present. In Toronto, the brass tablet was unveiled in the main waiting room of the North Yonge St. Station. At West Toronto the bronze tablet is located on the front facade of the depot building. Among other places where ceremonies were conducted were North Bay, Winnipeg and Vancouver.

BOOK REVIEW

The "Coal Manual" is the title of a book issued by the National Coal Mining News, Cincinnati, which deals with coal from all the aspects which are of use to a purchaser and user of this universal fuel. In addition to chapters on the analysis of coal, other chapters deal with the efficient burning of coal, and there are instructions to firemen and engineers. The book, which is published at $2.50 in the U. S., should be a valuable one for purchasing agents, plant managers, and engineers in general.

ATKINS
METAL CUTTING SAWS



Solve your Metal Cutting problems, easily, quickly and economically, by adopting the products made by

ATKINS

We make Kwik-Kut Power Hack Saw Machines which use practically the full cutting edge of the Hack Saw Blade at each stroke; Metal Cutting Band Saw Machines for general shop work, cutting all classes of metal up to 12 x 14 inches.

Your requirements for Metal Cutting Circular Saws can be supplied promptly and we solicit a trial of our "AAA" Non-Breakable and Power Hack Saw Blades and Frames.

"A Better Saw for Every Use"

E. C. Atkins & Co.

Established 1857

"The Sterling Quality Saw People"

Factory: HAMILTON, ONT. *Branch:* VANCOUVER, B.C.

INDUSTRIAL ACTIVITY IN FORT WILLIAM DISTRICT

Preliminary work is well under way in the construction of an additional traveling coal handling bridge at the Island Number One coal dock of the Canadian Pacific Railway. The work is being done by the McMayler Interstate Construction company, of Cleveland, and will involve an expenditure of over half a million dollars. Most of the material for the structure has arrived and the actual fabrication of the steel will commence within a few days. The bridge, when completed, will greatly increase the efficiency and storage capacity of the plant.

The last of the sixteen hundred piles for the new Parrish and Heimbecker grain elevator being erected in the Port Arthur harbor, just south of the Canadian Government elevator, was driven early this week and sheet piling is now being sunk for the wharf. The first unit of the elevator will consist of a working house and six concrete storage tanks with a total capacity of 250,000 bushels. Arrangements are being made in the building of the foundations for extensions as the ultimate intention is to enlarge the plant to a house of one million capacity. The elevator will be finished it is expected, in time to assist with the 1922 crop and will be equipped with the most modern apparatus for the treatment of off-grade grain. J. W. Cook, superintendent of construction for the Canadian Stewart Company, Chicago, who are building the elevator, is supervising the work and will spend the summer here.

Much material is being assembled by the Canadian National railways upon the site of their new yards, extending from a point just within the westerly limits of Fort William, to a point about five miles west, and construction of the yards will commence immediately. The new yard will contain, besides tracks for many thousands of cars, roundhoses, repair shops and offices, and residential quarters for the staff. Plans call for the tearing up of the present Canadian government railway spur running from Fort William to Dona, about thirty miles as traffic over both the Canadian government railway and the Canadian National will be diverted through the new yards of the latter.

Construction will be commenced within a few days by the city of Fort William, upon the mile and a third street railway extension running from the Mission industrial extension to the newly opened up municipal park, west of the Mission industrial sites. Plans call for not only the laying of steel but the construction of a highway.

On April 24 the plant of the Consolidated Water-Power company's mill, formerly known as the Kaministiquia Paper Company's mill, at Port Arthur. commenced running double twelve-hour shifts. Nearly forty men are being employed continuously and it is expected that the output will reach a carload of ground pulp per day. It is being shipped to Wisconsin Rapids.

Continuous operation still continues at the Mission plant of the Fort William Company and the output of the plant has reached 120 tons of dry pulp per day. The company, during the winter has bought the output of many pulpwood camps situated along the upper reaches of the Kaministiquia river, and as soon as water conditions are favorable, the wood will be driven down stream to Thunder Bay. Some 41,000 cords are boomed at Dona, thirty miles up. The drive will be the largest of its kind ever undertaken in this district and will be especially hazardous as the wood must be shot over Kakebeka Falls, one hundred and forty-six feet high.

Geo. A. Benson, superintendent of the Fort William Coal Dock Co., since the erection of the big dock at the Mission, several years ago, has severed his connection with the firm and has left for the United States. L. Savage, of Cleveland, has been appointed superintendent.

Chas. L. Jobb, manager Canada Iron Foundries, in the city last week from Montreal, in connection with the company's local foundry, declared that business outlook was not particularly encouraging. The plant is operating about three quarters capacity upon the manufacture of iron pipe and car wheels, some of which were to be used in filling orders and some would be placed in stock.

F. H. Palmer, junior trade commissioner, commercial intelligence service, department of trade and commerce, Ottawa, was a visitor in the city recently for the purpose of acquiring information respecting local industries and the operation of grain elevators and the system of handling grain generally. He was given valuable assistance by Leslie Boyd, chief commissioner, board of grain commisisoners of Canada, and other officials of the grain controlling and inspection staffs.

Judgment has been handed out in connection with the case between the Motor Trucks, Ltd., of Brantford, Ont., and the United States government. The buildings, valued at $343,000 were first awarded to the U. S. but the appeal court has decided that these are the property of the Motor Truck Co. The United States of America put $1,900,000 into the plant of Motor Trucks, Limited, Brantford, for the purpose of having high-explosive shells manufactured there for the war. The company dropped all its other activities and bought four acres of land for extending its factory. Then, before a single shell had been manufactured, the contract was terminated.

A certain number of accidents involving injury to the eye are unavoidable. The presence or absence of permanently detrimental results is likely to depend on the promptness and efficiency of the treatment that is instituted.

Tomlinson, Macaw & Macdonald, of Winnipeg, have secured the contract for the intake on the Queenston-Chippawa power devlopment. The estimated cost of the work approximates $450,000.

The dredging work on the Welland River, in connection with power developopment of the Hydro-electric Power Commission, will be undertaken by Lachay & Co., the cost of the work being about $500,000.

OBITUARY

L. S. Starrett

Leroy S. Starrett, philanthropist, inventor and founder and president of the L. S. Starrett Co., manufacturers of Starrett tools at Athol, Mass., died April 23 at St. Petersburg, Florida, where he had been spending the winter months, as had been his custom for a number of years. Had Mr. Starrett lived two days longer he would have been 86 years old. In addition to his connection with the L. S. Starrett Co., Mr. Starrett was treasurer and practically the owner of the Athol Machine Co., and was interested financially in the Union Twist Drill Co. Born in China, Me., April 25, 1836, he was of Scotch descent and one of 12 children of Daniel D. and Anna Starrett. When only 17, he operated a farm of 600 acres in Newburyport. At that time his inventive genius was developing rapidly, and in 1864 he was granted a number of patents, and opened a machine shop in Newburyport.

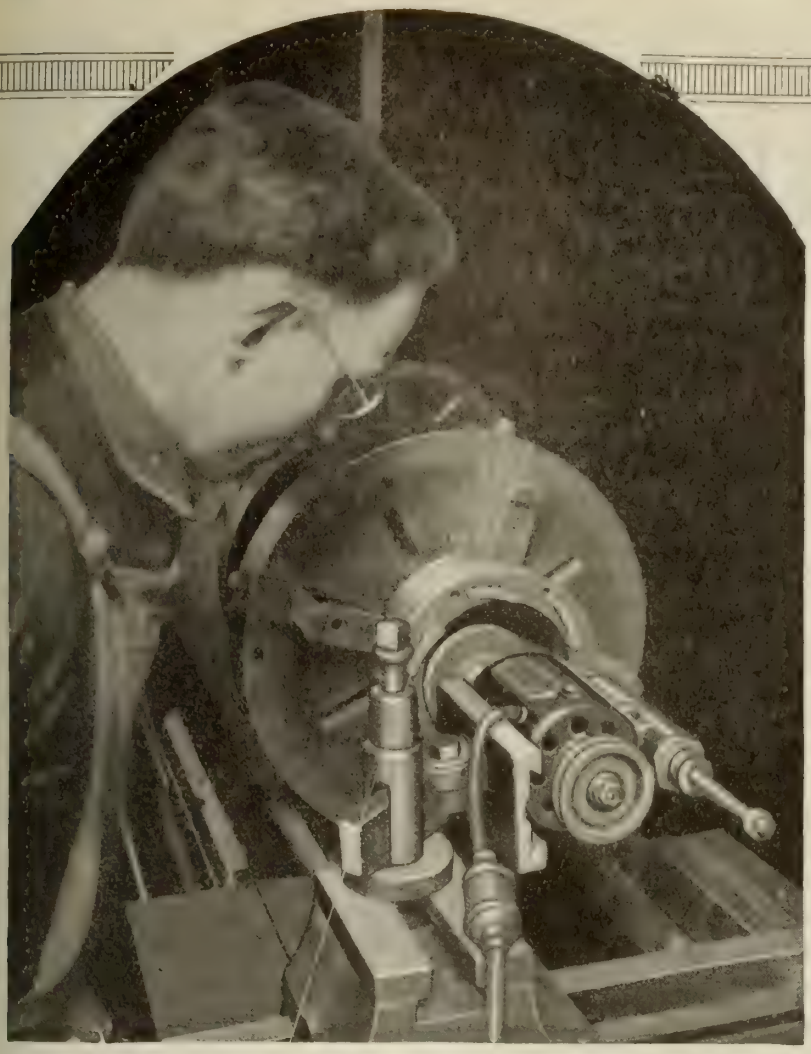
In 1868 he came to Athol, where he combined his business with the Athol Machine Co. in order to manufacture his own inventions. Prominent among them was a meat chopper. For 10 years he was general agent and superintendent of the concern, then resigned to begin manufacturing mechanical tools.

Joseph P. Rogers

E. P. Rogers, director of the Queen City Oil Co., died last week at his home in Toronto. The late Mr. Rogers was born in King Township, North York, October 17, 1856, and received his early education in Newmarket High School and Earlham College, Richmond, Indiana. He came to Toronto in 1876, and shortly afterward entered into business with his father, the late Samuel Rogers, and his brother, Mr. A. S. Rogers, under the firm name of Samuel Rogers and Company, and later under the name of the Queen City Oil Company Ltd. He was manager of the lubricating department at the time of his death, and was also a director of the Imperial Oil Co.

Matthew Stanley

The death occurred last week of Matthew Stanley, following a long illness. He was a mechanical engineer, and in that capacity had been connected with the Northern Aluminum Company prior to his retirement some five years ago. Before coming to Toronto Mr. Stanley had been with Vickers Limited in London, England.



At the left is shown a DUMORE grinder attached to the toolpost of an engine lathe at the Geometric Tool Co., New Haven, Conn. A cam for a die lead has been just machined and the hole is being accurately ground without tearing down of the original "set up." Result—faster work at a decreased operating cost.

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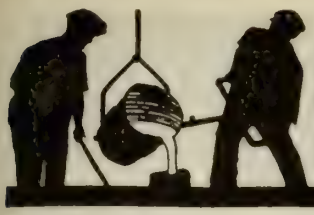
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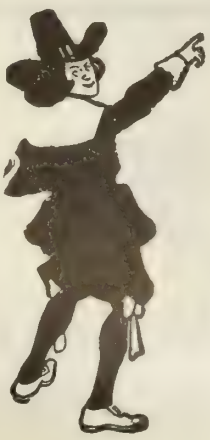
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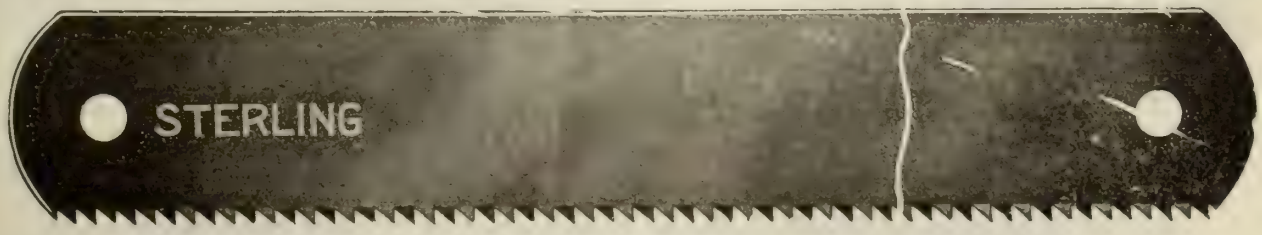
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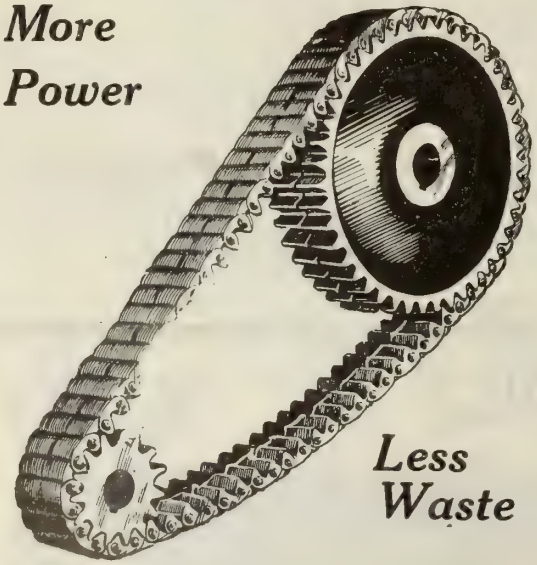
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Executive Office: Providence, R. I.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

The Walton Co.
Hartford, Conn.

A HOIST THAT WON'T WORK

Have You One?

It may have been abused by overloading or careless handling.

It may have "worn out" after years of faithful service.

You will probably need it soon.

Ship it to us. Our repair department will quote for the necessary repairs, even if the block is not one of our own make.

If it is a Morris hoist the cost of repairs will be comparatively small — Morris hoists are so designed that the wearing parts may be replaced readily.

Of course we test all rebuilt hoists with our usual 50% overload test before shipment.

The Herbert Morris Crane & Hoist Company, Limited

NIAGARA FALLS CANADA



VALLEY WASTE MILLS, LA GRANGE, GA.

Collecting Dangerous Dust Conveying Useful Material

The satisfactory disposal of dust, caused in many manufacturing processes, is always a problem.

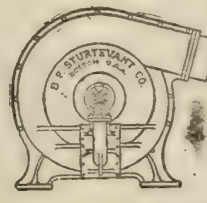
Whether in a pattern shop or grain elevator, dust is a nuisance and a recognized menace to life and property.

With over sixty years' experience at the back of them, Sturtevant engineers are called upon, almost daily, to solve dust-collecting problems in scores of different industries.

Or, it may be that light material must be conveyed from place to place. In a certain woolen mill, for instance, the wool is never touched by hand from picker to cards. Grain, fuel, bark, etc., etc., may be similarly conveyed.

If you wish to improve working conditions, lessen fire risk, or cut the cost of handling material, ask our engineers to call—without the slightest obligation to you.

Write for the new Bulletin on Collecting and Conveying, No. 291.



Sturtevant

PUTS AIR TO WORK

B. F. STURTEVANT CO. of CANADA, Ltd.

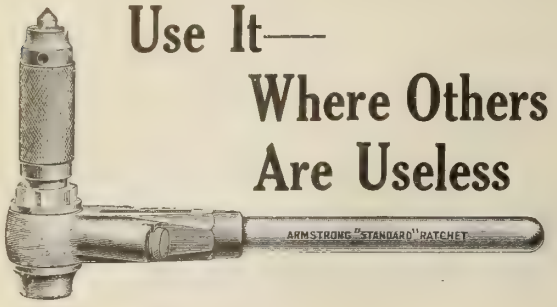
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Fryer-Baker Co., Vancouver, B.C.
Kipp-Kelly, Ltd., Winnipeg, Man.

627

ARMSTRONG
Standard Ratchet Drill



Use It— Where Others Are Useless

In many cases the flexibility of the Armstrong "Standard" Ratchet Drill will save the delay and expense of disconnecting and dismounting heavy machinery and repay its cost many times over.

Some of the difficult situations where this tool will be found indispensable, paying for itself many times on a single job, are:

Confined places in setting up new work.
Drilling and tapping pipes.
Repairing boilers and steam pumps.
Locomotive and heavy machinery repairs.
Repairs on board ship..

Simple Construction

The Armstrong "Standard" Ratchet Drill has no ball joints or bevel gears. It is simple in construction, made from drop forgings and bar steel with all working parts hardened. It drills 10 per cent. faster than an ordinary ratchet — two inches of motion at end of handle, in any direction, will drive the drill.

A Complete Line of Ratchets

The Armstrong Line of Ratchet Drills covers the field completely and is the only one that does. We offer our trade a Ratchet to meet the peculiar needs of any kind or condition of work. Write for catalogue.

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"THE TOOL HOLDER PEOPLE"
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If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
an engine
a compressor
or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

CANADIAN MACHINERY
Classified Advertising Section
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STANDARD

"V", U. S. S. and S. A. E. Cap Screws
"V" and U. S. S. Set Screws
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Semi-finished "V" and U. S. S. Nuts

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Screw Machine Product up to 2 1-4 in. diameter—to specifications.

Special Product, Hardened and Ground—to specifications.

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-With 32 Thread Changes

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"ECONOMY"

This double back geared, quick change engine lathe brings many advantages to the tool room. High grade, accurate, small in size but extremely powerful.

All gears are cut steel and covered to safe-guard the operator. A lead screw is used only for chasing. Sizes 12", 14", 18" and 22" swing. Write for circular.

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Limited
WINDSOR - ONTARIO


Plain

PRESSES
HYDRAULIC SCREW AND FILTER

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Made in Canada

WILLIAM R. PERRIN, LIMITED
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in shop and laboratory use the

Standard Scleroscope

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by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem.


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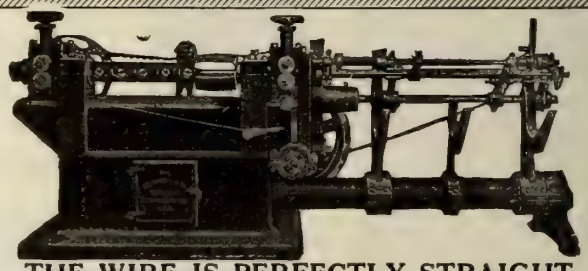


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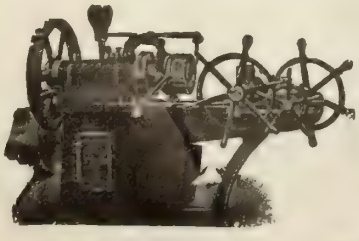
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and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?

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Flexible shaft equipments for grinding, polishing, drilling, reaming, scraping, scratch brushing, power screw driving and nut setting.
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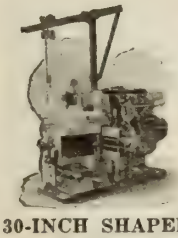


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Sheet Metal Working Machinery
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Hand Feed
Semi-Automatic, Fully Automatic
Also Lathe Chucks and Centering Machines
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MORTON 30-INCH DRAW-CUT SHAPER
Investigate this machine to-day. The most powerful shaper. Wide range of work. Ask for bulletin 3A.
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Unexcelled for Continuous Service
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WE MANUFACTURE RIVETS of every description, 5/8 inch dia. and smaller

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The CHICAGO
APPROVED PORTABLE
WATCHMAN'S
CLOCK

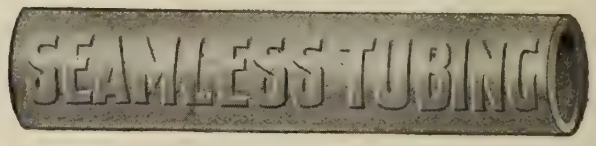
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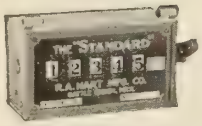
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BENNETT & WRIGHT TORONTO

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Model B (Five-wheels)
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Model B Gear Counters

will give you your accurate production. Tested 20,000 per hour.

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For classified section
see page 70



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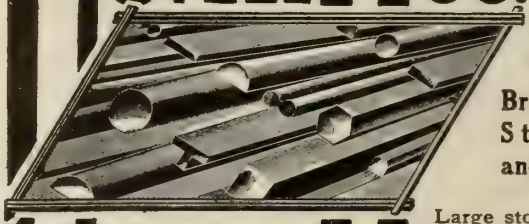
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SPECIAL MACHINERY

36" Fellows Gear Shaper indicates the complete and modern equipment throughout our Gear Department.
Send your custom work to us.

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"Where To Buy Your Castings"
section will be found on
page 69

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Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen Siphonage Ventilators, Bakers' Ovens, trucks, casters, etc. Write for Booklet.
Brantford Oven & Rack Co. Ltd.
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Machine Springs, Valve Springs, Automobile Cushion Springs, etc., of a quality that defies competition. Tell us your requirements. Send sample or specification for price.
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Stitched Cotton Duck Belting
"Maple Leaf" brand costs less than leather, rubber and balata; has a positive grip on the pulley and is true running.


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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
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STEEL TUBING
CLOSE Joints and Welded Steel Tubing for Bedsteads, Trolley Arms, Agricultural Implements, and all other manufacturing purposes, reliable quality, uniform in size, 14 to 20 gauge, 3-8 inch to 2 inch outside diameter.
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Canadian Machinery BUYERS DIRECTORY

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Norton Co. of Can., Ltd., Hamilton, Ont.
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Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E Eng.

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Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

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Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont

Anvils
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
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Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Babbitt Metal
Canada Metal Co., Toronto, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
United Alloy Steel Corp., Canton, Ohio
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.

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McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Dom. Belting Co., Ltd., Hamilton, Ont.

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Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Belting, Fabric
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

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Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Aluminum, Brass, Bronze, Copper, Die-Molded, Ferro-Alloy,

Iron, Semi-Steel, Steel.
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Brantford Brass Foundry Co., Brantford, Ont.
Brown-Boggs & Co., Ltd., Hamilton, Ont.
Canada Metal Co., Toronto, Ont.
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Can. Rumley Co., Ltd., Toronto, Ont.
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Corbet Foundry & Machine Co., Ltd., Owen Sound, Ont.
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Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Eureka Planter Co., Woodstock, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Fittings, Limited, Oshawa, Ont.
Galt Malleable Iron Co., Ltd., Galt, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn, Limited, John T.
Hull Iron & Steel Foundries, Hull, Que.
International Malleable Iron Co., Galt,
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Langley & Austin, Galt, Ont.
Lindsay Foundry & Pattern Works Limited, Lindsay, Ont.
Maxwells, Limited, St. Marys, Ont.
Machinery & Foundries Limited, Brockville, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Miller Bros. & Sons, Ltd., Montreal, Que.
Mitchell Co., Robt., Montreal, Que.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Sully Brass Foundry Co., Toronto, Ont. Ont.
Tallman Brass & Metal, Ltd.
Vessot & Company, S. Joliette, Que.
Wells, W. W., Toronto, Ont.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn. Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
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Petrie, Ltd., H. W., Toronto, Ont.
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Skinner Chuck Co., New Britain, Conn.
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Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

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Oakey & Sons, Ltd., John, London, S.E. Eng.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.
Goldie & McCulloch Co., Ltd., Galt, Ont.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Bliss Co., E. W., Brooklyn, N.Y.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Chains (See Sprockets and Chains)
Falls, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

BUYERS' DIRECTORY

Chucks, Vertical Boring Mill

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'

Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General

Oakley Chemical Co., New York, N.Y.

Clocks,

Chicago Watchman's Clock Co., Chicago, Ill.

Clocks, Time

Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's

Chicago Watchman's Clock Co., Chicago, Ill.

Clutches, Friction

Can. Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery

Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems

Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set

Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets

Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning

Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting

Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas

Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction

Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps

Canada Foundries & Forgings Co., Welland, Ont.

Contract Work

Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)

Jones & Glassco, Montreal, Que.

Cotters

Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution

Starrett Co., L. S., Athol, Mass.

Countershafts

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B., Galt, Ont.

Countersinks

Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive

Can. Steel Foundries, Montreal, Que.

Couplings

Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe

Fittings, Limited, Oshawa, Ont.

Couplings, Shaft

Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Kepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Locomotive

Can. Link-Belt Co., Toronto, Ont.

Cranes, Traveling

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines

Underwood Corp., H. B., Philadelphia, Pa.

Cutters, Gear

Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Cutters, High Speed

Atkins & Co., Inc., E. C., Indianapolis, I
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling

Brown & Sharpe Mfg. Co., Providence R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd. Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Cutters, Stay Bolt

Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread

Butterfield & Co., Inc., Rock Island, Que
Landis Machine Co., Inc., Waynesboro, Pa

Cutting-Off Machines

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)

Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., B., Galt, Ont.

Cutting-Off Tools

Armstrong Bros. Tool Co., Chicago, Ill

Cutting Oil Filters (See Oil Filtering Systems)

Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)

Petrie, Ltd., H. W., Toronto, Ont.

Diamonds, Black and Rough

Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and ...orts

Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools

Can. Desmond-Stephan Co., Hamilton
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings

Can. Steel Foundries, Montreal, Que
Ont.

Diamonds, Importers.

Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting

Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)

Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Dies, Forging

Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable

Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Dies, Threading-Opening

Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Dividing Heads

Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine

Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Materials

American Lead Pencil Co., New York City, N.Y.

Dressers, Grinding Wheel

Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Norton Co. of Can., Ltd., Hamilton, Ont
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.

Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders

Armstrong Bros. Tool Co., Chicago, Ill

Drilling Machines, Bench

Burke Machine Tool Co., Conneau Ohio.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand

Can. Fairbanks-Morse Co., Ltd., Montreal
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty

Bertram & Son Co., Ltd., The John Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)

Gisholt Machine Co., Madison, Wis

Drilling Machines, Multiple Spindle

Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic

Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable

Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Sensitive

Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret

Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
McDougall Co., Ltd., B., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center

Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Combination Centre.

Prentss & Schwartz, Galt, Ont.

Drills, High Speed Twist

Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Ratchet

Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat

Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.

Drop Forgings

Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment

Can. Blower & Forge Co., Ltd., Kitchener

Electrical Instruments

Bristol Co., Waterbury, Conn.

Electrical Supplies

Atkins & Co., Inc., E. C., Indianapolis, I
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)

Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors

Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Equipment, Elevator Safety

Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)

J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Norton Co. of Can., Ltd., Hamilton, Ont.
Montreal, Canada.

Engines, Capstan

Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical

Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

Expanders, Tube

Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric

Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Fans, Exhaust

Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating

Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre

Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps

Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que

Filler, Iron (See Cements, Iron)

Smooth Mfg. Co., Jersey City, N.J

Fire Escapes

Roelofson Elevator Co., Galt, Ont.

BUYERS' DIRECTORY

Fittings, Pipe
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont
Fittings, Limited, Oshawa, Ont.

Flexible Shafts
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Lt. Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

Foundry Equipment
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rockwell Co., W. S., New York City
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Thread
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Limited, Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiten Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Wheels
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont.

Lubricants
Oakley Chemical Co., New York, N.Y.

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Ill.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Manganese Steel
Can. Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mechanics' Fine Tools
Lufkin Rule Co., Windsor, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence,
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Vertical
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nipples
Canada Metal Co., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can. Fairbanks-Morse Co., Ltd., Montreal.
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patterns, Wood and Metal
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto,

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Pipe
Canada Metal Co., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Ship.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines
J. R. Baxter & Co., Ltd., Montreal, Que.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. B., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

BUYERS DIRECTORY

Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que.

Reamers, Expanding
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Limited, Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal.
High Speed Hammer Co., Rochester, N.Y.

Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
Lufkin Rule Co., Windsor, Ont.

Screens
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.

Screw Machine Work
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R.I.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
National Acme Co., Montreal, Que.

Screw Plates
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton.

Springs
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton.

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton.

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

BUYERS' DIRECTORY

Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill
Atkins & Co., Ltd., Wm., Sheffield, Eng.
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Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

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Williams & Co., J. H., Brooklyn, N.Y.

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Geometric Tool Co., New Haven, Conn.

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Atkins & Co., Inc., E. C., Indianapolis, I

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Tachometers
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Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Starrett Co., L. S., Athol, Mass.
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Geometric Tool Co., New Haven, Conn.
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National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

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Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
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National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont
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Greenfield Tap & Die Corp., Galt, Ont.
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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
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National Machinery Co., Tiffin, Ohio.
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Bertrams Ltd., Edinburgh, Scotland
Brown & Sharpe Mfg. Co., Providence, R.I.
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Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis
Preston & Schwartz, Galt, Ont.
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Starrett Co., L. S., Athol, Mass.
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Williams Machinery Co., A. B., Toronto, Ont.

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National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

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Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
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Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
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Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
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Winches, Stoplog
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Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill.

List of Directory of Dealers will be found above Advertising Index

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THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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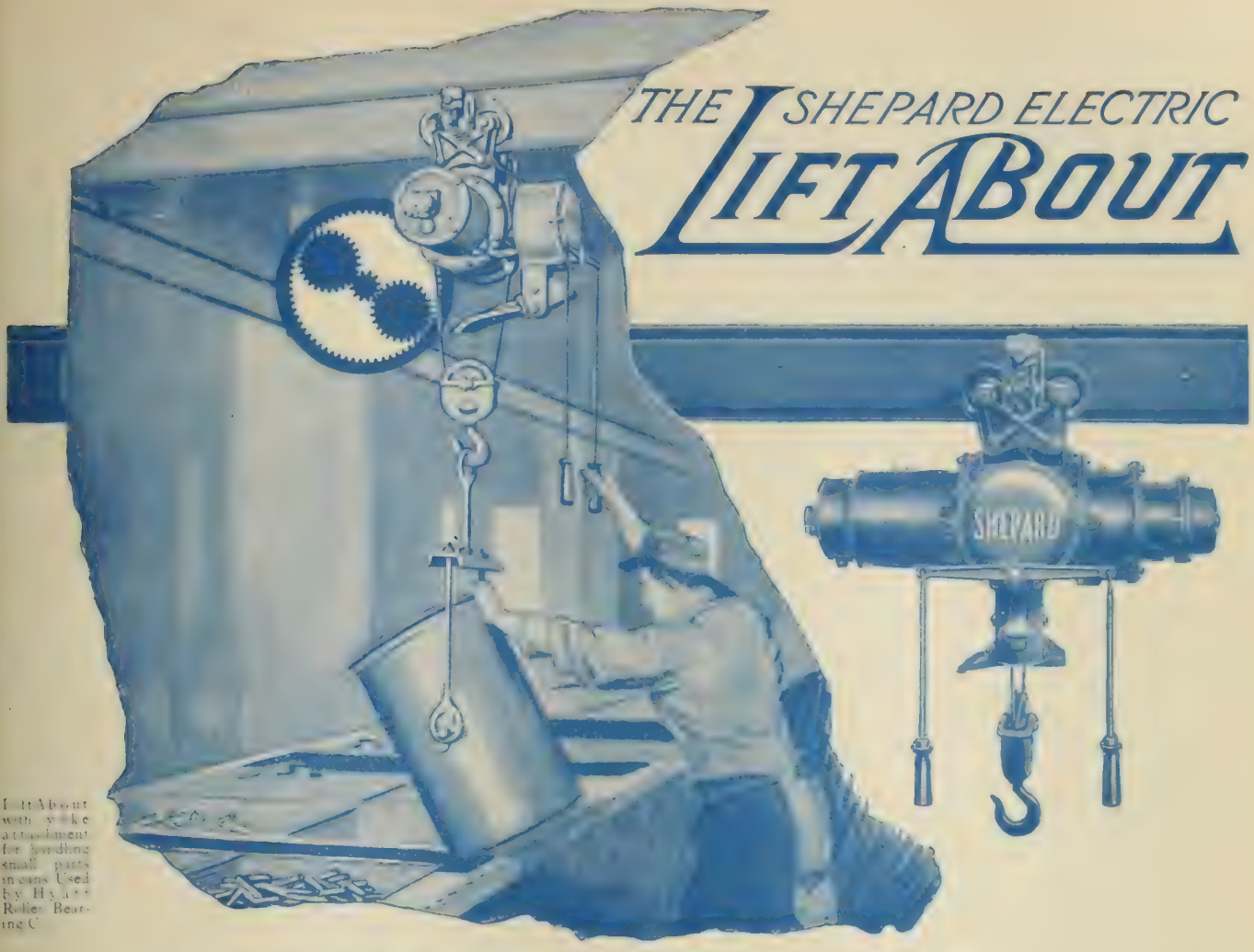
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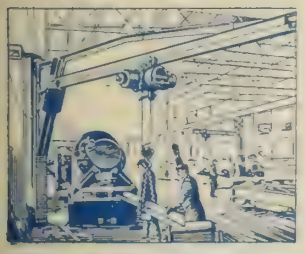


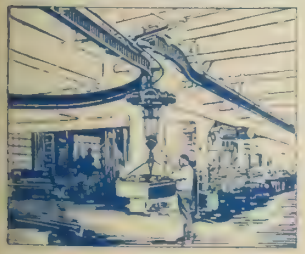
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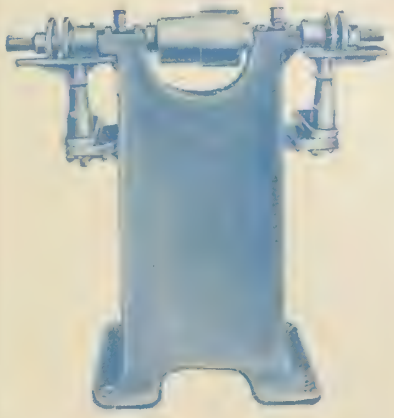
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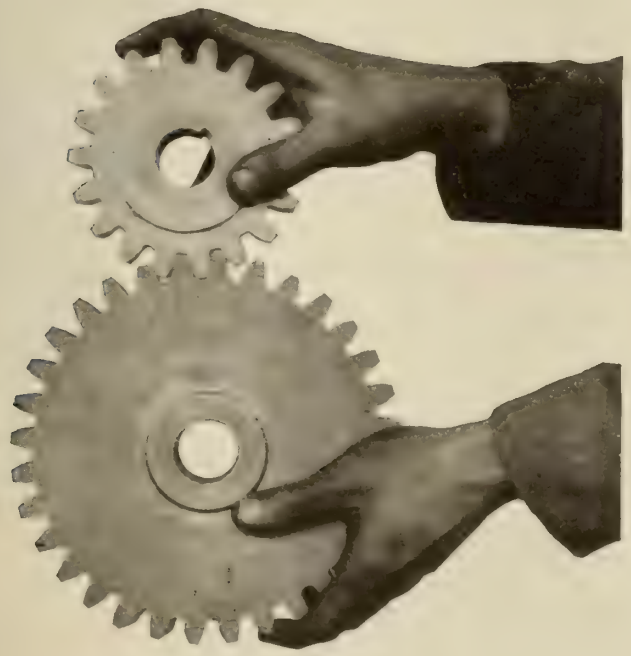
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The BERTRAM Page

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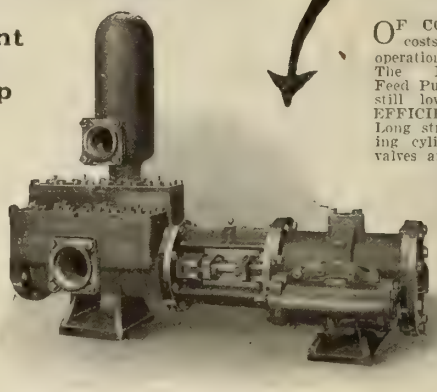
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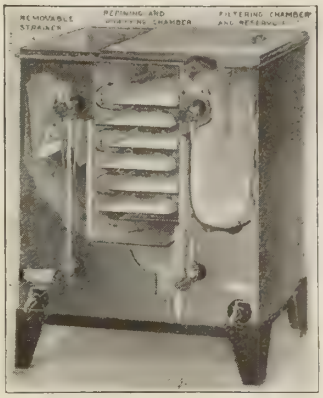
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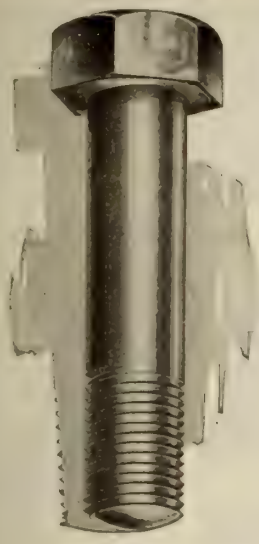
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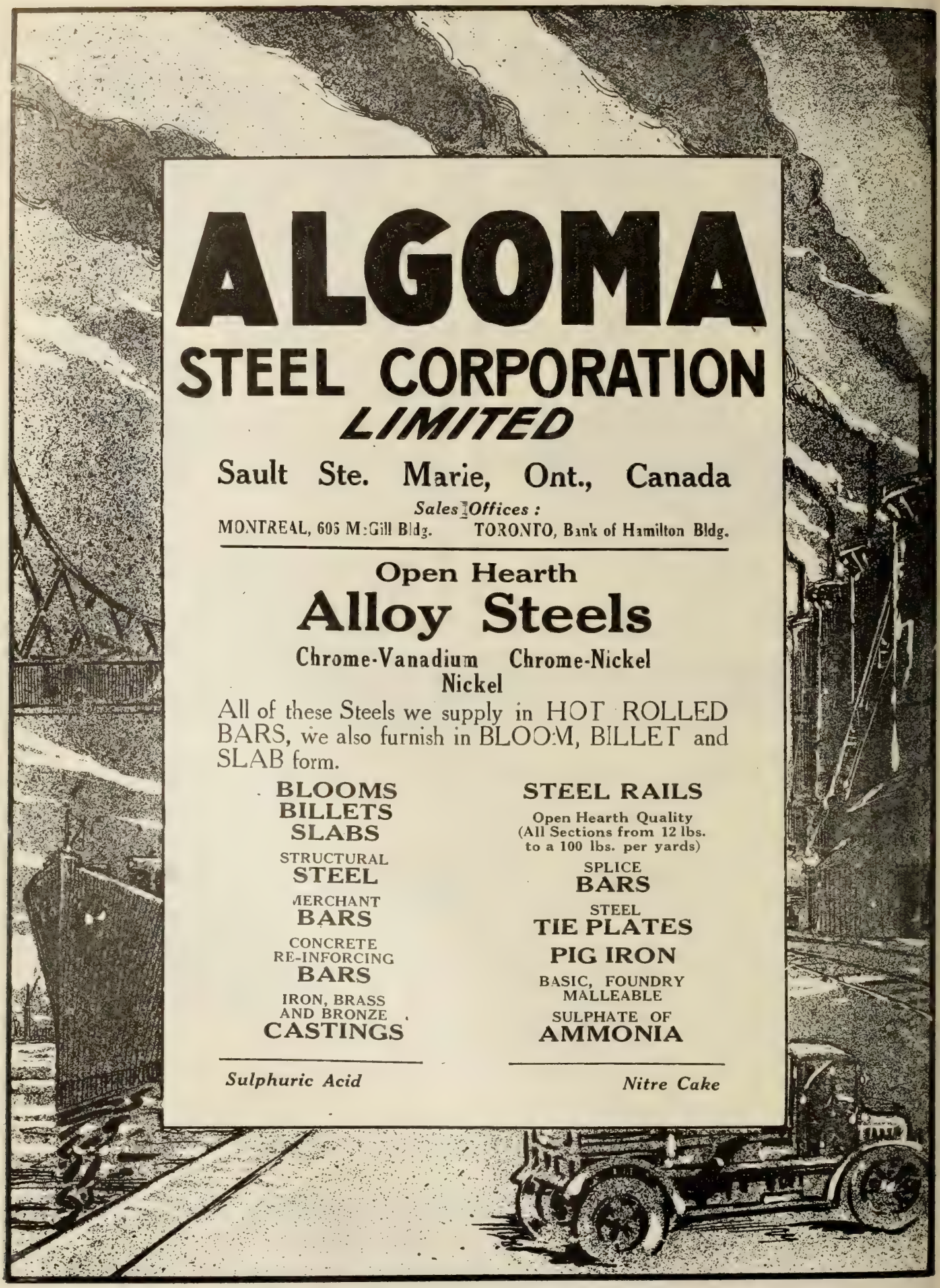
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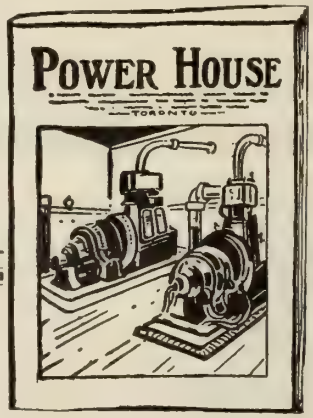
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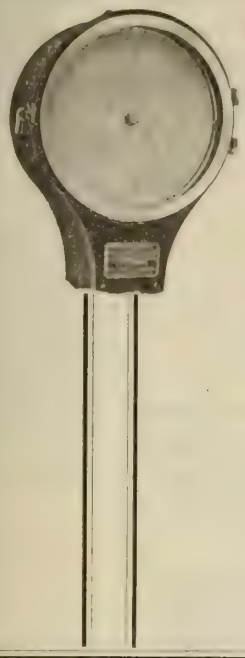
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One of These Gauges Is Saving a Firm $1,200 a Month!

The same combination of circumstances may never occur in relation to your own gas supply, but this situation, which is vouched for by the firm's own figures, actually exists. It may serve to suggest some place in your own plant where a reliable

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can save you money. Gas, air, steam and many liquids are being accurately measured and continuously recorded by one and another of the Bristol pressure gauges.

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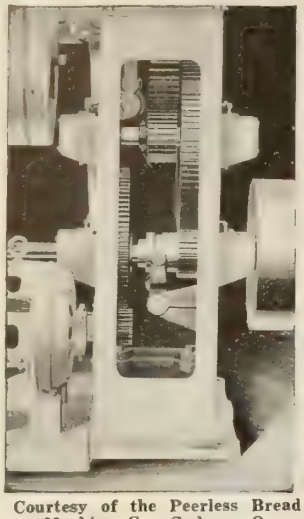
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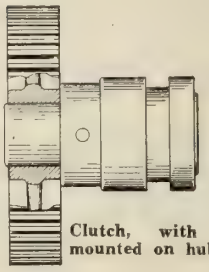


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A No. 4 single clutch is used to facilitate starting and stopping.

Lubrication is a necessity for all running bearings and frictions and an occasional application is all that is necessary.

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Sizes—½lb. to 5,000 lbs.

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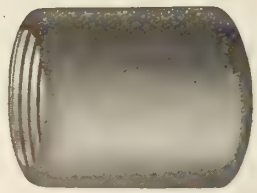
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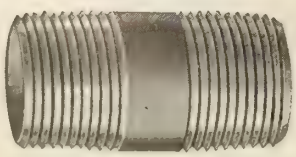
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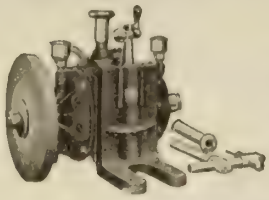


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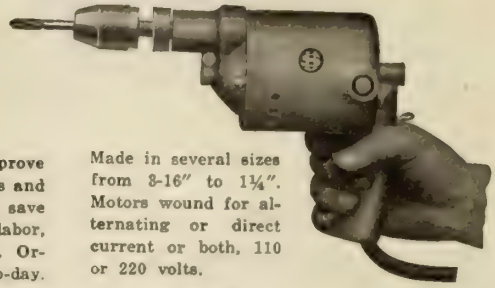


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Can be Attached to any Lamp Socket



For drilling in metal these drills are the superior of every other kind of portable drill. Their operating cost is only half that of air drills. And they can be attached to any lamp socket.



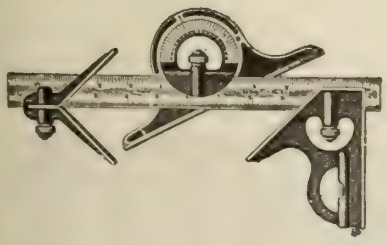
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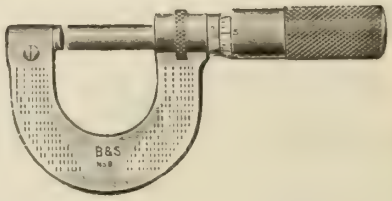
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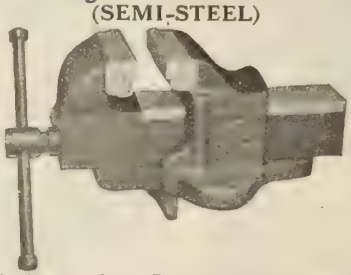
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combine perfect balance with correct speed to insure a degree of accuracy never before obtained with portable grinders. Write for information concerning what they will do for you.

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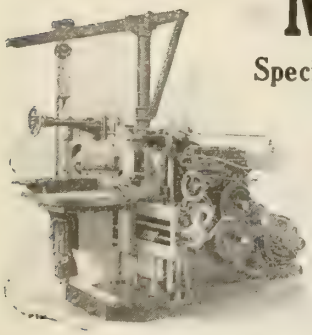
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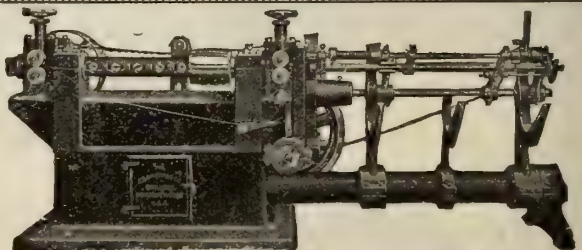


Special Heavy Duty Draw Cut
RAILROAD SHAPER

The most powerful shaper on the market, designed to withstand extreme strains of heavy cutting. Adaptable, Dependable, Productive.

Equipped with the Improved Double Chuck for Driving Boxes. This regular, unique feature eliminates unnecessary set-ups. Ask for Bulletin No. 6.

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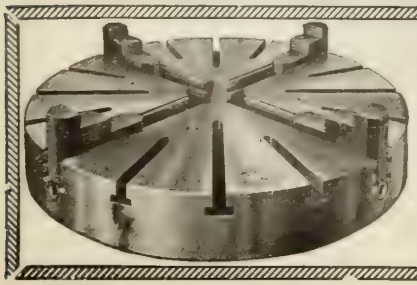


THE WIRE IS PERFECTLY STRAIGHT

and cut to accurate lengths when it comes from our AUTOMATIC WIRE STRAIGHTENING AND CUTTING MACHINE, whether it's ¾" diameter or only .020" wire, hard or soft wire, highly polished or rough stock. May we send you catalogue C?

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Also makers of Riveting Machines, Sprue Cutters, Cotter Pin Machines, etc.



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They represent strength and economy with high-speed cutting tools. Accurate and dependable always.

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Classified Opportunities
page 48



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J. C. McLAREN BELTING OAK EXTRA TANNED EST 1856 J. C. McL.

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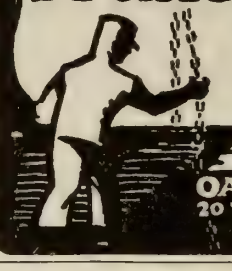
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Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
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SMITH'S FALLS MALLEABLE CASTINGS LTD
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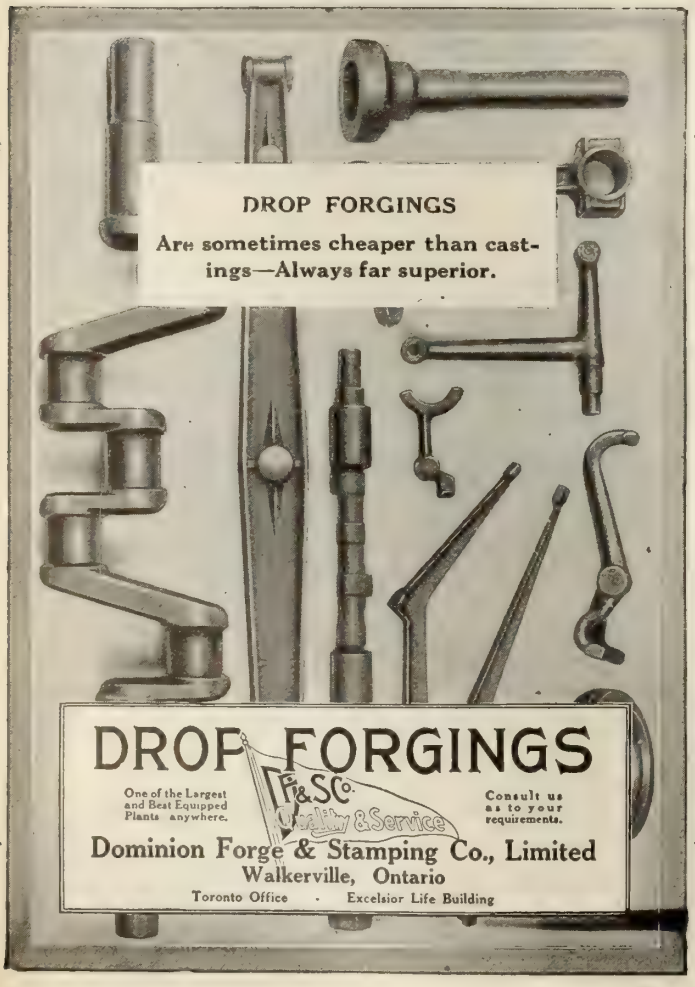


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YOUR DEALER WILL FURNISH THEM



DROP FORGINGS

Are sometimes cheaper than castings—Always far superior.

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Maximum Power, Speed and Service

Unlimited capacity for hard, fast service is the feature of Dunlop "Gibraltar RedSpecial" Belting.

The success of over a quarter of a century in the manufacture of Rubber Products is built into Gibraltar.

As the original Made-in-Canada Red Rubber, Frictioned Surface Belting, it has stood the test of time in turning the wheels of industry in a multitude of-belt-using plants from the Atlantic to the Pacific.

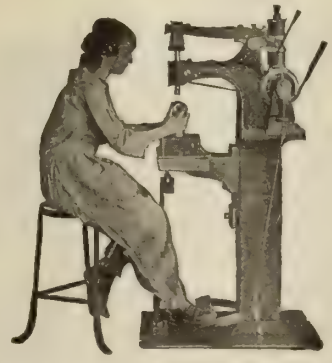
In buying "Gibraltar RedSpecial" Belting you get the advantage of years of careful laboratory work on our part with this result: The friction is of that "just-right" elastic quality which allows for the give and take necessary in rounding the pulleys; hence the reason "Gibraltar RedSpecial" is known for Maximum Power, Speed and Service.

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Head Office and Factories: Toronto

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The Hammer With The Human Stroke



HEADS RIVETS COLD

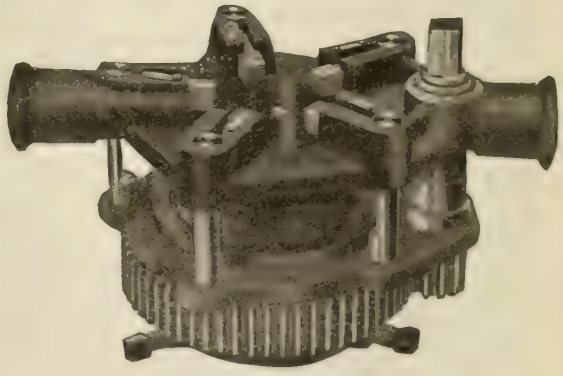
Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:
A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".
And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.
Built in eight sizes.
Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.
Send us sample assembly parts with rivets or sketch of your work,

and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.

ROCHESTER, N.Y.



With "Toledo" Tools

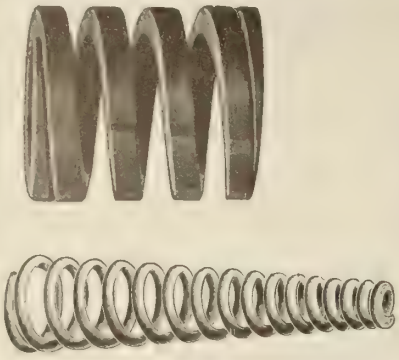
One Man Does the Work of Two

"Toledo" Geared Adjustable Threading Tools come in a range of sizes to handle pipes from ⅛" to 12" diameter. They are so simple and effective in operation that one man practically does the work of two. One cut finishes all threads. Every tool equipped with essential attachments.

"Toledo" Pipe-Threading Tools are described in detail in Catalogue P-3. Write for a copy.

A. B. JARDINE & CO., Limited

HESPELER, ONT.



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BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

PRECISION SPRINGS
OF HIGHEST GRADE
--FOR--
ENGINES, VALVES, DIES,
AND SPECIAL MACHINERY
ALSO SPECIAL DESIGNS
AND TYPES

The Lion and The Mouse

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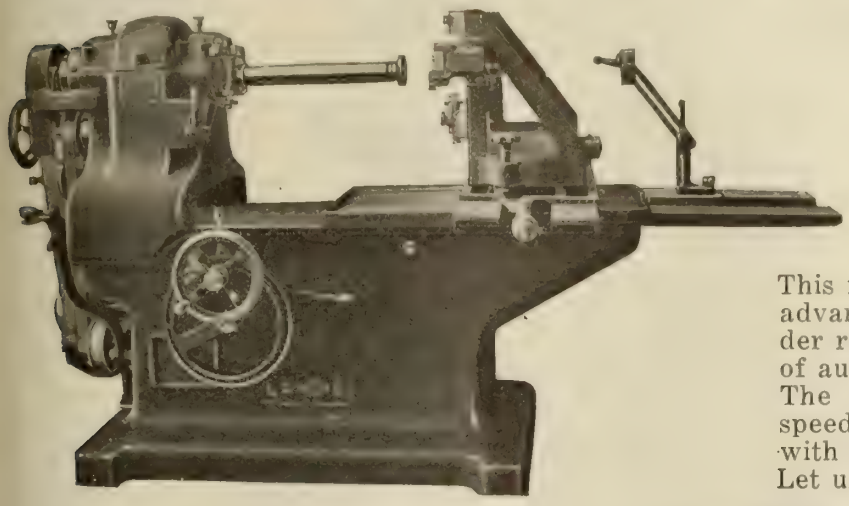
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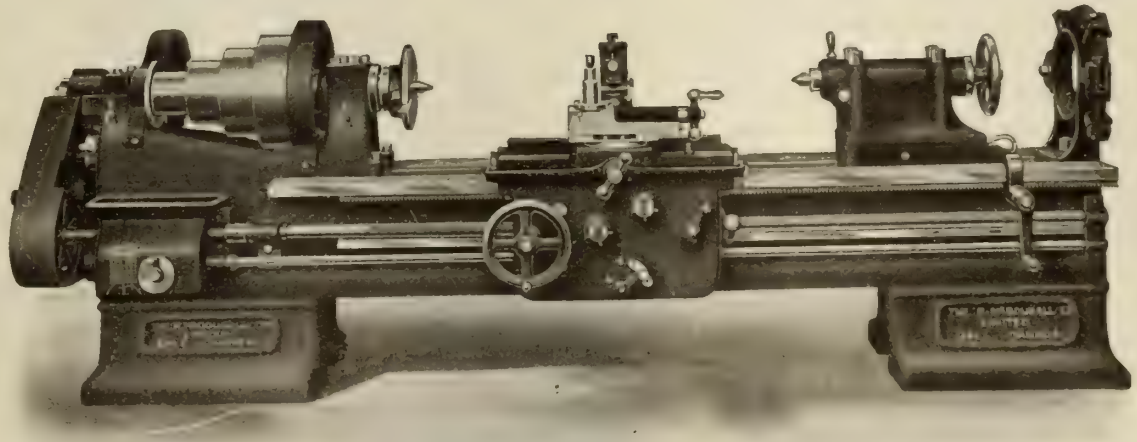
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VOL. XXVII. No. 19. MAL 11, 1922

Construction of Adapters for Turret Lathe Tools

Nature of Work Will Determine the Best Type to Use—Method of Holding and Adjusting Shanked Boring Tools—Floating Adapters for Specific Purposes

By FRED HORNER

AMONG the numerous problems which confront the designer and the tool-maker in tooling up turrets one of the most important is that of arranging the holding devices. This is not always a simple matter, especially in regard to the larger turrets. Diameters and shapes of tools, or of their shanks, vary considerably, and the lengths of projection are extremely diverse in some examples. All these things have to be considered in laying out the equipment, and special fittings may require to be made. Some of the tools go direct into the turret holes, and entail no further difficulty; others must have bushings, or brackets, or bars, or holders to provide the necessary accommodation. The purpose of the present article is to consider how these various adapters are made and arranged in different circumstances, with a few illustrations of the more typical specimens. Some are standard details, supplied by the turret lathe makers, but many need to be made up in the shop.

Until the nature of each job is examined, tooling diameters and lengths considered, and the apportioning of the operations throughout, the tool-designer is unable to say what kind of adapters may be wanted. The size and functions of the cross-slide or carriage have a partial influence upon this problem, for on the one hand there may be certain operations done from the slide instead of from the turret—which fact affects the design of some tool holders in the turret—and on the other hand requirements of turret clearance over the slide and between its front and rear holders may involve longer tools, or specific adapters. Also, if cross-slide operations proceed simultaneously with turret cuts, this will often necessitate longer projection of the turret tools, or some alteration in the mode of their holding. The chief instances where all these variable factors do not worry the designer are those of simple sets of short tools, not subject to interference with the cross-slide outfit. It is feasible then even to abolish adapter bushings, and make the shank of every tool, whether centering, starting, facing, drilling, counter-boring, turning, chamfering, etc. of uniform size to match the turret holes.

Simple Adapter Bushes

The elementary duty of providing a fit for a smaller or larger diameter of tool shank to the standard turret hole necessitates a bush bored smaller to suit, or enlarged into a hood, or sometimes flanged. Similar conditions prevail when the desire is to hold a tool out to a certain distance, its shank (which may or may not be of turret hole size) lying in an extension adapter. If the type of tool shank permits, a simple split bush, A, Fig. 1, or with knurled flange, and three cuts, B, is suitable; the grip of the binder bolt then serves to secure bush and tool shank. The shape of the last-named may, however, require something different from a parallel round hole, such as if a taper shank has to be carried, or a tool is made from flat stock. In the first case a solid adapter with taper bore and extracting slot, C, answers requirements, and a slotted bush, D, accommodates the second. The hood form of adapter is usually a simple enlargement to hold the extra diameter, with a screw or screws to bind the tool shank or body. To gain exact alignment of certain tools, the adapter can be flanged, and attached by screws to the hood (such as at E). Or if a loose floating action happens to be appropriate for the tool concerned, the hood can be fitted suitably into the turret bush, F.

For extra projection of a tool the best plan lies in the use of a bushing with split grip at its outer extremity, if arrangements for fitting various sizes of tool shanks are desirable; one of a set

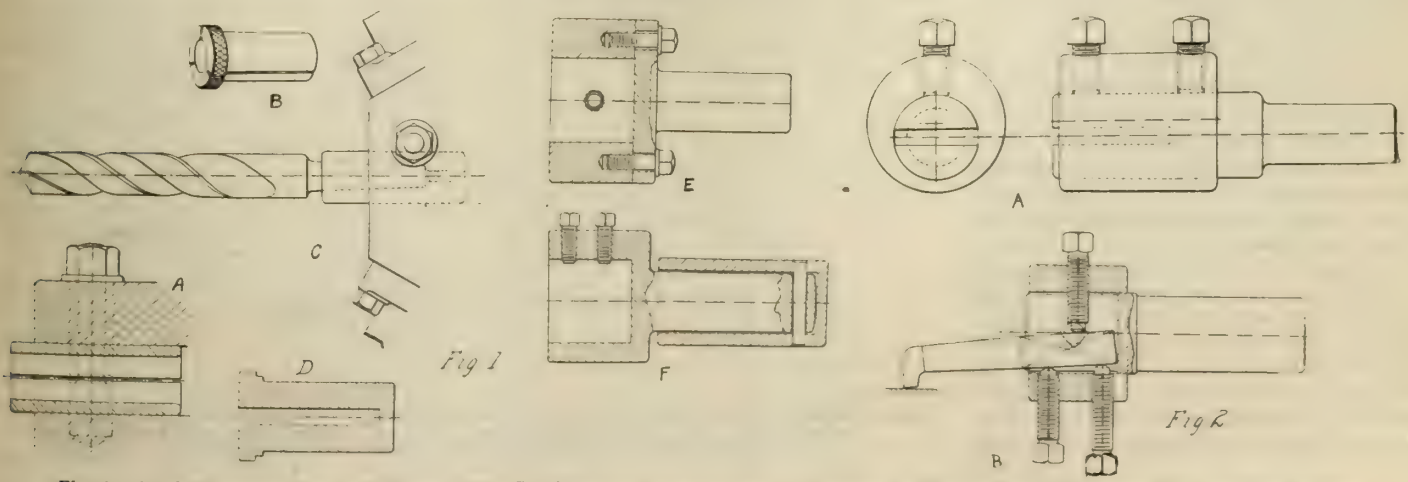


Fig. 1.—A, plain adapter bush, with three splits, C, adapter for taper shank. D, adapter for flat section. E, adapter with centering adjustment. F, with floating action. Fig. 2.—A, adapter for projecting flat shanks from turret, B, for holding square shank tools.

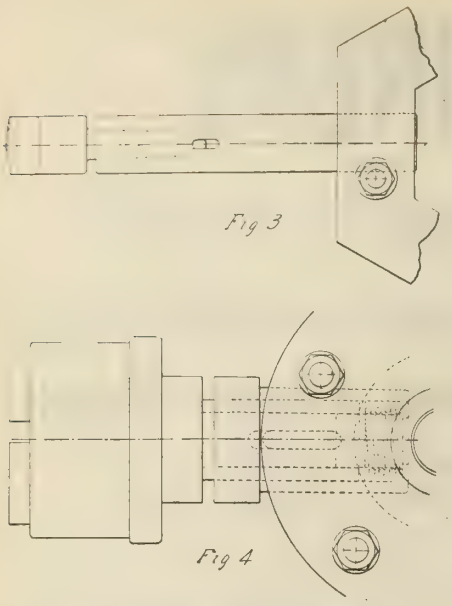


Fig. 3.—Long bar type of adapter.
Fig. 4.—Adapter with spring fitting.

of loose split bushings in the hood then receives the shank. When frequent substitutions of standard tools become necessary during the operations, a regular drill chuck actuated with key offers a more convenient solution of the problem.

With regard to flat shanks, which are either too wide to go into a turret bush, or must be extended further than such permits, a favored device embodies a slot in the lengthened body, and an encircling bush, Fig. 2, A, provided with screws for compression. Should different widths of stuff have to be gripped, side screws may be added to press on the edges, a similar principle being adopted when precise centering becomes necessary. Fig. T, B, illustrates a special modification made by Warner & Swasey for the purpose of holding and adjusting shanked boring tools. After setting the square shank to the angle and boring size required, with the manipulation of the three screws seen, it is firmly clamped by a side screw (shown dotted) which passes through the encircling collar and contracts the split end of the bush.

Extra projection of taper-shank tools turns the adapter into a shape like that in Fig. 3. Necessity for tool-steel economies explains the employment of many such extension bars, carrying only perhaps a bit of a tool on the nose. Such a long extension is essential to bring the tool end out to approximately the same distance as the other tools in the set. It never pays to make such a length wholly of tool steel, excepting in those circumstances which demand long fluted drills that are not conveniently fashioned with loose tips fitted in.

Delicacy of endlong adjustment occasionally modifies the particular requirements of an adapter, into the design of which a knurled nut is incorporated, with a fine thread to adjust the tool outwards in relation to the turret, until an exact depth of penetration into the work is attained. Or the relations of two tools held by an adapter are modified until the respective depths of recesses, or distances of shoulders, etc., receive their final and exact correction. A sample of such adjustment obtained in another manner will be shown in a subsequent figure.

Floating action in adapters has already been mentioned, and there exists another class of freedom provided in some circumstances, chiefly to screwing dies. If these are worked in a turret moved by cam action, a spring connection may be arranged, with a key, as shown in Fig. 4, whereby the die shank is allowed to yield slightly. Exact leading by the cam, a matter of difficulty to arrange, is thus not necessary.

Dual-Purpose Adapters

Tooling demands largely introduce extensions on to adapters, to fit them for conducting more than one operation. To select a simple example, the addition of an arm to the bushing, Fig. 5 presents a turning tool that cuts a certain length of body meanwhile the drill pinched in the adapter hole performs its duty. More complicated outfits incorporate three or four tools acting on diameters, or shoulders or bevels.

Adapter Brackets

We now come to an extensive class of adapters, utilised for turrets other than those of small sizes. The distance to which the tools must have their ends brought from the turret face, and the severity of the cuts imposed on some of them, necessitates stiff brackets that represent the bushings of the small turrets. Some of these brackets nevertheless often carry insignificant tools, such as those for centering, small drilling, etc; it is cheaper to leave the brackets in place and fit suitable adapters. Perhaps the next job may involve heavy-cutting tools in nearly every station. A further fact is that the importance of securing alignment of the tools, whether large or small, renders the provision of stiff adapter brackets essential, for an unduly long bar of comparatively small diameter would not always ensure satisfaction, nor perhaps withstand constant use with flexing. Moreover some of the tools have shanks which need a strong clamp device to hold them properly, and this is best afforded by a powerful bolt in the socket of the adapter. Such a fastening is more convenient and less damaging than using a cotter passed through the adapter and bar, and avoids the trouble of slotting the bars. When the turning effort on the bar is sufficiently strong to render a key necessary, a spline may be cut on the bar shank and a loose key be dropped in, or a cross slot and tongue coupling be used, but for a large number of tools the friction grip is ample.

Two requirements for a good adapter bracket are a well-spread base, firmly bolted to the turret face, and a spigot joint for centering. In dealing with cuts that demand a floating tool—piloted or not—the adapter, or its bushing is modified to give the requisite freedom. Other special arrangements include the facility for rapidly inter-changing different tools in one adapter (when a large number of operations have to be done from the turret); and means for giving a delicate feed to fine tools with an auxiliary rack mechanism, where the bulk of the turret and carriage would be too clumsy for the particular feed. Examples of these diverse requirements may now be noticed.

The nose of an adapter bracket either has set-screws to bind the bar or tool shank, or in preference a contractile action is gained, with a split, Fig. 6, A, or for greater strength a closed eye fitted with binder bolt and bush, B. If interchanging is necessary during the cycle of operations on each piece, a clamp handle C, suits requirements, including a key to prevent slip. Relative adjustments for amount of projection of the

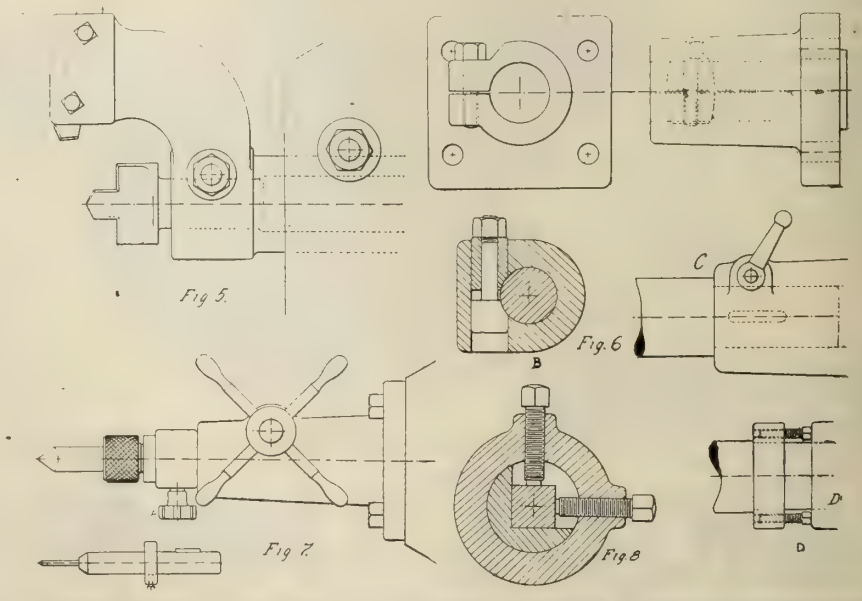


Fig. 5.—Double function adapter. Fig. 6.—A, split adapter, B, bolt and bush; C, arrangement for interchanging tools; D, adjustment collar. Fig. 7.— Adapter fitted with sensitive feed for small tools. Fig. 8.—Holding square section in round holes.

two or more tools that are interchanged can be provided for by grinding the shoulders of the bars suitably, to bed against the adapter nose; but if subsequent fine corrections are needful, a split threaded collar can be put on the bar. The trouble of cutting a screw upon the bar may, however, be avoided by fitting a plain ring as drawn at D, tapped for a pair of set-screws which thrust against the adapter face.

The delicate feed mentioned previously often happens to be required when small holes and recesses must be put into otherwise large objects involving the use of a heavy turret lathe. The adapter is then fitted with a rack-feed device to give a sensitive means of propelling the little tools, as the turret remains stationary. Fig. 7 illustrates a specimen of this character, fitted by Messrs. Alfred Herbert, Ltd., of Coventry (England) to one of their large turret lathes. A set of tools comprising centering tools, drills, etc., is used successively in the sub-adapter that is clamped in the adapter bush with the screw A, and fed with the cross-handle seen. One of the tools with its keyed shank and stop-collar may be observed in the drawing.

Floating holders exist in a variety of designs, there being usually a spring plunger beneath the bar to keep it from sagging too much, and bell-mouthing the hole. Or two plungers are located angularly underneath to afford a better balance. Alternative to this, where a long and heavy boring or reaming bar happens to project from the adapter, is the practice of bolting a sort of spoon-shaped casting to come under the bar and limit its sag.

The question of provision for holding square-shank turning or boring tools in the larger adapters depends on the frequency with which such tools may be wanted. If their use is common, the adapters may have suitable apertures slotted out to hold one or more shanks, making up necessary open spaces with distance pieces. Should only occasional gripping be desired, the neatest way lies in the adoption of filling-pieces or adapters laid in the bore, Fig. 8. Part of the circle thus becomes occupied, and the remainder of the space holds the shank. By having a curve or two inclines meeting, the shank can be rocked by suitable adjustment of the holding screws.

Space does not permit in this article to go into the question of the elaborate modifications of adapters that occur for tooling castings, extensions of the idea shown by Fig. 5. These outfits comprise multiple tools or cutters for dealing with several shoulders or faces, also slides to impart a cross-feed while the turret remains still. Somewhat unusual features also occur in certain cases, such as sloped or curved form strips attached to the adapter, to control a roller bar on the cross-slide post.

Box-tools have not, until recently, been subjects for the employment of extension adapters, as their construction generally includes a correct means of attachment to the turret. Lately, however, some of the heavy designs for turning long bars have been built simply as massive flanged castings, comparatively shallow from front to back, and their fixation to the turret face is effected by a strong box-shaped casting of suitable degree of projection, with the lower web cut through for the escape of chips and coolant. Thus a standard type of box-turner adapts itself for any lengths of turning required and the opposite flat of the turret can be used for the attachment of any other class of tool, without having to worry as to a clear hole for the passage of the bar across from the box-tool.

BETTER FACTORY FLOORS

The factory floor is an important feature, and is now being given more serious consideration by builders and owners of manufacturing plants. If the floor is not right, serious trouble is likely to ensue. It may vibrate or slump, either of which faults causes trouble with the machinery and shafting. Floors must also be made so that they are easy on the feet of workers who are obliged to stand on them for hours at a time.

One new factory has floors four inches thick, writes D. M. McAdams in a recent issue of Factory. The planks are three inches deep. A top floor of maple adds another inch. Trucks will roll smoothly over this floor, and it is easy to keep the maple boards clean and nice looking. Strength, however, is the chief reason for this heavy construction. This floor will not vibrate perceptibly when the machinery is running.

A factory with lightly built floors is likely to get out of shape and depreciate in value very quickly. One manufacturer took space in such a mushroom building not long ago. After going in he found that the shafting was bent out of true the entire length of the building. Slumping floors caused the trouble. There was a waste of power in running the shafting, and the manufacturer had to have the floors packed up and the shafting straightened before he could go on using the factory.

"Water leaked through the floors and damaged the stock on the floor below." That is not an uncommon report from large manufacturing plants. Whenever there is a fire, or even when a sprinkler head gets loose or water is spilled on the floor, it leaks through the cracks. Usually it does a lot of damage. Now, it is quite possible to prevent such accidents. Floors can be made waterproof as well as rigid. This is done by using a mixture of cement and asphalt, or mastic, as waterproof flooring is sometimes called.

In a recently finished factory building some of the floors are covered with mastic and others with waterproof paper. No water can get through. The caretakers can turn the hose on them and give them thorough washdowns as often as required. Concrete floors are hard on the feet of men and women who stand on them at work all day

THE KINEMATOGRAPH IN ENGINE DESIGN

A new type of petrol engine recently produced in Great Britain possesses many interesting features. It is designed to retain the essential advantages o the two stroke engine while avoiding certain disadvantages · · lifficulties usually met with in that type. In order to perfect the design the inventor carried out a series of experiments with the aid of a kinematograph apparatus for the study of the movement and velocity of gas. When under test this engine developed 10 horse power at 3,800 revolutions per minute, and when fitted to a motor cycle frame gave an average petrol consumption of over 60 miles per gallon. The use of castings requiring special care in the foundry has been avoided, and the machinery and erection have been made as simple as possible.

SAFETY DEVICE FOR ELECTRIC HEATERS

One of the drawbacks of electrical appliances for heating water and other liquids is that if by chance the current is switched on while the utensil, such as a kettle or urn, is empty, the element gets overheated and is apt to burn out. In order to get over this difficulty some makers introduced a safety device in the form of a metal plug which melts at a comparatively low temperature and breaks the circuit, thus preventing overheating of the element. This method works fairly well but it has the objection that in order to bring the utensil into action again a new plug must be inserted. A British firm has therefore devised a safety appliance which is equally effective in action but which does not involve any part requiring replacement. It consists of a simple mechanical arrangement which cuts off the current when the utensil boils dry. All that is necessary to restore connection is to fill the utensil with water, when the device automatically re-sets itself.

WORLD'S LARGEST LIFEBOAT

Arrangements have been made in Great Britain for building a new type of motor lifeboat which will be the largest of any yet known. Its length will be 60 ft. and its beam 15 ft. and its normal draught 4 ft. 6 in. It will be a 60 ton vessel propelled by twin screws, driven by two 75 horse-power oil engines, at a speed from 9 to 10 knots. It will be able to cruise for 100 miles without replenishing supplies. Two passenger cabins are provided, one at the bow and one at the stern, giving a total passenger carrying capacity of 150 people. Appliances are provided for supplying warmth and hot food and for rendering first aid to the injured. An interesting feature of the equipment is the provision of a searchlight and life saving net in addition to a gun for throwing a line over a vessel in distress. This vessel will be stationed on the Mersey.

Proper Care of Small Tools Increases Their Life

Workmen's Attitude Affected by Shop Conditions—Tool Room Facilities Should Prevail in Shop to Lesser Degree—Individuality Ability Basis of Plant Efficiency

By J. H. RODGERS

PROPER handling and storing of small tools and machine shop accessories are two essential factors in the problem of plant management. Few men fully recognize the important place that they occupy in the scheme of economic shop practice. The volume of production may not be directly affected by the amount of attention given to this matter but the ultimate efficiency of any factory is more or less affected by the policy of the shop regarding the foreman's and the employees' attitude towards the care of tools and fixtures while under their direct care or supervision.

In many manufacturing plants tool stores are provided for the purpose of keeping track of small equipment and passing out to employees when the same is required to perform the different duties for which the tools are designed. Under these conditions the tools, invariably, are given the attention necessary to maintain them in good working order for, once a tool is placed on the rack or shelf, it is not disturbed again until it is handed out for further work in the factory. These tool cribs are designed for orderly arrangement of all classes of equipment, so that the minimum amount of time is spent in obtaining the tool and handing out same to the different workmen. Likewise, when the tool is returned to the wicket it is immediately placed in its allotted place until again wanted.

But what takes place while the tool is out of the hands of the tool-room attendants? Here it might be said that "the tool is known by the company it keeps." If it so happens that the work is being performed by a careful and thoughtful mechanic the tool will be returned in as good condition as when it was taken from the crib; perhaps in better condition, as, very often, a reliable man will take sufficient interest to make any slight repair or adjustment necessary to place the tool in its proper working order.

However, should the tool be taken out by one whose only object is the completion of the work in hand, the "means to the end" may only be considered as a necessary evil, and when not in actual use may be placed in a position on the machine or the floor where it may receive more or less injury, and thereby make it less fit to properly perform its specific duties. The careless handling of costly equipment, such as gauges, cutters, precision tools, electric and pneumatic portable hand drills, etc., should not be encouraged in the shop, and workmen must school themselves to the need of thoughtful manipulation and personal supervision of such appliances when in their hands. They should realize that maintenance of efficient tool-room service is largely a question of overhead expenses, not directly related to actual production costs, and that carelessness on their part in the handling of tools needed to perform their particular work may result in replacement or repairs of parts to shop equipment, and the expense necessarily entailed must be added to overhead account and this will indirectly affect the net receipts and likewise the amount of cash available for labor cost. Individual ability is the basis of plant efficiency. As a factory personnel is made up of individuals the shop standard cannot excel the collective average.

Care of Private Tools

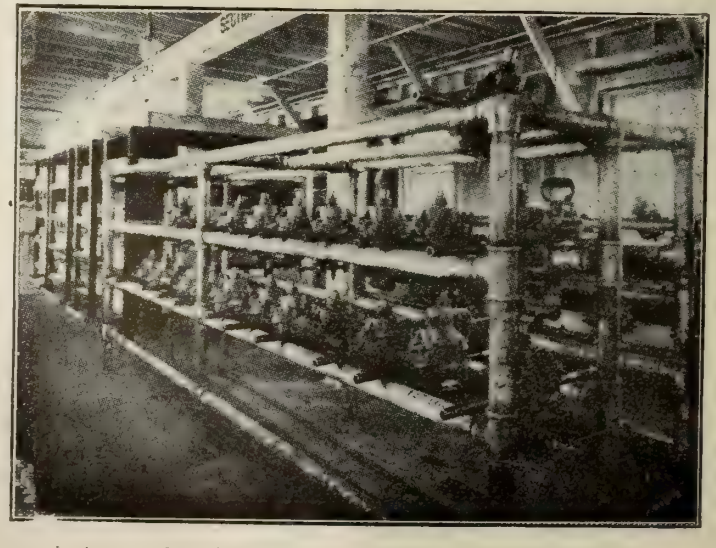
The majority of mechanics to-day have a varied range and supply of small tools for their own private needs and usually have a good tool box in which they are kept when not in actual service. Many men use these boxes constantly and seldom if ever place a fine precision tool on the machine or bench but use the open drawer of the box for this purpose. These men appreciate the value of the tools and the expenses incurred in acquiring the collection, and it is more than probable that shop tools (those taken from the tool-room for specific purpose) will receive the same care and attention from such men as their own private tools do.

Abuse of Shop Tools

The greatest possibility of tools becoming damaged is when they are being used by thoughtless men or when carelessness is an outstanding feature of a man or group of men. The human factor is the one that makes it almost impossible to accurately solve, in advance, the problem of shop supervision, or production.

Environment is one of the things that make or mar the shop. If the men are working in an atmosphere of cheerfulness and orderliness, the spirit will dominate their entire attitude. On the other hand if discord and disorder pervade the shop, the natural consequence is that nearly every action of the average workman will reflect the general surroundings. This is particularly true in contract shops, where quantity must step aside for variety, and where one will generally see a wide range of material of every description.

Manufacturing, to-day, is done on an interchangeable basis, and the use of templates, jigs and gauges is an imperative need where volume and accuracy are the essential features. Generally speaking; tools of this character are costly to make, and not constructed to stand any abuse, so that extreme care should always be exercised when used in connection with machining or assembling of the work. In the case of jigs or fixtures, these are usually in constant use when out of the tool room, and therefore, constantly under the eye of the man doing the work. However, should it be necessary for the workman to place a certain jig or fixture to one side temporarily, some definite place should be provided, such as a nearby shelf or cupboard. The usual course is to locate it on the bench or floor. It is comparatively safe on a bench, but often becomes a target if located on the floor.



A strong and serviceable rack for pneumatic and electric tools.

The writer has in mind a certain drill jig that was being used by a workman, but owing to a rush job coming along the jig was removed from the table and placed on the floor alongside of the machine. Through some misjudgment the piece being hurried through succeeded in getting away from the operator and in its flight to the floor struck the jig, with the result that a part was broken off that required two days to repair. In every case, where it is found necessary to change fixtures, it is always advisable to forestall the possibility of accident by making sure that the other tools are out of harm's way.

Great care should be taken when using fine measuring tools around machines. If possible it is well to have a wooden shelf conveniently located so that the gauges and other instruments may be placed thereon. This is advisable for obvious reasons. These tools are often very sensitive and easily affected by change of temperature. Invariably, wood will retain the general temperature of the shop, and when precision tools are kept in contact with wood, the possibility of change is very slight. On the other hand if a gauge is used on a piece of metal that has just been machined the small volume of metal contained in the gauge will rapidly absorb the heat, and when again placed on the comparatively cold machine will cause slight but certain contraction, which, in time will affect the accuracy of the tool.

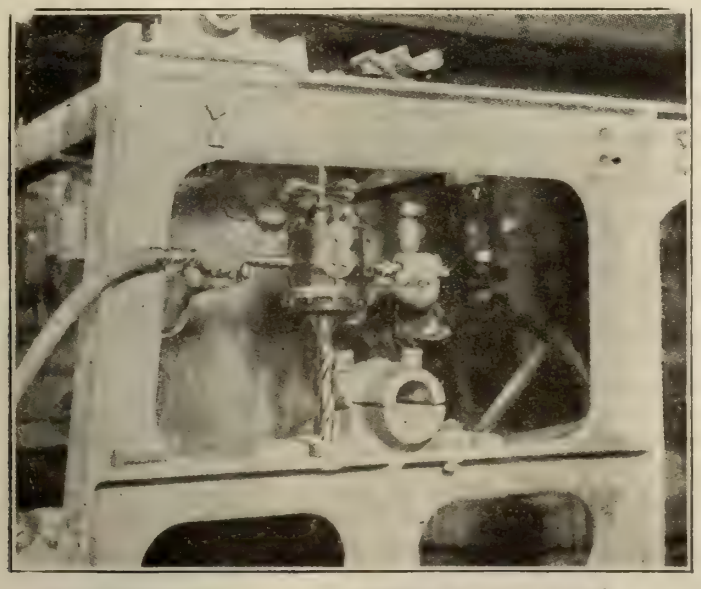
We have in mind an instance where a lathe hand was turning some 3 in. short steel shafts and was using a snap gauge for sizing. Being close to an outside wall he was using it to hang his gauge on when not in use. The following day several of the shafts were found to be slightly below size, but the operator insisted that they had been made to gauge. When the gauge was obtained from the tool-room it was found that the shafts were small. After thinking the matter over it was believed that the size of the gauge had been affected by contact with the cold wall—it being in the winter time. A few weeks later some similar shafts were going through, but in the meantime a small wooden board had been erected, several inches from the wall, and no errors were recorded. The contraction of the gauge had been sufficient to under-gauge the shaft.

Portable Tools

Portable tools, such as electric and pneumatic drills, are frequently subjected to abuse owing to the fact that they are not always given the attention they deserve. Owing to their peculiar construction and the awkward position they are often used in, they are difficult to handle and sometimes they are allowed to fall, and not too gently, to the floor, and injury often results. Under no circumstances should such tools be allowed to lay about on the floor, as damage is frequently caused by parts falling on them.

In using flexible shaft grinders care should be taken to keep the shafts as straight as possible. The fact that the shaft is flexible is no reason that the same should be used in the position of a hoop. The location of the power source may seriously affect the life of such tools. The writer has in mind a shop where one of these belt-driven flexible shaft grinders had been installed for grinding the shear on large dies. The work table had been placed in the centre of an open space but the location of the counter shaft made it necessary to use the grinder with the shaft always in the shape of a large U, and no adequate means of lubrication could be found to keep the shaft cool. It was finally decided to change the location of the drive, and this eliminated much of the trouble.

Every means should be provided to assist the workmen in keeping tools in good condition. A careful study of the needs of the shop regarding the proper facilities for temporary and permanent storing of tools, and the meeting of such requirements will more than repay the outlay necessary.



Care should be taken in removing portable tools from awkward positions.

COMBUSTION OF FUEL MOST IMPORTANT

Under ordinary conditions the ignition temperature of a fuel is less important than the maintenance of combustion. No matter how large the mass of fuel may be, whether it is a blast furnace, under a boiler, or in an ordinary household furnace, the origin of the heat necessary to raise this fuel to the ignition temperature is in the kindling which starts the fire. Hence the starting of an ordinary fire is a process depending upon the application of an outside source of heat, always at a high temperature, to some portion of the mass of coal until a part of the coal itself burns and propagates heat to the remainder. It is, however, in connection with the storing of coal in piles that the ignition temperature takes on a real significance. Coal is actually burning at all times and even at low temperatures. If the heat thus produced is sufficiently confined and air is supplied to the coal at the proper rate the temperature of the interior of the mass will rise. As the temperature rises the rate of combustion also rises and after a certain safe temperature rises the rate of combustion also rises and after a certain safe temperature is passed the process goes on quite rapidly until burning or flame results. Bulletin No. 128 of the Engineering Experiment Station of the University of Illinois, "The Ignition Temperature of Coal" by R. W. Arms makes a study of this problem with the object of determining the influence of the temperature of ignition of the various coals upon the liability to fire while in storage. In this bulletin is given a discussion of what point may actually be designated as the ignition temperature and what factors influence that point, the methods for determining the ignition temperature of different coals, and the results of tests upon the various coals used in this investigation. Copies of Bulletin No. 128 may be had without charge by addressing the Engineering Experiment Station, Urbana, Illinois.

BRITISH ELECTRICAL RESEARCH

Practically every loading section of industry in Great Britain has its organised co-operative research Association. In the case of brass, copper, and other metals not containing iron a great deal of very interesting research is now being carried on. The casting of brass, influence of impurities on the working of copper, the electric melting of non-ferrous metals, and the grinding, jointing, and polishing of such metals are being closely studied. Perhaps the most important part of this research lies in the investigation of corrosion. The production of rustless iron and steel has stimulated the brass and other industries to give attention to the causes of corrosion. It is stated that the examination of tarnishing, which is the first stage towards corrosion, has already yielded very interesting results.

The Industrial Diamond and Its Various Uses

Location of Different Fields—Sorting and Grading for Practical Application—Appraising Value and Quality—Experience Necessary for Accurate Selection—Different Settings

By W. FURNISS CLARKE, M.E.

THE SUBJECT of diamonds is a very interesting and fascinating one for the student. Volumes can be written on their history, their baleful or happy influence upon humans, and the part they have played in shaping the course of many notable lives and events.

Take as one instance, the history of the popularly known "Koh-I-Noor" (mountain of light) originally weighing 793 carats and which the Hindoo accounts deduce from the time of the God Krishna. It appears in the treasury at Delhi, and taken in conquest by Ala-ed-Din, came into the possession of the Sultan Baber of the Mogul dynasty in the year 1526.

By adventure and duplicity, the stone came into the possession of Nadir Shah, conqueror of India, from whom it was handed down through the family, to Achmed Shah, whose son Shah Sujah was eventually forced to hand it over to Runjit Singh.

British troops, at the time of the Sikh mutiny, captured Lahore, and this famous stone fell into their hands, and was presented to the late Queen Victoria in June, 1850.

When the Koh-I-Noor was shown at the exhibition in 1851, its weight was then 186 carats. Previous to its capture, it had been shamefully and unskilfully cut by Hortensio Borgio for Emperor Aurenzebe, who did not pay for the work, but instead, confiscated the whole of Borgio's possessions, and threatened him with death. A skilful workman named Voorsanger of the firm of Mr. Coster, Amsterdam, recut the stone in England, and after 456 hours of labor, transformed the lustreless crystal into a brilliant gem weighing 106-1/16 carats. The Koh-I-Noor is famed for its fire and purity, and is to day, a gem amongst the Crown Jewels of Britain.

We might proceed with these histories from the "Great Mogul" traditional Indian diamond, of 280 carats, to the "Mattam," 367 carats, which was the cause of an exceptionally cruel and bloody war, the "Braganza," 1,680 carats, the "Shah," 86 carats, the "Regent" 136¾ carats, which Napoleon wore in his sword, the "Florentine," 139½ carats, down to the later African find known as the "Cullinan" diamond weighing 3,254 carats, and which, because of its formation, was eventually cut up into 200 stones of unparalleled beauty and quality. The largest of these stones, now known as the "Stars of Africa" weighing 516½ and 309-3/16 carats repose in the British Royal Sceptre, and the Imperial State Crown respectively.

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Many more noted diamonds could be mentioned if space and time would permit, each with its own peculiar or bloody history the various details of which are described in many works for that purpose. The oldest diamond mines are in India, where large quantities and some very wonderful stones were found. The Indian mines, however, are now practically abandoned, and Madras is not now the centre as it was years ago.

Diamonds were found in Brazil in 1728, and several great fields were opened. It is from Brazil that we get the black diamond, or carbon. The Brazilian fields are still large producers. Diamonds were also found in Chili, Australia, Borneo and North America, but to a limited extent. They were found in South Africa by O'Reilly in 1867, and later by Prof. Emil Cohen in 1872, since which time the mines have extended over hundreds of square miles of territory in Cape Colony and the old Vaal River State, now the Union of South Africa, and the mines are the world's largest producers at the present day.

Diamonds as a whole when mined, consist of stones of all shapes, sizes and colors. They are minutely sorted, and those suitable for gems are taken out, and after being cut and polished by expert workmen, they appear in the market in the form popularly known as "Diamonds." The balance of the sorting which has been rejected for gem purposes either because of unsuitable grain, color or other defect, are called Bort, sometimes Bortz, and it is this class of diamond we are more particularly concerned with in this article.

The Industrial Diamond

This Bort, or industrial diamond is in turn again closely sorted and graded according to its particular mine, color, shape, grain, hardness and general condition of solidity. In these grades they are put on the market for industrial purposes, all in their various sizes, and with regard to their suitability for particular work. The last grade, consisting of stones badly cracked up, small pieces, etc., are called Crushing Bort. This is crushed up in pestle and mortar to various grades of powder, and is used for cutting and polishing gems, or the various shaped diamond tools.

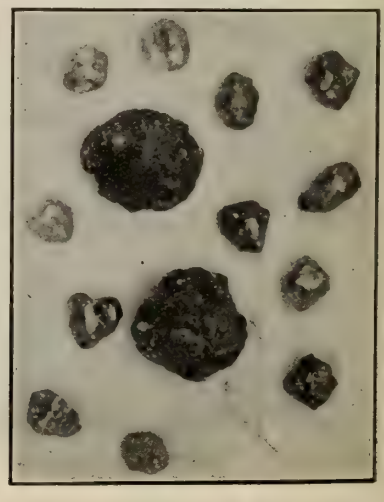
During all the above sorting and classifying, a tremendous amount of experience and knowledge is being used; knowledge gained only by years of continual activity in handling stones, together with close attention to every detail, variation or phenomenon. It follows that consumer should be quite sure he is dealing with a reliable importer when he is buying his diamonds or tools. As can be seen from the above descriptions, diamonds vary infinitely, and it cannot be expected of anyone who has not made a life study of them, to be able to accurately judge from a parcel of stones, their exact values and their suitability under given circumstances. It is therefore advisable to deal only with those who have the knowledge, and in whom every confidence can be placed, to supply proper and suitable diamonds for the work, at fair prices.

Except in extreme cases of business expediency, when dealing with an experienced firm, the price is a sure indication of the value offered, be it high or low, for there is a standard starting price on all industrial stones. This may not hold good when dealing with the casual dealer who has not the experience necessary to appraise and determine the actual value or condition of such a variable commodity.

Practical Utilization

We now turn our attention to the actual use of diamonds for industrial purposes, and a few hints from practical experience will be in order. There is no question but that the diamond is very much harder than any of the materials it could be called upon to cut, and although diamonds themselves vary in hardness, this variation is negligible in comparison with the great difference in hardness between the softest diamond and say, carbide of silicon or corundum. At the same time, the existing difference in the hardness of various classes of diamonds is a point which must be taken care of, and it is in this regard that the experience of a practical diamond man is valuable, so that the most economical sort of stone will be used for the work in hand.

Grinding wheel dressers.—The diam-



Industrial diamonds in the rough.

grain of the grinding wheel, and the following table will give some idea of the size of diamond required in most cases:

Dia. of Wheel inches	Size of Diamond Carats
6 and under	½
8	¾
12	1
16	1¼
20	1½
24	2
30	2½
36	3
42	3½ to 4

As regards the thickness and grain of the wheel, this is covered by the quality of the diamond chosen, its shape and general condition. Too large a diamond is not necessary, but it must be large enough to allow of secure setting. Nor is it imperative to choose a perfect stone in all cases, when an ordinary stone will do, for the more perfect the stone, the higher the price must be. It is a good plan to acquaint your dealer with the class of work you are handling, and the size and grain of the wheels you use, leaving it to him to make you a tool complete, trying one or two tools of various prices, and with the shop records, determine the most efficient tool for your purposes in connection with price. All reliable tool makers keep records of the diamonds they supply, and can within limits, keep your tools to that standard, with probably slight variation in price as affected by the diamond market.

Suitable Mounting

The diamond should be mounted in an approved setting, with cuttting edge exposed. Great care must be taken, and if an experienced man is not on hand, it is far better to have the work done by those who employ experts for this work. Many a good diamond is ruined because of incorrect setting.

The "cast" mount is the best, because it grips the diamond properly, but the metal used, must have a low melting temperature. Molten steel is sometimes used, but this is too severe, and is extremely liable to injure the temper of the stone, and make it brittle. This injury is exaggerated each time the stone is re-set, and consequently its service is shortened considerably. This difficulty has been overcome, and special alloys of sufficient hardness, and with low fusion points are used by the more particular and progressive diamond tool makers.

The copper setting is used successfully for very small stones, but is dangerous for larger sizes, and not uniformly good. The diamond holder must be of a size and shape to suit the grinding machine equipment, and it must be held firmly and without chatter in such a position, that the diamond will be fairly well on the centre of wheel, and working in a straight line across its face. A round holder is better than a square one.

Take very light cuts, and keep the diamond cool by allowing a plentiful stream of water. Only the diamond must be in contact with the wheel, and not the holder, otherwise the metal will be ground away and weaken the setting, which is dangerous. Heavy cuts should not be taken, for there is a risk of breaking the diamond not only by making it take too heavy a load, but by overheating it and causing unequal expansion with its setting. The finest diamond can easily be cracked or crushed by sudden shock, a sharp blow, or excessive pressure.

Method of Using

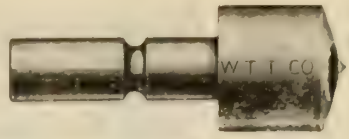
When using a diamond set in a hand tool, the tool must be firmly held against some part of the machine. It is nearly impossible to dress a wheel absolutely true with a hand tool, and it is necessary therefore, to use a fixed dresser in order to obtain a perfect cutting wheel and accurate work. Use the hand dresser only on very ordinary work. When the cutting edge is worn, the diamond should be re-set, so that a new cutting edge can be exposed. This will prolong the service, for after the cutting edges have gone past a certain point, the diamond wears away very rapidly. Another point to consider is, that a blunt diamond will overheat very quickly, it will also burnish the face of the wheel and cause glazing. This means the use of more power in return for indifferent work, and a drop in production. A lot of trouble has been caused in this way, and all sorts of others things have been blamed for it. A blunt diamond is almost useless.

In the case of re-setting, care must be used in taking the diamond out of its setting, and here again, unless there is a man on hand who understands the work thoroughly, it is safer and cheaper to send the tool to a maker, who is equipped to do the work correctly and without accident. If the above suggestions are followed, the maximum value can be obtained from each diamond, and expense kept down to the lowest possible point.

Diamond turning tools are rapidly coming into favor, although "first cost" has acted prejudicially against them. This is quite natural, but enquiry and experience will show that it is a mistaken idea. There are many operations being performed with difficulty and expense, and steel tools, which could be more accurately done by the proper diamond tool, with an infinite saving of labor and time. A Bortz diamond can be cut along with its cleavage planes and a very sharp edge is obtained which can be shaped into either a square or round nosed tool.



Diamond pointed turning tool.



Diamond pointed tool holder.

Sustained Accuracy

Black diamonds, or carbons, lend themselves readily for use in special tools, because they are of non-crystalline form. They will not give as keen a cutting edge as the Bortz will, but they are tougher and will not chip as easily. A diamond tool when once "set-up" in the machine will continue to size its work very accurately for long periods (in cases, of months duration) and this, upon hard and gritty materials which will, in a matter of minutes wear the keen edge from the finest high speed steel tool. This of course, effects a great saving of time resharpening the tool and setting it up in the machine again. In short, they effect a vast economy when properly handled in such materials as fibre, hard rubber, ivory, brass, bronze, copper, aluminum, celluloid, mica, paper, and cotton rolls, etc.

The writer's firm have gone so far as to make tools for taking light cuts in Stellite and various other operations in steel quite successfully, and with reduced costs. When the natural fear of using such a thing as a diamond is overcome, together with the sceptical attitude as regards costs, the diamond tool will take its well deserved place amongst standard equipment.

The same care must be taken with this class of tool as is taken with the diamond dresser, both as regards taking light cuts, and having the tool firmly and properly secured in the machine. After the tool has been at work until the cutting edge becomes dull, it simply is a matter of returning it to the maker to be re-sharpened or re-ground, and the cost is trifling when it is considered how much work the repaired tool will perform. A properly made diamond tool can be sharpened many times, and the original tool will last many months, probably a year or two, according to the kind of work it is given to do.

Various Applications

There are many other tools made with diamond points, such as optical drills, cutters, glaziers' tools, engine turning tools, chasers, etc. There is also the diamond wire drawing die which consists of a diamond set in a casing, and which has a shaped hole drilled through its centre of the size of wire required. These tools are of course, specialties, and instruction is generally obtainable from the makers suitable to their own special designs.

Another branch of diamond tools is the stone saw tooth. Circular saws as large as 98 inches in diameter are fitted with these tools. They saw through blocks of stone 3ft. 6in. thick with ease, leav-

(Continued on Page 27)

Great Accuracy Developed in Gear Tooth Form

Inserted Tooth Almost Obsolete—Gears With Cast Teeth Used Only for Heavy Rough Work—Small Gears Often Made by Die Casting Process—Cut Gears Most Efficient

By CHESTER B. HAMILTON, Jr., B.A.Sc., M.E.

IN THIS aticle the author continues to deal with the classification of gears and their respective applications. The next type to be given consideration will be the mortice gear. This class of gear is almost obsolete, though some are still used. It must be considered, however, for two reasons; first, as a link with the past and, second, as one of the first successful attempts to make heavy power gears that would be reasonably silent at high speed and correspondingly free from vibration and its attendant ill effects.

The mortice gear, with its inserted wooden teeth, held in place by driven keys, is a lineal descendant of the pin cog wheel and lantern pinion of medieval times. The teeth of the mortice wheel are usually of some such material as hard maple boiled in oil, the wheel itself being cast iron with cored mortices. The tooth thickness is about sixty five per cent. of the circular pitch. The pinion which mates with the mortice wheel would usually be cast iron with cast teeth, dressed by chipping and filing to a better finish than required where two cast iron gears mate. The thickness at the pitch line of the iron tooth would be thirty-five per cent of the pitch. The form of the tooth curve was nearly always epicycloidal, for at the time the use of mortice wheels was at its height the involute tooth curve had not been developed. Both spur and bevel gears were common. The type does not appear to have been adaptable to helical, and not very much to worm-gears.

Machine Made Teeth

The teeth, formerly made by hand, were later made in various ingenious fixtures applied to the narrow-bladed or pattern makers' hand saw, or they were finished on a revolving sand paper roll with the aid of a pair of tooth-form templet, one attached temporarily to each end of the work and taking bearing against a smooth portion of the roll beyond the sand paper. The latter method was particularly favored for making a nice job on the teeth of bevel gears, as one templet could be made much larger than the other, and their size and distance apart calculated to give the correct taper to the teeth. Later on, William Gleason adapted the gear planer to finish inserted wood teeth in place in the gear, with precision as to form and pitch, as well as angle in the case of bevels, by mounting a small circular saw in place of the planer tool on the reciprocating head of the machine. The saw revolves in a horizontal plane and its farthest out point describes the tooth, under control of a templet. These gears when run with an iron mate with cut teeth, planed on a similar machine, give really excellent service.

At the present day almost the only mortice gears to be found are the bevels in small water turbine installations, which transmit the power from the vertical turbine shaft to the horizontal main line shaft into the mill. For this work, they appear to be fairly satisfactory.

Gears With Cast Teeth

For many years the great majority of gears were made with cast teeth, and for some purposes this class of gear is still used. It is due, however, to the deficiencies of the cast tooth that the gears lagged many years behind other mechanical work in relative progress. Only since accurate cut teeth have been available has the machine designer been able to use the gears freely in his constructions without feeling that they were the weak link in the system. This applies not only to the actual servicibility of this part of the apparatus, but also its saleability. Many a machine has been judged according to the number of gears it contained.

Cast gears are still used with some success on very heavy slow moving work with large coarse teeth. There are two reasons for this. One is economic. These heavy slow-moving jobs are usually for intermittent use and like any other article that is only used occasionally, the tendency is to hold the first cost as low as possible, in order to keep the operating overhead per unit of use as low as possible. The other reason is mechanical. The time element from tooth to tooth is at a maximum with coarse pitches and with slow revolution, and the apparatus has time to adjust itself to inequalities of angular velocity which, in faster running machinery would combine with the inertia to produce enormous stresses.

Die Cast Gears

The name cast tooth gear would appear to cover all gears in which the teeth are formed in a fluid state by being run into a mould and allowed to solidify. The name as commonly used however, does not cover the special class known as die cast gears. In this the fluid metal is forced under pressure, considerably greater than ordinarily supplied by gravity, into an accurately machined die or mould, which it thus fills to the last minute corner. Pressure is maintained during solidification. The metal is usually an alloy of relatively low melting point which can be cast with a negligible scale. As the casting may be forced out of the die mechanically when solid, the draft required is also negligible in most cases. Die casting can be made to produce a very high-class job, strength and durability of metal being the only disadvantages.

In general, cast gears are made in sand moulds from either gray iron or steel. Malleable iron is not a suitable material for gears either cut or cast. It is the reverse of a high class case-hardened, heat-treated gear, for it is soft on the surface where it should be hard, and rigid in the core where it should be tough. Air furnace iron is not much used, as any one wishing for refinements would naturally either use steel or have the gears cut. The great majority of cast gears are made of cupola gray iron of a rather strong mixture of low shrinkage co-efficient, low sulphur and phosphorus. For cut gears the shrinkage is not such a vital matter, and the silicon must be kept up for the sake of machinability. Semi-steel is used to a considerable extent, either made by charging steel scrap in the cupola, or adding turnings in the bull ladle. The latter is a doubtful expedient with cast tooth gears, as it may reduce the fluidity so much as to prevent a good filling of every corner of every tooth, and a gear like a chain is no better than its weakest member. Outside of the agricultural implement and such trades, steel is really the only first class material for cast gears. For small gears the converter steel has some advantages over open hearth on account of its fluidity. From the point of view of cleanness the case is reversed. The electric furnace by its fine temperature control permits the heat to be as high as needed for the class of work and no higher. It also has the advantage of a deader melt with less boiling than either of the others, and consequently tends to produce the soundest castings.

Cast Gear Molds

The moulds in which gears are cast may be either dry sand or green sand, though the latter is by far the most common. Shrouded pinions are frequently cast with the teeth in a dry sand ring which is set in the middle of the two-part box, while the top and bottom shrouds and hubs, if any, are in green sand in the cope and drag respectively. This saves the use of a three-part box, which is always a nuisance. Worm wheels, on account of their concave face may be treated similarly. Segmental cores for large work are not a success,

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for it is practically impossible to hold to pitch at the points, and the resulting gear has an assortment of thick or thin teeth at regular intervals. A segment pattern is the better way if the expense of a full pattern must be avoided, and a really skilful moulder can produce a creditable job with a surprisingly short segment by sweeping and laying off on the bottom of the mould. This refers of course to very large work only. It is worthy of note here that there is no draft on work moulded from short segments as the pattern is withdrawn radially inwards, and the space within the rim built up afterwards, perhaps with dry sand cores.

Moulding Machine Practice

Moulding machines of practically every type can be used in the production of cast gears. A favorite for small and medium-sized work is the stripper plate machine, because it eliminates draft. In the Pittsburgh district there is in use a special type of moulding machine for very heavy work such as roll pinions. In appearance these machines, which are made in various sizes, resemble boring mills but of much lighter construction. The table may be revolved for sweeping, or indexed tooth by tooth as the job progresses. What corresponds to the boring bar, carries the pattern segment which generally consists of only two teeth, and may be only one. By traversing the pattern holder toward the center the pattern is withdrawn in a radial direction, which permits shrouded pinions or double helical gears to be moulded. The moulding of bevel gears is of course a comparatively simple matter, provided the tooth flanks are not under cut, as the whole job is essentially conical. The under cutting is prevented by laying out the pattern with a high pressure angle. This point can be considered better further on in connection with cut gears.

The shortcomings of cast tooth gears are fairly obvious, but it may be well to state them. They are noisy, because the surface is rough and the pitch usually far from uniform. The noise is only a demonstration of vibrations which tend to wreck the whole machine. They absorb power because of the friction of the rough surfaces and the varying angular velocity of the mass. They are weaker than the corresponding cut gear because the load is concentrated on the high spots of the rough and often badly shaped tooth face. These high spots are quite as likely to be at a corner as anywhere else, giving maximum stress. When worn to a reasonably smooth surface they suffer from excessive back lash.

Cut Gears

This subject will be more fully developed in another section, and will here be touched only briefly. It had long been customary to dress the teeth of cast metal gears with chisel and file. The desire to eliminate the cost of this tedious and unsatisfactory operation, as well as the call for better gears for higher speeds, led to the development of cut gears. It was natural for the skilled workman, worrying over some particularly bad sample from the foundry, which must be dressed to templet, to speculate on means for "finishing the whole tooth at one pass of the tool," or "making a machine to use the template, instead of hand and eye." With the development of machine tools this gradually came to pass. There were three lines of development. The first was the planing method, using a tool of the full size of the space between two teeth which was fed radially into the gear while it traveled in a direction parallel to the axis. It is natural that this should have been first for, next to the lathe and drill, the planer was one of the earliest machine tools, and was consequently in wider use and better developed than other types. This method of gear cutting was not satisfactory for several reasons, and attempts to overcome these difficulties gave rise to the second and third lines of development.

Such a depth of cut and mass of metal had to be removed in coarse pitches so that the ordinary planer was a slow producer. Two methods were developed. One was to replace the planer by the milling machine, which is especially adapted to deep cuts in solid metal with formed tools. The other was to not cast the rim solid, but toothed and thicken the teeth enough for a good planer cut on the sides. Then the formed tool was replaced by a single point planer tool which was controlled by a templet device so that as it fed down the side of the tooth, its point traversed the desired tooth curve. A templet and a tool on the other hand would finish the opposite side of the tooth. This idea, developed in special machines of the slotter and shaper types, is the modern way of cutting coarse pitch gears. The milling machine method, above referred to, worked well, but two objections arose. On large gears the cost of the formed cutter was great, and a careless operator could destroy it in a few minutes, whereas with the Templet machine the tools are cheap and the Templet is beyond injury. Also, no one would think of keeping spare templets, while a stock of spare cutters is a practical necessity.

Milling Gear Teeth

As milling practice developed, however, the speed, accuracy and convenience of this method of producing gears of small and medium pitches overcame its disadvantages for all but large work. Better and cheaper cutters became available from the larger manufacturers, Brown & Sharpe in particular being pioneers, and special machines, and, later, automatics were brought out containing many refinements. Up to recent years the form milling process has been the standard method of production of spur gears. Of late the generating process has tended to supersede milling, especially where the generating tool is of a type that can be ground all over after hardening. As to bevel gears, the milling process was never theoretically correct, really no more than a makeshift, and their development was altogether along the templet shaper line, and later the generating bevel gear shaper. In the case of worm gears also the form milling process was not correct, and in this case a generating process, namely, hobbing, was used from the first.

Rolling Process

The forming of the teeth of a gear by rolling the blank with a die by some such process as is used for rolling the threads on bolts, is a very attractive process in theory, but attended by many serious practical difficulties. It is being worked to a very limited extent in the United States by the patentee of certain specialized machines which he has devised. The process is started at a forging temperature. The blank is fixed by a quick-clamping device, onto the overhanging end of a powerful arbor. The die, which has the form of a gear, is on an adjacent arbor, located a little way back from the position which it will occupy when fully in mesh with the finished gear, and removed from that position in a direction perpendicular to the teeth. The die and the hot blank, through their arbors are connected by a train of gears giving them the relative number of revolutions dictated by the number of teeth in the die and the number to be formed in the work. Thus tool and work have the same pitch line velocity. With the work at a forging heat, and die and work both revolving at high speed, the die is forced into the work and the teeth are formed by the moulding generating process as the hot and plastic metal rolls in mesh with the rigid teeth of the die. The rolling is continued till far below all critical points of the steel, and on account of this low finishing temperature the quality of the metal is particularly good.

For spur gears the shafts are parallel and the die is a spur gear or pinion with accurately generated involute tooth curves. For bevel gears the die is a flat crown gear of 90 degrees pitch angle. Any form of gear which has both shafts in the same plane could be generated by this process. That is to say, any form where the tooth action was practically pure rolling, and the sliding was negligible. Herringbone or other special tooth profile can be generated in both the spur and bevel. While this process has been under development for quite a number of years, its commercial progress has been slight; the only product on the market being one size of bevel for rear axles of a cheap motor car.

To be Continued

Any oil that contains animal fat, while a desirable lubricant for a great many metals, is a bad element on any machine. Animal fat contains more or less acid, and unless the acid is eliminated, or neutralized, it will rust and gum up the machine.

Safety Features in the Operation of Lathes

Tools Should Always be Firmly Secured—Keep Bolts, Clamps and Gibs Tight—Provide Guards for Flying Chips—Protection and Production Go Together

By H. ALTON

IN THE OPERATION of a lathe many accidents occur as a result of the displacement or breakage of the tools, or of the piece that is being machined. When a tool is insecurely or improperly set, it often works loose and causes trouble in many ways. Frequently it digs into the work, and unless the lathe is stopped immediately, the tool may be broken or forced out of the tool post. If this does not occur, the work may be torn out of the chuck or the centres, or all of these things may happen at once. In such an event the operator of the lathe is very likely to be injured, especially if the machine is a large one and the work is heavy. A "safety first" measure is to select a tool that is suited to the work in hand, make sure that it is in good condition, and be certain that the setting is right, and that it is held rigidly. In operating lathes that are more or less worn, it should be remembered that when a lathe spindle is loose in its bearings, and the carriage slack on the ways, a good deal of vibration and chatter is set up that are contributory causes to work shifting, bolts or clamps loosening, all of which are factors that frequently cause an accident.

Eye Protection

When metal such as brass is being machined, the eyes of the operator are endangered by flying chips of metal. It is a wise precaution to use goggles when working under these conditions, and foremen should see that they are worn when the occasion demands it. Guards of stout wire-mesh, framed and secured to the tool posts, so that they will intercept flying chips, have been used extensively. A guard of this kind is shown in Fig. 1. Better protection is afforded by the use of heavy plate glass as illustrated in Fig. 2. Care should be taken, however, to keep it clean, so that the work can be seen distinctly at all times. In constructing a guard of this kind, it should be made in a manner that permits of easy adjustments and removal. To prevent glass chips from flying in case the guard is broken, the glass should consist of two thicknesses, cemented together with a thin film of transparent celluloid.

Chips that lodge in the eye cause severe pain, and the injuries they inflict are often followed with serious results. Unskilled treatment of such injuries adds greatly to the danger of complications. Therefore it is the best course to consult a physician at the earliest possible moment.

Filing in the Lathe

Filing, if not done intelligently, is a hazardous operation. Every machinist knows that he is taking chances when he uses a file without a handle, yet this is done every day. The man in charge of the shop should see that such a practice is discontinued. The position in which the file is held is also of great importance, because even with the handle in place the file may be pushed back against the operator's abdomen with great violence. A file should be held in such a way that, in case it is forced back, the handle will be pushed to the side of the body instead of directly against it. Filing irregularly shaped pieces with projecting portions, must be carefully done, and the operator should keep his attention concentrated on the work. Rolling up the sleeves is important, as loose sleeves will catch on all projections from the work or from the face-plate or chuck. When it is necessary to lean over to inspect revolving work of an eccentric or unsymmetrical nature, an operator should always keep in mind that there is danger of being struck by some portion of it.

Set Screws and Other Projections

Many old lathe dogs with projecting set screws were, and still are, the source of accidents. Such designs are being replaced in a large measure by dogs in which safety or guarded set-screws are used, or by types that have no projecting parts. In as far as it is practicable, all face-plates and chucks should present smooth even surfaces with no set screws or other projections upon them. When adjusting a chuck, be sure to remove the wrench before starting the lathe.

Using Bar Stock on Hollow Spindle Machines

Pins, bolts, studs, screws and such products are often machined from long bars, which at the beginning of operations project several feet beyond the head stock of the lathe. These bars frequently revolve at a high rate of speed, and constitute a source of danger even greater than that of unguarded shafting. In small bars they will whip about considerably and if unguarded would be a very prolific source of accidents. A simple and inexpensive guard is provided by placing a tube over the revolving end of the bar and support the tube as shown in Fig. 3. If it is not possible to place a guard over the rod then the space should be railed off temporarily.

Belts and Pulleys

Careful attention must be given driving belts, pulleys and shafting used to drive lathes. A large proportion of lathes are provided with cone pulleys for speed changes, and the belts have to be frequently changed from one step of the pulley to another. Mechanical belt shifters may be utilized to advantage to minimize hazard.

Lathe operators usually grasp the belt while the power is off, to turn the work to a desired position for making certain settings or adjustments. For this reason it is advisable that endless belts with cemented joints be used, but it is very troublesome and expensive to take up slack that is bound to develop in such a drive belt. A belt that is laced with a leather lace presents the least danger to the hands of the lathe operator. Metal belt fasteners, wire clips, or wire lacings are the source of many nasty cuts and tears of the hands of the operators. The handle of the belt shifter which operates the belt from the line shaft to the countershaft, should be located in a position where it is conveniently and quickly accessible, in order that there may be no delay in stopping the machine in a case of emergency.

In many shops the individual motor drive has been applied to lathes, and in some of these instances the motors are geared directly to the machines, while in others the power is transmittted by silent chains and sprockets or by short belt drives. From a standpoint of safety this application of power is often desirable.

Adequate protection and effective guards should be provided for all gears,

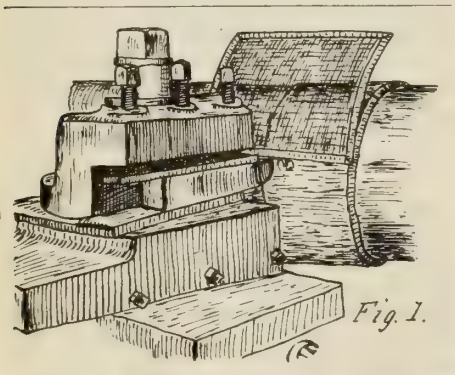


Fig. 1.—Wire-mesh Eye-protector Guard

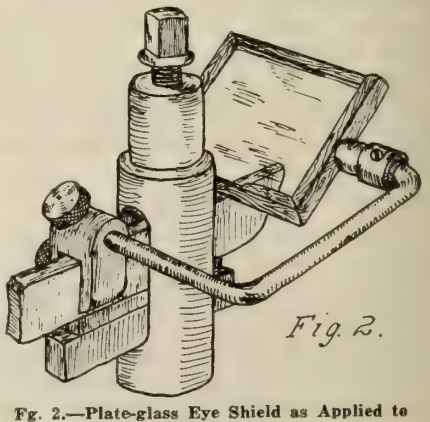


Fig. 2.—Plate-glass Eye Shield as Applied to Tool-post.

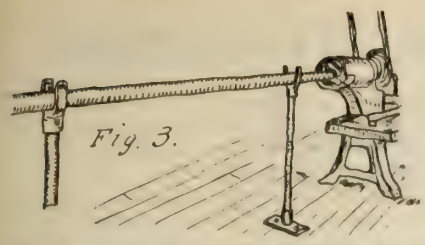


Fig. 3.—Pipe Guard for Confining Long Rods Projecting Beyond the Head Stock.

and it should be seen that these guards are kept in position while the lathes are running. If it is necessary to remove them for any reason, they should be replaced before starting the machines. There is present a very positive element of danger when an operator attempts to clean, oil, repair, or adjust machines while they are in motion. Shop rules should prohibit these practices. Sometimes a mechanic is seen leaning over the headstock of a lathe in an attempt to change the back gears before the machine has come to a stop. Some part of his clothing may be caught and drawn into the machine, which would cause serious injuries. Such practices are also very likely to do some damage to the lathe itself, quite apart from the risk taken by the operator.

Miscellaneous Suggestions

When attempting to remove filings and chips from a lathe it is always a good precaution to use a brush, because many severe cuts have been received when doing this work with the bare hands. It is not a good or safe practice to change clothes while standing near moving belts or machinery of any kind. Torn or ragged clothes, and unbuttoned or loose smocks or overalls all invite trouble. Machinists should not wear rings while working on a lathe. It is not only bad form but dangerous practice to leave tools lying about on the machines, especially in elevated places from where they may be jarred or pushed off. It is infiinitely better to place them in a tool box or rack provided for the purpose.

Many other causes of accidents could be mentioned, but the ones touched upon are responsible for the largest share of accidents. If the points refered to are noted and precautions taken to avoid the dangers pointed out, there is no doubt but that the safety and the efficiency of any shop will be greatly improved.

THE INDUSTRIAL DIAMOND

(Continued from page 23)

ing a smooth finished face, and are great labor savers.

A specified number of these diamond tee h are inserted in vee slots round the rim of the blade, and held securely by means of rivetted dowels. There are several designs of teeth, and some are made containing one, others containing two diamonds in each tooth. Others again, are filled along the cutting edge with small diamond splints, and are known as "splint teeth."

The setting of diamond teeth is somewhat technical, and is always done by firms specially equipped for this class of work. By one method, a deep hole is drilled in a piece of bar steel. A diamond is dropped into this hole, which is then closed up in an electric welding vise. This method has a disadvantage, inasmuch as the welded piece of steel has to be ground down until contact is made with the diamond, and there is grave risk of injury to the stone. There is also danger of overheating, and consequently spoiling the temper of the diamond. The diamond is not set on cutting edges by this method, which is not correct.

There has been improvement here also, and the "cast" process has been perfected in the making of diamond teeth. The alloy used is extremely hard, and has a low fusing point. This method also allows the diamond to be placed exactly, and with cutting edges exposed, and it is universally accepted as the correct and most efficient mounting. With regard to the running of these saws, care must be taken to see that the blade is hammered correctly to suit the 12,000 feet per min. periphery speed, so that it will run in a true vertical plane, free from gyroscopic action. There must be side motion of the spindle, and the more abundant supply of water there is directed into the cut, the better the teeth will cut.

Shocks and sudden blows on or near the rim of the blade must be avoided, and the feed speed not more than the diammonds will comfortably cut without forcing. This varies according to the kind of stone being negotiated. It is not commercially possible to cut granite with these saws. There are many other points in connection with this interesting work, which must be taken care of, but the above gives a general idea of the methods, and what is required.

There may be found in the future, other uses for the industrial diamond, for in these days of business courage and progress, anything towards economy in manufacturing will most assuredly be taken up. It is with this idea of economy that this article is written, and the handling of diamond tools is something every tool maker and machinist should know, in order that this costly commodity may be used to advantage, and be given the right to prove the value there is in it industrially, as well as it has hitherto done to establish itself as a thing of beauty for personal adornment.

INTERESTING NEW LAMP

A demonstration was given recently in England, by A. J. Elverson the inventor, of a newly designed lamp which makes machinery running at the highest possible speed appear to be running quite slowly, so that every movement it makes can be easily seen. The light is not continuous but flashes are emitted with a duration of about 1,000,000th of a second, so that the effect on the eye is a series of photographic impressions. The lamp is operated by a system of gearing.

OBITUARY

John H. Patterson, founder and chairman of the board of directors of the National Cash Register Co., Dayton, Ohio, died suddenly a few days ago while on a train bound for Atlantic City. Mr. Patterson has been failing in health lately, and the trip was being taken in the hopes of his recovery. Mr. Patterson will be missed not only in his own locality, but elsewhere as he was an earnest social worker, and has done much to increase the comfort and improve the working conditions for his employees.

CANADA'S WATER POWER

Canada comes second among the nations of the world in water development. The United States leads with developed horse power of 9,243,000 while in Canada electrical installations provide 2,470,580 h. p. annually. In Europe, France leads with 1,400,000 horsepower and other leading nations are: Norway, 1,350,000 h. p.; Sweden, 1,200,00 h. p.; Switzerland,; 1,070,000 h. p. Japan and India are the only two nations with more than 1,000,000 h. p. developed water power. Australia has practically none and New Zealand but 45,000 h. p. Norway has per capita water power development of 0.54 horse power and Canada comes second among the nations of the world with 0.26 h. p. In the United States the figure is 0.07 h. p.

BLOW TORCH OPERATES UNDER 10 FT. OF WATER

Interesting experiments have been carried out in connection with the operation of the oxy-acetylene torch under water. One of these was made recently in England, the diver working inside a huge circular tank filled with water. The tank is fitted with several plate-glass windows, which allow close examination of what is going on inside, the tank itself being internally illuminated. Equipped with a diving suit, complete with telephone apparatus, the diver could be heard acknowledging instructions that the oxy-acetylene apparatus was about to be lowered to him. From above several attendants worked the diving apparatus and the above-water end of the telephone, while a mechanic lit the oxy-acetylene flame from an ordinary candle. This submersible flame burned with an increasing roar as more power was turned on, the roar abruptly ceasing as the apparatus dipped below the surface to the waiting diver, who proceeded to demonstrate the possibilities of this new process, neatly applying the flame to a sheet of steel which reposed on two iron trestles. From the observation windows the illusion that the diver was doing salvage work on a sunken ship was heightened by his apparently awkward movements in the green cloudy water. The impression was left that this new invention will have a great future in salvage work on vessels sunk during the war which cannot be raised intact owing to present prohibitive costs.

Careful Tool Set-Up Assures Better Production

Automatic Machines Should be Kept in Good Condition—Operator Must See That All Settings Are Properly Made Before Starting Machine—Effective Feeding Reduces Unproductive Time

By DONALD A. HAMPSON

NEATNESS about a machine counts for a great deal in appearance, discipline and production. Floors about automatics need not be slippery with oil. Neither do they have to be covered with saw dust like a butcher shop. Proper splash plates, proper piping, and trained men can keep an automatic floor almost as dry as that in any other department. Oil on a wooden floor increases the fire risk. Oil will make a concrete floor crumble like clay in a few years' time.

An oil separator ought to be part of the smallest screw machine department. A machine of only moderate size will use a barrel of oil in two months, at least half of which can be recovered in a chip separator at no cost other than for power. An attendant has to remove the chips in any case—and it costs no more to remove them to a separator than to a dump.

In line with savings comes that of operators' time. Where there are machines enough to keep him busy, he should not remove chips and parts. That should be laborers' work. And the best time to remove it is out of running hours A night man can remove the afternoon's work and employees working during the noon hour can take away what has accumulated during the morning. It is even better to have the afternoon's product removed early the next morning, after it has had time to thoroughly drain. When kept busy, the operator should do no more than haul away work and chips that obstruct tool movements.

High spindle speeds are necesary for low production costs but high speeds mean throwing of oil. On Acmes, the writer has found it best to augment the front and back splash plates by a top plate resting on the other two. This is a floor protection and it assists the operator and set up men. No matter how nicely tools are set when feeding by hand, they always cut differently when power feed is applied and settings have to be made ultimately to conform with this. Threading to a shoulder in the third position is hard to see without getting splashed with oil but the top plate protects the workman from this, enabling him to observe action close to a shoulder near the spindle.

Removing Chucks

Chuck nose pieces are invariably drilled for a spanner, as are numerous other nuts on automatics. Now if there is one abortion in tools, the spanner is it. It is unmechanical, it is inefficient, it is an all around nuisance. Millions of holes and notches cry loudly of abuse, evidence that the spanner would not do what it was intended to do. Spanner slips, knuckles skinned, workman swears, hammer and chisel applied, hole ruined. That is the story of the spanner nut every time.

We found that a great deal of time was lost on our automatics from this "tool." Two conscientious men would work an hour getting off the nose pieces from a four spindle machine that hadn't been changed for a year; they would try in vain to block the spindles or hold the belt while one man would hold some miserable patented spanner in place for the other to strike with a hammer. (Punches and chisels were forbidden on the machines). Finally we gathered all the spanners together, wrapped them up, and gave them to the sweeper with instructions to carry the package down the street to the bridge and drop it in the river.

Then we made the simple tool illustrated by Fig. 4. The teat fits the hole and the long end comes out where a man can strike it conveniently with a hammer. We have no more spanner trouble, we have no holes bruised up, we now do in three minutes what used to take two hours to do. Away with the spanner! A plain pin or turning with the fingers will move any spanner nut after it is started off and will bring it up to its shoulder, going on. One light tap on our tool, either way, does all the hard work.

Something About Tools

The tools supplied by manufacturers are so well designed and of such a wide assortment that it does not pay to make them in the shop. Stock tools will do everything but special operations or work beyond the capacity of a machine. There are some tools, like box mills. that are not made with a set screw back of the cutter to take the thrust. On a heavy cut, this metal-to-metal contact does not hold well; a simple way to increase the friction is to place a narrow strip of emery cloth between the cutter and the hardened body of the mill.

Under heavy cuts, the set screws or binder screws used in various tools or in the turrets do not hold—and the tools slip with attendant troubles and stoppage. Stock wrenches are supplied for these positions but they are designed and seletced for the strong man—when a person of slighter build works on the machine, it is advisable (and permissible) to permit them to use wrenches of a larger size in order to keep their machines going to capacity.

Reference to Fig. 5 will show how a die head may be secured from changing position when pulling hard, and secured without straining any parts. A split block is bored to fit the stem and tap bolts put in. One half has projecting lugs that reach over the cylinder. It is a slip-proof arrangement and very cheaply made. The coarsest thread may be cut without the die moving the least bit.

When the number of tool positions is limited and the number of cuts many, auxiliary tools must be arranged. A tool for pointing the ends of blanks is shown by Fig. 6. It is placed within the body of an ordinary box mill. Three pieces of drawn steel, some screws, and a cutter make up this tool. The larger piece fits in the mill opening and is clamped at the ends—also adjustable for length in this manner. The cutter is a tangential tool and is well backed up. Facing tools could be created from the same design.

There is one drawback to wire feeding in a screw machine. Where the bar is large and the feed long, the inertia

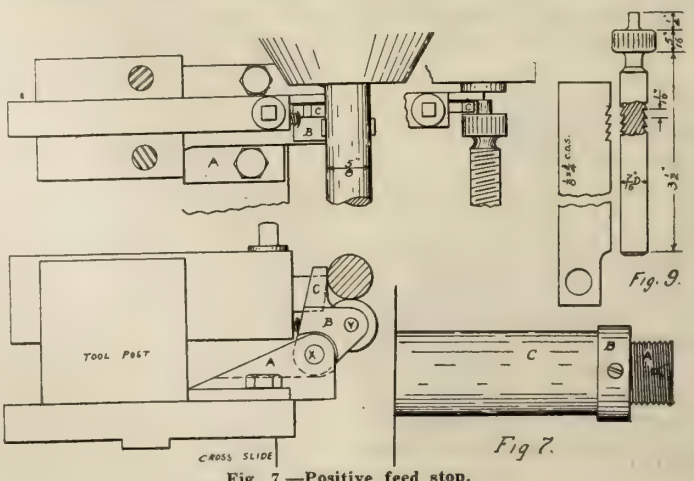


Fig. 7.—Positive feed stop.
Fig. 9.—Buttress screw details.

The first part of this article appeared in May 4 issue.

acquired during the forward movement is considerable and the bar, instead of being innocently fed up, becomes a battering ram. A stop held by friction only cannot resist this force. Fig. 7 is a positive feed stop. The regular stop is the part A, which here has been threaded and fitted with B a round nut (hand fitted by the way), and supplied with pieces of pipe C in lengths to suit the job. The use of such a top eliminates one more of the sources of trouble common to automatics.

Difficult Screw Product

Figs. 8 and 9 show how a rather difficult piece is being turned out on a 7-8 in. Cleveland. The work, a buttress treaded screw is shown by Fig. 9, reference to which will show that there is considerable work on the piece. In view of the fact that the machine doing this work is a Model C—a type with but three positions in the tool cylinder—the production of these screws is 5 in. over all, the shortest is 1½ in. over all, the difference being in the length of threaded body. Th longest screws are made at the rate of 16 per hour.

Buttress threads are about as difficult to produce as any shape and when the diameter of the piece is small as compared to the lead, there is present the same trouble found in cutting square threads, i. e., that of a heavy cut which nearly twists the piece from the bar. The buttress thread has also an inherent source of trouble in not being a symmetrical thread, as are other familiar threads; there is a constant tendency for the sloping side to crawl back, leaving the load side at other than right angles to the axis. In the service for which these screws are used, a variation of one-quarter thread in a length of two-inches condemns the piece.

At the plant where these screws are used, they used to buy them of big specialists. Then, it was a common sight to see a keg full being headed up for the return trip—condemned because of roughness or faulty lead. The shop people did not underrate the difficulties a bit but when this Cleveland automatic became available after a long run on war work they decided to make them at home and have the difficulties under their own roof instead of a thousand miles away. And during the first few weeks, the difficulties appeared in profusion.

Knurling Device

Some idea of the set-up may be gained from the photo. All went well during the first year, when a knurl was decided upon for the head. Some sort of knurling device had to be provided that would work on all lengths of screw, which was something of a problem as there was no extra tool position, no chance for a center tool between the three, no room to index the tools if a knurler was added ahead of the box mill.

Fig. 8 shows the arrangement adopted for knurling. It is applied to the front, or cut off, tool slide and works in connection with the cross slide tools. A is the body casting, B a tool steel piece pivoted at X and holding a knurling wheel on the pin Y while there is an arm C extending upward on the side toward the cut-off holder. It is evident that a forward movement of the tool slide will bring the arm portion in contact with the bar stock and further movement cause it to swing about X and imbed the knurling wheel in the bar, but not at the same spot as touched by the arm, for which see the plan view.

Knurling is done while the cut-off tool is near the bar and immediately after the chuck has closed on the newly fed bar. Then the tool recedes and the body is box milled and threaded. As the die is drawing off, the forming tool is approaching from the rear and it forms the head, neck, and teat at the inner end. Finally the cutting off tool advances a second time, this time to sever the piece. All the time the tool post is carrying the knurling unit. But

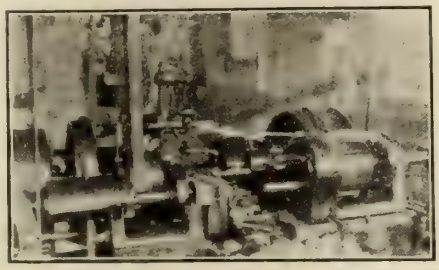


Fig. 8.—Cutting buttress screws on Cleveland Automatic.

in this last move, the arm C does not encounter the bar for that section was cut away in forming the teat and the arm occupies the space, as seen by the upper right hand view.

Coarse Straight Knurl

A very coarse straight knurl was desired. To roll this in with a single tool and in the limited time allowed by the other tool positions exerted a tremendous extra load on the front spindle bearing cap. These are lined with a renewable white metal bushing but after replacing a couple the scheme shown by Fig. 11 was adopted to relieve the bearing of some load. This consists of a U shaped steel casting secured to the front face of the headstock and carrying inside the U a bronde shoe which bears against the projecting front end of the spindle. This arrangement worked very well and proved a decided aid in prolonging the life of bearings.

This same plant turns out other buttress threads of more or less "tricky" design. It was anticipated that the die would not maintain any kind of a satisfactory lead unless backed up by a cam—and trial proved this to be true. Carefully made cams follow the die on all these threads. Even then the thread will vary or will start badly. Some means of compensation has to be provided and on some parts it is necessary to make the piece longer than required so that the poor thread may be cut off.

Buttress threads are successfully produced on the Acme as well as those on the Cleveland. Recently the writer saw an Acme working in a buttress thread, cutting it with a Namco round adjustable die while nearby was the Cleveland making the screw before described and threading it with a Modern self opening die.

Spindle Stopping Kink

Acme automatics have a spindle stopping device which throws out a friction clutch and while it is out dogs on a spindle member engage a stop piece which prevents the spindle from turning while the die is being run on at the other end. When the thread is cut, the clutch re-engages and the dogs revolve clear of the stop piece. There should be plenty of room between piece and dogs when running and ample engaging surface when threading but, due to neglect or lack of knowledge of the trouble, many operators worry along with the contact ends of these parts rounded over badly and working in a very unsatisfactory manner. The remedy is to renew the pins and rollers—two each—on the clutch throw-out. It is simple when one knows the cause of the trouble. Sometimes it is better to make the rollers oversize and gain additional movement. This point has been a valuable aid to many men who were complaining of the Acme scheme of threading.

Better Records

In Canadian Machinery of Dec. 9, 1920, Mr. Scriber took up the matter of better and more efficient records for automatic machine tools. This may apply with full force to screw machine automatics. The writer has found some of the blanks supplied by makers and the charts in instruction books to be almost a detriment because their notations were not direct enough. He has found it better to disregard the forms in part and depend upon dimensioned sketches of the tool settings and cam drums. In the matter of gear trains, he has lettered the gear positions in the diagrams and the charts and found that method far superior to the "driver and driven"—"back shaft and front shaft" scheme of notation. A set-up record should be plain on its face, evident at once in all points to the man who has'nt touched the machine for a year or one who has attempted to set it up for the first time.

Let no one suppose that screw machine work is all trouble. True, "for ways that are dark and tricks that are vain," the automatic has the heathen Chinese beaten a mile, but it is interesting work and work that demands a high degree of skill to master in its several branches. It is a wonderful trade in itself. Let no one seek to belittle the all around screw machine man.

Among the interesting articles which will appear in forthcoming issues are the following: Proper Piling of Goods Reduces Costs, May 18; Saving Money By Means of the Turret Lathe, May 25; Punch Presses and What They Can Accomplish, June 1; Machine Shop Problems of Interest, June 8.

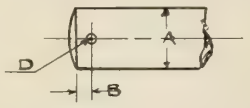
Practical Ideas for Shop Executives

STANDARD COTTER PIN SIZES

By Robert Mawson

Most machine shops design their small details in a very haphazard manner, the larger elements are given some thought and rightly so, but the smaller onsidered very insignificant and when these go into the shop to be made there is no system observed, the result being that the work is costly and unsatisfactory when viewed in the light of modern manufacture.

One of these glaring examples is the simple round stud or pin in which a hole is drilled for a cotter pin. Each draftsman has a different idea as to the size of cotter pin to use and also how far the hole should be drilled from the end of the piece. The result is that a variety of jigs are often provided for the same diameter of pin entailing different bushings and as naturally follows increased expense of manufacture.



A	COTTER PIN	B	D
UP TO 1/2	1/16 x 3/4	1/8	.48-.076
1/2 TO 9/16	3/32 x 1"	3/16	.36-.1065
5/8 TO 3/4	1/8 x 1 1/4	3/16	.27-.144
7/8 TO 1 3/16	3/16 x 1 1/2-2"	1/4	.9-.196
1 1/4 UP	1/4 x 2-2 1/2-3	1/4	13/64

Standard cotter pin sizes.

We resently prepared the list of standards for pin holes and cotter pins as illustrated in the drawing and it has proved itself very useful both in the engineering department, and also in the shop. By its use the draftsman knows exactly what size to call for on each drawing and when the design finally reaches the shop the machinist has also the necessary information to complete the job without asking any unnecessary questions which always means a loss of valuable time.

The first column A shows the diameter of pin to be drilled; for example 5/8 to 3/4 inch, in each case the sizes being inclusive. The second column is the diameter and length of cotter pins to be used in the piece, in the example taken this is 1/8 in. dia. and 1 1/4 in. in length. For the last two sizes in the tables there are a number of lengths given; this is necessary to provide for the diameters of pins in question, the diameter of cotter pin however being constant between the diameters of pin to be drilled as given in the table.

The third column marked B is the distance the hole is drilled from the end of the pin and is self-explanatory. The fourth or last column is the size of hole to be drilled or the diameter of drill to be used, the size for the example taken being therefore No. 27 which is .144 of an inch. It might be said that this table could be expanded to suit the various requirements of any machine shop, the one given being adequate for our shop however.

POSITIVE STOPS FOR TWIST DRILLS

By Harry Moore

Twist drills offer a very poor surface when it is a question of holding a stop collar on the fluted portion, and whether a screw be used, for tightening purposes, bearing direct on the drill, or whether a split collar is clamped thereon, the result is generally the same unless some means is used to back up the stop to prevent it slipping back under pressure. Whether a stop should be used, apart from the regular one on the machine, depends of course on the nature of the work, but in all cases where the face of the work differs in relation to the distance from the machine stop, some sort of a device on the drill itself must be used. Any method or means to obtain this must be positive in its action and therefore the examples of stops to be described will perhaps be of interest as each one contains this very essential feature.

The first example shows a special holder for use on turrets and screw machine work, which is specially adapted for use when drills have to be fed in but a short distance. In such cases there is ample room for a collar and the one shown in the drawing A, is held to the drill lightly by a setscrew and backed up by two knurled head screws B sliding in clear holes in the holder, these being held to their adjustment by hexagon nuts C resting against the face of holder. To obtain a positive stop the drill must always be pushed to the back of the hole before tightening. The holder shown at Fig. 2 is for a purpose directly opposite to the first; that is for drills which have to be fed in to a good depth, which consequently leaves very little room for collars or the like. The shank of holder fits the turret as usual, and the front end is drilled out for the largest size drill likely to be used, the top of the holder being milled away, as shown, to expose the drill. The adjusting screw A has a series of holes drilled in the head, and this member works in a tapped piece B which is driven snugly to the bottom of drill hole, the hole in the shank C being clear. This method of construction was necessary as the position from either end was too distant to permit the use of a standard length tap. The front of the holder is the actual stop for the work to come against, the drill being set to the required depth and backed up by screw A which is moved by inserting a piece of wire in the holes. Different size drills are taken care of in both holders by the use of bushes.

When a stop is required in a hurry it can be made as shown at Fig. 3, though this kind is not recommended as a permanent device. After the drill is pushed to the back of the hole, a strip of sheet metal the correct width is cut and bent round, both ends being pinched together with a pair of pliers, after which a slot is filed out to take a screw a nut to tighten it onto the drill, the flattened ends being chamfered off as shown at A. When the size of drill allows, the idea shown at Fig 4 is handy in all cases where a stop is to be kept permanently on the drill for use on one particular job. A small hole is drilled through the shank and a stud slipped in with a nut on both ends. The stop A is a piece of tubing with a slot filed in the top to suit the stud B, so that when the drill is ground on the end, this slot

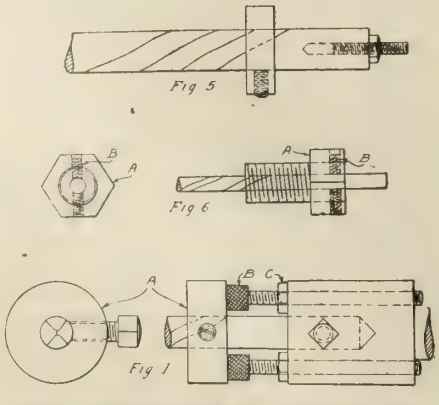


Fig. 1.—Drill stop for use on turrets and screw machines.
Fig. 5.—Collar and nut stop.
Fig. 6.—Quickly made stop.

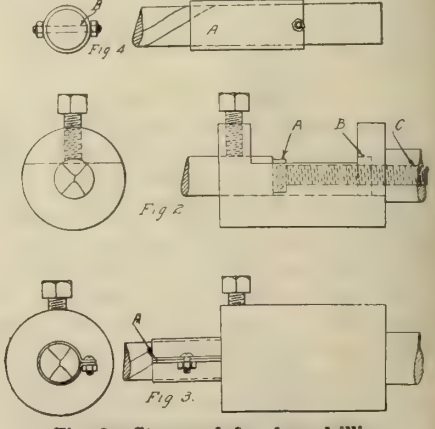


Fig. 2.—Stop used for deep drilling.
Fig. 3.—Emergency drill stop.
Fig. 4.—Permanent drill stop.

can be easily filed on the bottom to equalize the distance.

In Fig. 5 a collar is used together with a nut and screw, the latter fitting a clear hole in the end of drill. In this case the collar is backed up by the end of chuck jaws, and the drill by the end of the hole in chuck, the necessary adjustment being obtained by the nut and screw, which in effect lengthens or shortens the drill. A one-inch hexagon nut is handy for obtaining a quick stop for various sizes of drills. Tap the nut A as shown in Fig. 6, on each side, for 3/16 in. headless screws B, then all that is necessary is to drill out an old bolt with the drill to be used, and cut off the required length. Screw this into the nut until it touches the screws B, then slip the whole thing on the drill and tighten by means of screws B. As in the former case the back of the drill is supported by the chuck and the nut by the chuck jaws. The same nut, of course can be used for various sizes of drills.

THE DESIGNER AS A COST PRODUCER

By I. N. B.

The designer is often classed as a non-producer in spite of the fact that he may be, and often is, one of the greatest producers in the plant, measured by his ability to increase production. A certain shop had a number of complicated machines to build, the original machine was built by the inventor who was a fairly good mechanic but lacked the technical ability to lay out the machine along general engineering lines. The first machine was constructed by the cut and try method and proved a success when completed. He had notes and sketches that only he understood and he was engaged by the concern to make the duplicate machines. Two months was the time allowed for the production of the first machine. Six months has elapsed and the first machine is not yet completed, and part after part is made and discarded and the cost has run into figures that are seriously embarrassing the company for capital. As soon as the first machine is completed and is working as good as the original model there is plenty of capital available.

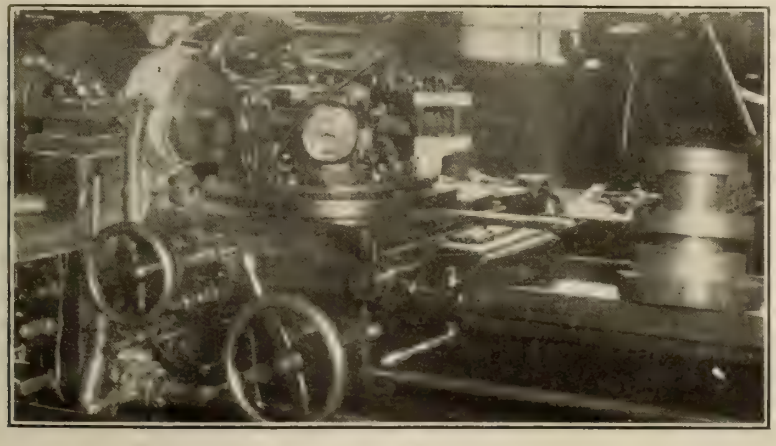
If a capable designer had been put on the job and made a complete set of working drawings the machine would have been finished and at cost within the prescribed limits. A bill of material would have been made out, and all the material could have been ordered and been on hand instead of shortage constantly occurring. The work could have been laid out in an efficient manner and furnished to the assemblers to keep them busy instead of having to wait for parts as they often have to do now. If the present man in charge was to die or even take sick it would be necessary to stop the work until a new man could become familiar with the original machine. Furthermore if a change is required it can be demonstrated on paper, interferences discovered and eliminated, changes made and the only cost involved would be the cost of paper and the time of one or two men. In the present case a change often means the holding up of five or six men and the piece discarded or used in such a a condition as to cause a break down when the machine is finished.

As an example of the value of a designer one has only to look at the high efficiency of the strops producing for automobiles. Take the vertical automatic lathe in the Nash Motors Co. shops that finishes turning and boring both sides of a flywheel in about seven and a half minutes. Imagine building a machine of that kind on the lines mentioned and yet the aforesaid machine is required to do more than five different classes of work while the lathe is only required to do two. Of course all well regulated concerns employ a designer but many smaller shops might find it would pay them to do so if only for a short time, even if they had to pay a premium on the short time employed.

HEAVY TURRET LATHE JOB

By Henry James

In the manufacture of their geared head lathes the Greaves, Klusman Co., require gears of flawless metal, and for this reason it is necessary that they machine from a large rough forging. The illustration shows a Cincinnati Acme universal turret lathe machining these chrome nickel steel forgings into rough turned gear blanks. The piece is chucked on outside diameter. An ordinary lathe tool is held in the flat turret and used to face the end. A centering tool is held in the flat turret and used for centering, so that a cone centre can be used to securely support the work. The tools held in the square turret are used to turn the various diameters and necks. The next operation is to drill, bore, ream, turn and face the opposite end. The metal removed in the two operations is 162 lbs., the rough forging weighing 275 lbs. The production time on each piece is approximately 1 hour and 15 minutes.



Machining chrome nickel gear blanks.

REMOVAL OF SCRAP

By R. V. Williams

A means for labor saving which has been worked out at the works of the Stearns Rogers Co., is inexpensive and simple in design, as well as possible for application in a wide range of plants. At this plant metal chips and turnings are gathered together on an elevated platform just outside the main building. When a carload of this scrap has been accumulated, a freight car is set in and scrap is loaded by hand from the platform.

All this scrap must be hauled from the plant to the platform—a distance of 30 feet—and raised to the platform by hand. Wheelbarrows are used for this purpose, and to make it possible for the workmen to push the barrows up to the platform level without an incline of excessive length, a piece of 4-inch channel iron has been built in the center of the incline walk. Cleats are nailed along the incline on each side of the channel. This metal track offers little resistance to the wheel of the barrow, and since there is a channel form, the workman need not bother about direction; he can put all his effort into raising the load.

Two other arrangements have minimized the labor necessary to handle the scrap. One of these is the covering of the platform floor with scraps of boiler plate to facilitate shoveling; the other is to have the top of the retaining wall about the platform just level with the top of the standard gondola freight car.

Experiments conducted during the war showed that aluminum could be obtained not only from pure clay, but from many inferior grades subjected to certain treatment. As a consequence the aluminum industry has been developed extensively in southern Germany where hydro-electric power is used in its production. Prior to the war the output of aluminum amounted to around 800 metric tons annually, while it is now about 32,800 metric tons.

Technically Trained Men Make Good Salesmen

Opportunities as Great on Distribution Side as That of Production—Salesmanship To-day Must be Backed With the Ability to Give Service—The Engineer Drummer

ONCE upon a time the effective salesman was a man who knew a lot of good stories and understood how to entertain the buyers. He got orders because he was a good scout. That's the way it used to be. But effective selling is not done that way any more. A new type of salesman has risen....a man whose most valuable asset is his knowledge. A salesman these days must know his product. He must know how it was made and what materials were put into it, and he must possess the same knowledge of the articles against which he is competing. He must know how the thing he is selling can be used most effectively, and he must tell his customers how to get the maximum value out of it. Of course, appearance and personality still count for something. A successful salesman still has to make a favorable personal impression on his prospective customers. But mere good fellowship is no longer sufficient. It must be backed with the ability to give service, says the Industrial Digest.

Technically trained men in fast increasing numbers are taking selling jobs during these days. An engineering training used to be considered a preparation for a job on the production of industry only, but now many engineers are joining the sales force. There's more money for them right away in selling than in the usual engineer's job. And they are making good as salesmen.

"From conversations with employers, and from a general discussion of the subject, I am convinced that there is a greater demand now than formerly for men with engineering training in the sales department," said George B. Pegram, dean of the Columbia University schools of engineering. "I have no statistics upon which to base this opinion, but I believe it to be true. Business has developed in such a manner that technical training is absolutely necessary to a man who wants to sell certain kinds of goods.

"For instance, it is hard to see how the General Electric Co., could sell its goods at all without the aid of men with technical knowledge. The same thing is true of all concerns which deal in machinery. A man buys a machine because he thinks it will be the most economical means of obtaining the results he wants. Since the determination of the most economical methods of obtaining a given result is an engineering problem, it is natural that engineers are well equipped to sell goods that are bought on that basis."

Prestige Sustained

Dean Pegram was asked if he thought that an engineer loses any of his professional standing when he becomes a salesman:—"No. Selling is just as professional as any other branch of engineering," he replied. "Salesmanship is a field in which a man can display all the high qualities of an engineer. A good engineer-salesman will co-operate with his customers and not try to put something over on them. He will sell them the goods they really need, instead of unloading his inferior stocks on them. And, as business is done today, there is room for such a man to succeed."

The best field for the technically trained salesman is, of course, a field in which the product is used by other technical men for technical purposes. An engineer is naturally adapted to sell such things as electrical goods, machinery, chemicals, and steel products. But the new type of salesman is not confined to these lines. He is appearing in all trades; selling socks, office specialties, and even ladies' waists.

"A technical training is useful to a salesman in almost any line today," said a young engineer who has made a success of selling ladies' hosiery, "because the modern salesman has to know how his product was made. Most prospects tell you, these days, that your prices are too high. One of the most effective ways to meet an argument of that kind is to explain just what items entered into the manufacture of your product, and show the prospect that your article really costs a great deal to make. He can go into great detail about processes of manufacture while the prospect listens open-mouthed, and frequently this ability enables him to come home with the order.

The New Conscience

"Now suppose an engineer runs into a situation like this: He is trying to sell a corporation a piece of machinery, and his competitor is offering something that he knows will fill the bill just a little bit better than his machine. What ought he to do? A salesman pure and simple, will point out the advantages of his own article, and let the other fellow point out the advantages of his. If the customer makes a mistake and chooses the wrong machine, that isn't the salesman's fault. His business is to sell machines, not to guide his customers along the most efficient path.

"An engineer-salesman, placed in a position like that, would be likely to hesitate before urging his customer too closely to buy a machine that was not the best solution for his problem. The technically trained man has been taught to look at such a situation as a problem in engineering, not in salesmanship. So he would be tempted to slow down on his selling talk, and perhaps the other fellow would get the sale."

The National Council of Traveling Salesman's Associations, the spokesman organization for 500,000 commercial road men, is preparing to fortify the members of the twenty-eight bodies affiliated with it with technical information on the merchandise they are selling.

Herbert L. Schamberg, managing director of the National Council, in discussing this plan, agreed that the popularly pictured type of drummer is rapidly passing out of the business picture. "I believe that the growing sharpness of competition makes selling along more scientific lines absolutely necessary. We have found that in a selective market, such as prevailing to-day, bluff good fellowship is becoming a drug on the market. The retailer, for example, is serious these days. He knows that the consumer has a pair of hawk eyes fastened on values and that the funniest story in the world won't sell a pair of shoes for six dollars when somebody else is selling them for five. The salesman must be able to show the retailer that he is giving him real value, and the only way he can clearly discuss his product is by learning all about it himself.

"One factor that enters into the supplanting of the old type of salesmanship is the fact that the men of the new school are more studiously inclined. For the most part they are better educated. Their minds are trained for analyses. The old school salesman usually worked up from the stock boy or office boy. There were few schools in salesmanship. College trained men seldom took to selling on the road.

"The National Council is prepared to lend its assistance in equipping salesmen with technical information on the merchandise they are purveying."

MAKING OF SMALL TOOLS

Although Great Britain was the pioneer engineerinng country and its manufacturers cover practically every section of enterprise, there were one or two directions in which, for reasons which are a little obscure, British engineering firms did not trouble themselves at one time to give much attention. One of the most curious instances is in the range of small tools required by engineers. Among these tools are various kinds of callipers, squares, gauges, etc. Arrangements have now been made, however, for turning out in a British factory a complete range of all these necessary accessories. A factory which was erected during the war for the purpose of making magnetos has been adapted for the manufacture of these small tools; and already a very extensive range of extremely accurate and well-made appliances has been turned out.

New Things in Shop Equipment

ADJUSTABLE TEMPLET THREAD GAUGES

An adjustable templet thread gauge of the ring type, in which the threaded hole is located eccentrically relative to the periphery, has recently been placed on the market. The ring is slotted completely through at a point where the ring wall is widest. The gauge is adjusted by tightening up a screw placed perpendicularly to the split ends of the gauge. A hardened drill-rod pin keeps the gauge from twisting. The gauge is made in all sizes from 3/16 of an inch up, and in all standard, as well as many special, threads. The manufacturers are the Superior Thread Gauge Manufacturing Co. of Brooklyn, N. Y.

ELECTRIC-DRIVEN GAS FURNACE BLAST

There is now being placed on the market an electrically operated blast intended for application to gas furnaces for regulating the mixture of air and gas delivered to the furnace. The blast is driven by a one sixth horsepower universal motor and delivers 210 cu. ft. of air per minute, at a motor speed of 10,000 r. p. m. Current for the motor may be taken from any lighting socket. The device functions somewhat similar to that of an automobile carburetor. The mixture of air and gas should be rich until the furnace has been warmed up, after which a damper on the blast adjacent to the blower, should be gradually opened to admit more air. The blast is not dependent on a normal gas pressure, a sufficient amount of gas is drawn from the mains to heat a furnace without variation. The apparatus offers a convenient means of heating a furnace after regular working hours. It is marketed under the trade name of "Cadillac". It is manufactured by the Clements Mfg. Co. of Chicago, Ill.

SCREW PLATE SET

A very useful screw plate set, complete in an attractive well-finished box has recently been placed on the market. All the dies of the set are hexagonal. The die-stock is made of an aluminum alloy and the tap wrench is made of steel, with hollow handles to reduce its weight. The dies are made adjustable by splitting one side and providing a filister head screw for drawing the split ends together. An ordinary wrench may be used to turn the dies instead of the stock. Such provision is often convenient when working in cramped places. The dies are of standard form and chip clearance, and are intended to cut full and perfect threads. A hexagonal adapter furnished with the set provides for holding dies that are small in outside diameter in the same stock. Attached to the stock by means of knurled-head screws is an adjustable guide which may be swung to one side to permit the changing of dies after the screws have been loosened. When tightened again the screws hold the guide in position over the centre of the die and lock the jaws of the guide so that they will not move while threading a number of pieces of one size. The cutting faces of the die are formed by broaching. In this way a correct shape is produced and an equal distance maintained between all cutting lands. The set is made with both the U. S. standard and the S. A. E. forms of thread. The set is manufactured by the Frank O. Wells Co., Inc. of Greenfield, Mass.

LAPPING AND FILING LATHE HEAD

In order to provide for lapping and filing small work without tying up expensive equipment there has recently been placed on the market a lapping and filing head. In the head a spindle is supported, which is mounted on ball bearings. The drive is through an overhanging pulley on one end of the spindle, and is direct. On the other end of the spindle there is mounted either a Casler twin screw drill chuck or a three-jaw chuck. A belt guard can be readily attached to the head casting. The base of the casting is 10¾ in. and the distance between the pulleys and the chuck is 14¾ in. The head is manufactured by the Marvin & Casler Co. of Canastota, N. Y.

BALL BEARING HANGER

A simplified and improved design of ball-bearing hanger with a two point suspension for the bearing box has recently been placed on the market. The self-aligning ball-bearing incorporated in the older types of hangers is accommodated in the new type. The bearing is contained in a split housing rigidly held by two suspension rods. The arrangement is one that is very compact, is easily assembled, located or inspected. Vertical or horizontal adjustments can readily be made, at the end of the housing by means of lock-nuts and set-screws. This does away with the possibility of applying pressure to the bearing while making adjustments. The self-aligning feature of the bearing allows the shaft to turn freely at all times, with a minimum of friction and heating. A shaft which is long can be assembled on the floor with the bearings placed at the proper intervals and in plain view and it then can be raised into position for final adjustment with bearing caps off. The hanger is manufactured by the S. K. F. Industries Inc. of New York City.

PORTABLE SAW BENCH

Rather unique in the field of portable tools for the pattern-shop is the universal saw bench, mounted on a pedestal on rollers, which has recently been placed on the market. The saw is driven by a half horse-power motor and is capable of handling stock up to 2 in. thick. The table can be locked in place at any angle up to 45 deg., a graduated dial to indicate the angle being provided. The cross cut gauge may be used on either side of the saw and can be quickly set and clamped in position. The ripping gauge may also be used on either side of the saw. This gauge is automatically lined up with the saw when locked in position. The saw is seven inches in diameter and may be of the ripping crosscut type or a combination of the two. A splitter guard is provided to keep the stock from pinching in the saw. The height of the saw above the table surface may be adjusted as the saw arbor is hinged for this purpose. The pedestal has two rollers at the back. At the front there are located two legs that firmly hold the machine when in operation. Between these two legs is mounted an elevating roller mounted on a swivel and connected to a tongue or draw bar. This roller is lowered and the feet at the front are raised when it is desired to move the machine. The saw bench is manufactured by the Union Machine Co., of Grand Rapids, Mich.

DIE-FILING MACHINE

A small size die-filing machine which may be mounted on a bench, or on a pedestal having elevating rollers has been placed on the market recently. When the elevating rollers are lowered and the pedestal raised, the machine can be conveniently moved about the shop. When it is located where it is desired to use the machine, the base of the pedestal forms a solid foundation when the rollers are again raised. The machine is electric driven and current can be taken from any lighting socket. A one-eighth horsepower, 1,720 r. p. m., motor is provided which is fully enclosed in a sheet metal case. The file is operated through a ram which is driven by a crank and connecting rod. By adjusting the throw of the crank it is possible to obtain any length of stroke up to three inches. The length of the connecting rod can also be adjusted to bring the working section of the file into any desired position relative to the work. Speeds of 200, 300 and 400 strokes per minute can be obtained through a cone pulley. The work table is pivoted on a yoke to enable various degrees of clearance to be filed in a die.

This yoke is in turn pivoted on the frame of the machine. A graduated dial is provided for each of these pivoted supports, which feature facilitates rapid and accurate setting of the table, to any desired clearance angle. There is an outboard support for the file and standard or special files can be used. The height of the table is convenient for a man sitting on a stool. The table is 12 in. square. The weight of the machine is about 80 pounds. It is manufactured by W. D. Rearwin of Grand Rapids, Mich.

AUTOMATIC MIXING AIR-GAS INSPIRATOR

There has been recently placed on the market a new type of low pressure air-gas inspirator. The original design was intended to be used on a certain type of furnace. The new design is, however, applicable to all other makes of furnaces. The entire operation of a furnace equipped with this device is controlled through one valve. The mixture of gas and air is always constant, that is to say that an increase or decrease in the air supply automatically causes the amount of gas delivered to be increased or decreased proportionately. The gas cock is operated only when starting or stopping the furnace, and therefore is always in either the "full on" or "off" positions. It is claimed that no explosive mixtures are possible in any part of the distributing mains as the gas and air are mixed only at the point of supply to the burners. The advantages claimed are an automatic supply of air and gas in the desired proportions under all conditions, through mixing of the air and gas just prior to entering the furnace, and an instantaneous combustion. The inspirator is manufactured by the Surface Combustion Co. of New York city.

PATTERNMAKER'S LATHE

There has recently been placed on the market a motor driven patternmaker's lathe built in sizes of 16, 20, or 24 in. swing. The lathes are supplied in standard bed lengths of eight and ten feet. A somewhat unusual feature is one that permits the headstock to be swung about five degrees each side of the centre to provide for turning tapers. For the accommodation of face plates the spindle is threaded on the outer end as well as on the inner and usual place. Radial loads and the end thrust of the spindle are taken by double-row self-aligning ball bearings. The open side type of tailstock is provided. For turning tapers the tailstock may also be set over. A compound rest is provided with complete graduations, which permits quick settings to be made at various angles. Power feed is regularly furnished to the carriage and in addition a hand feed can also be provided. Where power feed is provided it is controlled by a friction knob on the apron, and reverse can be obtained by operating a lever. A two horsepower motor, mounted on an adjustable base and direct connected to a four-step cone pulley, is located on the under side of the bed directly under the head. The adjustable feature of the bed allows for belt adjustment. Belt shifters and a control box are conveniently located. A brake lever, operating on the inside of the cone pulley on the spindle instantly stops the rotation of the spindle when the power is shut off. If desired the machine may be equipped with a countershaft drive. The manufacturers are The Imperial Metal Products Co., of Grand Rapids, Mich.

UNIVERSAL ANGLE FIXTURE

A very useful fixture for tool room jobs, where it is necessary to hold the work in angular positions while being machined, has been recently placed on the market. The device has a work-holding plate which may be swivelled 90 degrees, on either side of the horizontal plane, and which may also be revolved around an entire circle. Graduated dials are provided to facilitate settings. All surfaces of the plate are ground square with each other and this member has a series of holes which provide for the quick clamping of work by means of patented clamps. The plate hinges about a ¾ in. stud which is threaded on one end, and is used to clamp the plate in desired positions about the horizontal plane. Large flanges on the plate engage in desired positions about the horizontal plane. Large flanges on the plate engage the faces of bosses on the yoke lugs which provide sufficient friction to hold the plate secure under all conditions. The yoke casting revolves on 1½ in. pilot at the centre of the base. The yoke casting is secured by two half inch bolts which ride in a circular T-slot machined in the base. The size of the fixture plate holding surface is 3⅜ by 4¾ in.

The weight of the fixture is twenty-five pounds. The manufacturers are E. L. Krag and Co., of Chicago, Ill. It is marketed under the trade name of "Little Bob."

"SIMPLEX" ELECTRIC SAFETY STOP

There has recently been placed on the market a stop that is used to obtain instantaneous operation of a clutch or to shift a belt, on various types of automatic machines in the event that the stock is oversize, undersize, overfed, or underfed, or in the case of some other irregularity. It is electrically operated and is intended for use on a lighting circuit although it can also be operated on a battery or generator circuit. On a blanking press the stop is mounted on the foot treadle rod, a latch on the stop engaging a notch in this rod. When the stop operates, the latch is disengaged stop operates, the latch is disengaged from the notch and the rod is forced forward by a spring. A small spring lever is also arranged to bear on the blanked scrap as the latter is fed from the die. When the scrap has been fed the desired amount, the lever rests on the metal between the blanked holes and while thus positioned the circuit is open. However, if the scrap is overfed or underfed the lever will extend into one of the blanked holes and the circuit will be closed. This will cause the stop to function and stop the operation of the machine. In this way injury to a die, as a result of punching the metal at a point where it has already been partially blanked out, is avoided. Wires may be run from the stop to contact points located on a machine wherever trouble is likely to happen. The pressure of the clutch or belt shifter rod against the stop-latch is reduced by means of two levers of unequal length. A spring for exerting pressure up to 75 lbs. may be used in connection with the stop. This spring is ample for shifting a 6 inch belt. The stop may be operated at any time by means of a hand-trip. The device may be so arranged that it will not interfere with the ordinary method of stopping and starting the machine. It is manufactured by the Atlantic Co. of Brooklyn, N. Y.

SPRING CUSHION FOR PUNCH PRESSES

There has recently been developed an even-pressure spring cushion for use when drawing shells on punch presses. It is claimed that the pressure on the draw ring is reduced by the use of the fixture. Wrinkles in work are completely eliminated, it is stated. The device has been designed for small and medium sized presses, where one of the necessary conditions is that it can be quickly and easily attached and detached from a press. It had been so designed that it is unnecessary to provide holes in the machine for attaching it. The cushion is simply held in place by screwing the upper threaded end of the suspension bolt, into a trapped hole in the bottom of the die or bolster plate. The suspension bolt extends through a sleeve having teeth cut on its outer surface near the upper end which are engaged on opposite sides by the teeth of two compensating cams. These cams swivel about their bearings when the draw pins of the die are forced downward, the draw pins resting on plate and spacer block placed on top of the cam housing. The swivelling of the cams on their bearings causes a vertical movement of the rollers and so controls the compression of the spring in operation. This compression is naturally less than if the spring was not provided with compensating members. The friction between the rollers and cams caused by the spring forces the cams to return to their original positions when pressure is released from the draw-ring. An adjustable nut placed on the lower end of the sleeve provides means of regulating the original pressure on the spring. The die cushion is manufactured by the Marquette Tool and Manufacturing Co. of Chicago, Ill.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Buyers Have the Say

AN ENCOURAGING improvement can be noticed on the machine tool market this last few weeks. Not that the improvement has been sensational, but a better tone exists. Prospects are showing more real interest and although the orders closed so far have been small, several real deals are developing.

Luckily for makers of machine tools, the improvement is coming their way. Manufacturers are enquiring more and more for new tools rather than second hand equipment, and this may be owing to the fact that they are at last realizing, what we have told for some time, viz, this is a buyers market. The purchaser to-day can get better bargains than for many years past. Competition is keen, and it is questionable if a similar period to that existing at present will ever return again.

In many cases dealers and manufacturers are selling below replacement cost to liquidate stocks. Now is the time to buy equipment, for if the prospective purchaser is reasonable in his demands and does not try to take an unfair advantage of the situation. he can secure a real bargain.

This applies not only to all lines of machine tools, but small tools and supplies as well. Drill prices are cut to the bone, and even the quotable market price is forgotten occasionally if a good sized order comes along. There is an old saying about making hay while the sun shines, and now is the time for the manufacturer to gather his hay in the form of good bargains in tool equipment.

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Now is the Time to Clean Up

THIS IS CLEAN up week. Get rid of all rubbish. Throw out anything that is not actually required. Clean up those dirty corners. These slogans and many others of similar character greet us from the pages of the daily press these days, for all cities are in the midst of their spring cleaning campaign. But how about manufacturing plants. Should they look at these slogans and say "Oh, that applies to ordinary residences"? To our mind it applies to every factory, large or small just as much as it does to any home.

Instead of cleaning up once a year however, there should be periodical clean ups. Not simply the sweeping of the floors, whitewashing of the factory, or the ordinary clean up duties, but a tool and equipment clean up.

Get rid of old files which are only taking up room, and perhaps the man's time who is trying to use them. Throw away old stubs of drills that have outlived their usefulness much as you may hate to part with them, for ten chances to one they are so short that when you use them the chips clog up the hole, and wasted time results.

These are only two of many other ways of cleaning shop. Some of your vises may be more bother to you than they are worth, the old brooms really don't clean the floor correctly any more, and some of the trucks you may be using are on their last legs. Machine tools are by no means exempt, for if several of the tools now in use could only speak, some owners would get a pretty red face.

We have in mind a lathe, that because it happened to be extremely well built to start with, is still doing service at the old stand, but at what a sacrifice. Only one man in the shop can run it, as he is the only worker who knows where the bed bends, and knows exactly how far to ease back the tool in order that a true (?) surface can be secured.

This editorial is not a plea to purchase material you do not actually require, but when you should buy, do not shut your eyes and say, "Oh, it will do for the present." Every time you fool yourself in this way you are losing money. Forget the initial expense, look further ahead, and you will soon discover that the cost of the new machine, the new drill, file, or vise, is soon wiped out by the added production secured.

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Research is Essential

BECAUSE an industry has shown phenomenal growth is no reason why the leaders in that industry should rest on their oars and say contentedly "We have done well indeed." The automobile trade is a case in point. Here we have an industry which has jumped by leaps and bounds, and, while it is admitted that many improvements have occurred since its innovation, there is yet great room for improvement.

Take one example, valves. We know the material from which they are made is better than several years ago. but, engineers admit they have not secured an ideal metal yet. A valve to be successful must be able to work at a fairly high temperature, be non-corrosive, distortion proof, and wear resisting in quality. The stem must be able to take a high polish, yet resist wear, and with all these requirements are many others including ease of machining. A better valve material will be discovered eventually, but why not as soon as possible?

There is a great need of some research committee devoted to not only the automotive industry, but other lines. This body could be subdivided into several sections, the members being specialists in the group they represent. At present the United States have several research committees, including mechanical engineers, automotive engineers, etc., but all these are honorary positions, and do not make the same progress as a body of men working continuously would accomplish.

The only true solution is for the different industries to get together and support a central investigating committee, appointing both practical and theoretical men to the positions. One will balance up the other, and without either one, the judgment is likely to be very much one-sided. Pay these men good salaries, making it distinctly understood that reasonable progress must be shown, otherwise other members will be appointed. In fact, it would be a good idea to made changes occasionally for new blood brings new viewpoints, but the real valuable man should be kept on as the backbone of the committee. A move of this kind would have to be developed gradually, but one thing sure a start should be made as soon as possible.

Steel Prices Firm But Demand Only Seasonal

Practically All Lines in Market Report April Business Better Than March—Small Tools and Supplies Fairly Active—Machine Tools Show Better Tone—Pig Iron Demand Tapers Off Slightly

NO IMPORTANT CHANGES OCCUR DURING WEEK

THE Canadian iron and steel market is firm, but no advance of importance has occurred. Seasonal improvement is taking place, but no more than has been expected. April business showed a slight increase over March, and from present indications, May will gain over April.

Bars and small shapes are principally in demand, although even these lines cannot be termed features for the call is not strong enough.

Small tools and supplies are moving at a fairly good rate, and if the present strength continues, and it is expected that it will, May should show an increase over April. Competition is very keen, prices being cut to the bone in many cases.

Machine tools are steady but not brisk. The tone is better, prospects are showing more interest, and several good deals are under way. At present these look very rosy, but when they will break is another matter. This is a buyers' market, with the result that several good purchases have been closed, that is from the buyers' bargain viewpoint.

Montreal reports a good demand for building supplies and lines such as spikes, nails, bolts, and heavy hardware. Merchant bars are also active in that locality.

Non-ferrous and scrap metals are quiet in Toronto district. Montreal shows some price advances in scrap metals, but as the demand is weak, these prices mean little or nothing.

Miscellaneous lines such as waste, oils and steel pipe are all in fair demand, pipe being the most active of those mentioned. Bolts are rather strong in some quarters, one firm working overtime to supply the demand.

The motor industry is very lively, and textile trades are also busy. Business generally is improving gradually, and reports from various centres show that this improvement covers a wide field.

Finished steel prices in the United States are very firm. Shading has disappeared entirely, and some mills are even demanding advanced prices. On small tonnages they may get the premium price, but regular quotations apply to larger orders.

Pig production increased during April 5 per cent. over March. A few districts showed a loss, but the total production rate registered a gain. The coal strike was responsible for the lower rate in some localities.

The steel market still shows good signs of strength. Consumers in some cases are becoming anxious and importuning mills to accept their orders. The majority of steel ordered, however, seems to be going into stock. Based upon activities of the past three weeks, the rate is around 36,000,000 to 38,000,000 a year.

Connellsville coke offerings are very light, also the demand. Furnace coke is quoted at $6.25, and foundry coke $6.75. Connellsville coal has strengthened slightly during the past week, as Eastern buyers came into the market, and the price is now $3.

Toronto

May 10th.

CONDITIONS on all markets remain practically the same as last week. What activity exists is seasonal, and was expected. Competition is keen, especially in small tools and supplies, also machine tools.

Iron and Steel.—Business on this market shows fair activity only. Bars and small shapes are selling best of all lines, and prices are firmer than for some time past. Shading does not appear on the surface, but in a few cases, is being quietly followed out. This, however, is the exception rather than the rule, and therefore does not truly reflect the market tone, which is firm. A certain amount of local jealousy enters into the price shading, and the peculiar part about it is that the firms doing the cutting quote their regular customers the market quotations, but wherever the prospect of a new customer crops up, they offer special inducements, usually five or ten cents off the regular price.

Other steel lines are moving at a fair rate and, from present outlook, there is no reason why May business should not be ahead of April. Several dealers are still discussing the probability of an advance in bars and shapes, but so far it is talk only. Competition remains so keen that each one is afraid to make the move. Hoops are stronger, having moved up from 3.75c to 4.00c. This has been threatening for the past two weeks, because the spread was not as wide as it should have been. The new figure seems to be fairly well established, but no doubt if a really good order came along, dealers would forget the advance in their effort to bring home the order. Following are the local quotations:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—The demand for pig iron is not quite so heavy this week, although it is still better than it was a month ago. The price remains the same, and foundries evidently feel they are well protected against the possibility of a drawn out strike, for they are not pleading for quick deliveries as they were a week or so ago. Prices are being given cautiously, however, for few know which way the cat is going to jump. Following is the local price:

Silicon 2.25% to 2.75%.....$29 15

Non-Ferrous Metals.—This still remains a draggy market with no price changes. The strange part is that while business closed has not improved the tone seems to be better. Dealers themselves feel that things are brighter, that people are more interested than formerly, and yet, when it comes to totalling up the weekly sales, no improvement can be recorded. Manufacturers are purchasing very cautiously, and seemingly only for immediate requirements. Following are existing prices:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	
Aluminum	26 00

Scrap Metals.—Here again we have a dull market. Prices are stationary, and whatever demand does exist is nothing to speak about. Quotations given below are firm, however, and we know of one or two cases where slightly more than the figures given had to be offered before material could be secured. If you know how to buy, the quotations given in this letter can be secured.

Copper, light .. per 100 lbs.	9 50
Copper, crucible	12 50
Copper, heavy	12 50
Copper wire	12 50
No. 1 composition	9 50
New brass cuttings	7 00
Red brass turnings	8 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	12 50
Boiler plate, per gross ton	8 50
Heavy melting steel	10 00
Axles (wrought iron)	9 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	22 00
Pipe, wrought	7 00
Car wheel	17 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	18 00
Cast boring	3 00

Small Tools and Supplies.—May business looks to be shaping up nicely and if the present rate continues, will show an advance over last month. The demand is general, no line being featured. The automotive industry is helping this branch of the market as things are very busy in the border cities, Oshawa, and other cities where Canadian automobile factories are in operation.

Machine Tools.—The machine tool market is steady but not exceptionally brisk. Whatever business is closed is worked very hard for, but it is safe to

say that a much better tone exists. Prospects are showing greater interest, and dealers are doing more for customers today than in any other period in machine tool history. It is a buyers' market, and the slogan is "Satisfy the Customer." One large firm in the States has a special representative over here at present following up possible buyers. In one office we were in, a phone message was nearing completion, the important part of which ran like this: "That's too bad, we are very sorry to hear of the trouble, but do not worry, we shall send a man up at once, and make all necessary adjustment and repair." The said repair would cost a considerable sum, probably wipe out all the profit made on the sale, but to make themselves solid, they were willing to chase the matter to the very limit. We simply retell this incident to show how eager dealers are after business. Prices, such as they are, cannot be considered firm, because quiet bidding against each other is continually taking place.

Oils, Waste, etc.—No change has occurred during the week in oils, waste, or steel pipe. The latter is the strongest of all, deliveries being longer than for some time past. Following are present quotations:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal.	1 35
Linseed oil, raw, single bbls.	1 00
Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bls.	1 00

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

The demand for bolts is increasing in this locality, and one well known firm is working overtime to keep up with the demand.

Montreal

May 10

A SLIGHTLY better tone is evident in business circles. Nearly all jobbers report that business closed in April was larger than March. The demand for all kinds of building supplies is still good. Spikes, nails, bolts, and heavy hardware are moving nicely, and the increase in business which appears to be most significant is in marchant bars.

Machine tools and wood working machinery are occupying the attention of a greater number of prospects and all lines are showing a slight, but steady, improvement. It is difficult to pick out any special line that has been particularly active during the month, for the commodity that moves well this week will perhaps be sluggish next week. Thus when the figures covering a month are reviewed a better idea of the situation can be obtained. April figures from all quarters are better than those of March, showing that business is on the upgrade.

Iron and Steel.—Locally, business has shown a fair improvement during the week. It is difficult to discuss steel, without the subject of the coal strike being worked in. As far as local markets are concerned, the strike does not appear to have made the slightest difference. No quotations have been increased, and supplies appear to be ample to take care of business being offered. It is reported, however, that stocks in the warehouses of local jobbers are getting low and that it will be difficult to replenish these quickly. One must accept these statements reservedly, for such facts may have no bearing on the market, due to the unforeseen settlement of the strike, a slackening off in the demand, or for several other reasons. We are not entirely dependent on American fuel to operate our steel industries, and although prices are somewhat stiffer than they were a few weeks ago, this movement was in evidence in the United States before the strike became an established fact, being partly due to general improvement in conditions. The base price generally accepted is $2.75, but it is known that large consumers have secured steel as low as $2.65. Were a shortage really expected there would be very little price shading.

Take the base price at Pittsburg $1.50, and add to that the freight, duty, exchange, etc., and it is found that Pittsburg steel can be laid down in Montreal for about $2 53 base. Moreover, local jobbers are not organized, therefore are not adhering to any fixed base price.

Plates are not moving very well but sheets are fairly active. One jobber reports that they were all sold out of standard sizes and gauges before the recent shipment by water arrived. At this writing they are again sold out of standard sizes and gauges, and are awaiting the arrival of the second water shipment. Merchants bars are again in rather fair demand and a reasonably large tonnage is expected to be moved within the next few weeks No rail orders have come through up to time of writing, but it is confidently expected that when these orders do materialize, they will be for a large tonnage. Considerable orders for small lots of structural shapes have been coming through, this representing a very fair volume of business is general and comes from varied sources. No advance in quotations has been made locally, and following are local quotations:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—No change in pig iron quotations have been made during the week. Prices are firm and sales are restricted to thirty days. The volume of business moving has eased off a little but there is still a fair amount of buying. No. 1 iron is being quoted at $31.80. Shortage of coke in some of the U. S. blast furnaces has had the tendency to curtail production and to make the price firm. The buying seems very general as not only have the small foundries covered their needs but some of the larger ones have come into the market to a limited extent.

Machine Tools and Supplies.—This market is very spotty. There is evidence that more firms are lining up as probable customers, a greater interest being taken in the market, but up to the present there has been little encouragement in the form of sales. Wood working tools have been in a little better demand during the past few weeks, but this has slackened up slightly, while iron working tools have improved a little leaving the general volume of business about the same. The supply business seems to have had a break in some quarters. Some dealers report that business is poor while others state it is improving. No price changes have come through during the week, but the increased activities in local and contract shops will no doubt create a slightly increased demand. April business closed in most cases exceeded those of March

Non-ferrous metals have had another inactive week. Sales have not quite been up to the average. Foreign markets are firm and business seems to be improving. Local quotations remain practically unchanged, and quotations are as follows:

Lake Copper	16 75
Electric Copper	16 50
Castings, Copper	16 25
Tin	34 00
Lead	6 75
Spelter	7 50
Antimony	6 50
Aluminum	23 50

Scrap Metals.—The demand for scrap metals has been somewhat better during the past few weeks, and quotations have been advanced to a point where they are almost prohibitive. As these prices are beyond that which consumers can afford, it is difficult to make a list that would represent a figure that would permit business to be transacted. There has been an increasing demand for scrap in the United States, but so far as can be ascertained little scrap has found its way over there from local dealers. It appears to be a case of putting up the price as the demand appears. The following list is what dealers quote, but where a good offer appears they would no doubt accept a somewhat lower figure.

Copper, light, per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00

Medium brass	4 50
Yellow brass turnings	4 75
Light brass	3 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Pittsburg

May 10th.

PRODUCTION of pig iron in April was 5 per cent. greater than the average rate during March, and was approximately equal to the rate at the end of March, as during that month there had been a steady increase.

The Pittsburg district and the Mahoning valley went back during April, from the rate existing at the beginning of the month, but did a shade better than their average for March. The Shenango valley showed a moderate increase, and the Chicago district a large increase. The Wheeling district and Southern Ohio had losses.

Cases of restricted production were due to the coal strike, or rather to one part of the general coal strike, viz., the trouble in the Connellsville region, of non-union men who were induced to "join" the United Mine Workers by payment of $1 or $2 initiation fee, but who will receive no strike benefits. Production of the Connellsville region is about one-third the rate in March. As these strikes were not expected, consumers tributary to the Connellsville region were not well stocked, as were consumers normally using union coal, for the latter laid in large stocks prior to April 1, some beginning as early as last December.

There has been no material change in the strike situation during the past week. The regular union strike goes on and will hardly come to a head for many weeks yet. Some observers predicted in March that the strike would not be ended until five or six months had elapsed. The non-union strikers are in a different category, and are expected to end sooner but even here they are practically certain to last quite a while yet. Five weeks have already elapsed and the men show no signs of weakening. They are not getting out additional mines, however.

Iron and Steel.—The steel market presents an appearance of great strength, with some anxious consumers importuning mills to accept orders, while the mills are accepting orders cautiously, while a few of the independents have announced advanced asking prices. It would look, from the surface, as if a shortage of steel might develop in a month or two.

These surface indications, however, are not to be trusted, and probably would be quite misleading if followed. Looking deeper one sees a large production of steel with heavy shipments and consumers running along smoothly. Some consumers may wish to buy more steel, being alarmed about the future, but there is no case of any consumer restricting his operations because he has not enough steel. What has occurred in the past four months by way of greatly increased production and shipments would indicate that distributors and manufacturing consumers must have accumulated stocks of considerable magnitude, for there has been no evidence of actual consumption being equal to the production.

It will be of interest at this time, when a fairly steady rate of production is in prospect, to trace the ups and downs of production of steel ingots in the past two years. In the first nine months of 1920 the average rate was 42,000,000 tons a year. By the middle of July, 1921, the rate had dropped to about 10,000,000 tons. Then an increase began and a rate of about 25,000,000 tons was reached by November 1. At the end of the year the rate was much lower, probably under 17,000,000 tons. Then production increased rapidly, to 30,000,000 tons March 1, and 35,000,000 tons April 1, while the rate in the past two or three weeks has been between 36,000,000 and 38,000,000 tons. These figures are approximate, being based on estimates, but they are pretty close. Comparing industrial conditions from time to time, one cannot believe that actual consumption varied as greatly as did production. At some time buyers were accumulating stocks and at other times liquidating stocks. Even in 1920, when steel appeared very scarce, some buyers were carrying stocks. This is hard to believe, but is proved by the fact that in the past few months mills have had claims for detective steel, shipped during the first six months of 1920, the buyers only recently taking a look at it.

Whether the steel was defective or not, has nothing to do with the point at issue, viz., that buyers kept the steel instead of using it or even looking at it. In 1921, on the other hand, buyers were liquidating stocks of steel and there was also liquidation of goods made from steel. The natural conclusion from the figures cited is that a considerable part of the steel shipped in the past three months has gone into stock.

The change in the steel market is due to psychological rather than physical influences. Buyers are alarmed, rather than short of steel. Fear that there will be a shortage of steel owing to the coal strike does not seem reasonable, for the iron and steel industry is fairly well stocked, and if there were a general and serious shortage of coal, this would interfere with the consumption of steel. A similar lack of judgment has sometimes been exhibited in connection with labor supply, there being fears that with a labor shortage steel could not be made whereas labor shortage would affect the consumption of steel more than its production.

Finished steel prices are very firm, concessions from regular prices having entirely disappeared. Some mills are demanding advanced or premium prices, and are probably obtaining these prices on some small tonnages. Regular market prices are: Bars, shapes and plates, 1.50c; bands, hoops and hot rolled strips, 2.00c; standard steel pipe, 71 per cent. basing discount; blue annealed sheets, 2.40c; black sheets, 3.15c; galvanized sheets, 4.15c; automobile sheets, 4.50c; tin plate, $4.75; plain wire, 2.25c. Nails are held at $2.40 by the American Steel and Wire Company, and at $2.50 by independents, who advanced recently. The leading interest is of course picking and choosing the business it accepts.

Merchant furnaces in this general district are out of the market, as are consumers, there being only an occasional inquiry. On a forced purchase one would probably have to pay about $24, furnace, for either Bessemer, basic or foundry.

Connellsville coke offerings continue very light, and demand is likewise light. The market, what there is of it, is quotable at $6.25 for furnace and $6.75 for foundry. Connellsville coal, after weakening some ten days ago, has stiffened during the past few days, chiefly on account of the appearance of eastern buyers, and is bringing fully $3.00.

SEA SLEDS TO BE MADE BY CANADIAN VICKERS

The shipbuilding firm of Canadian Vickers, Montreal, have obtained the Canadian agency of the Sea Sled Co., and will manufacture and sell this product under license. The commercial demand for sea sleds, which are a new type of power boat, and which it is believed will revolutionize entirely the motor and power boat industry, is taxing the company's American plant to its full capacity. The taking over of the Canadian end of the business by the Vickers Company will mean that the large demand from Canada will be immediately taken care of by the Vickers Company's large and complete organization. The latter company will pay to the Sea Sled Co. royalties on all boats built and sold.

Initial construction work has already been started on several boats, the first of which is expected to be launched in a few weeks. Among those interested in the new venture are: C. R. Hosmer, Col. Herbert Molson, J. W. McConnell, W. A. Black and the Hon. W. J. Shaughnessy, etc. To consolidate the association, A. R. Gillham, the vice-president of Canadian Vickers, has been appointed to the board of directors of the Sea Sled Co., Limited. The latter company is purely Canadian, but owns the basic patent rights for Canada, United States and its dependencies, the company's present plant being at Mystic, Connecticut.

Mr. Ferguson, of the Toronto office of the Pratt & Whitney Co., and John Bertram and Sons, Dundas, is at present on a business trip in Northern Ontario.

Foreign Trade and the Standard of Living

FOREIGN trade is essential to the United States if American people are to maintain their present high standard of living, James S. Alexander, president of the National Bank of Commerce in New York, told delegates to the Ninth National Foreign Trade Convention this week. "We have established upon this continent an economic society that has given to the average laboring man a higher standard of living than his fellow laborer enjoys in almost any other part of the world," he said. "The existence of that standard constitutes one of the greatest achievements of American democracy. This standard, however, has been conditioned upon the maintenance of the productivity of the laborer and this productivity in turn has been conditioned upon the continued enlargement of the supply of highly productive land as fast as population grew.

"While there still undoubtedly exists a considerable amount of land which may be cultivated more profitably than land which is cultivated in some other parts of the world, yet we must recognize the fact that we have reached the point where upon the new land the operation of the law of diminishing returns in agriculture will cause a smaller and smaller yield of foodstuffs per unit of labor than has resulted in the immediate past. It is true that invention and improved methods of farming have tended to postpone to some extent the early working of the law of diminishing returns but the evidence of the last few years points clearly to the fact that we are now utilizing less fertile land at a greater per unit cost of production than was the case in former years.

"If we are to maintain our standard of living under a condition of diminishing returns in raw production we must offset such increased cost by devoting a larger proportion of effort to those lines of industry that yield increasing returns per unit, namely, to manufacturing. That we are doing this to some extent is evidenced by the census figure for manufacture. It should be borne in mind, however, that this process of offsetting diminishing returns in agriculture by increasing returns in manufacture involves an ever-expanding market for our manufactures and that such an expansion points unmistakably and inevitably to the extension of our foreign trade.

"From the most important point of view that a nation can take, therefore, namely, that of the standard of living of the masses of the people, we must have foreign trade to an ever-increasing extent."

Mr Alexander argued against the belief that domestic trade alone can assure the prosperity of the United States. He declared that domestic trade is in fact dependent on progress in the international field, since this gives an outlet for surplus production and for industries overexpanded by the war, and thus prevents price demoralization. Although America's foreign trade is only 10 or 15 per cent. of its total commerce, he pointed out that its importance can not be measured by this ratio, saying that many of the most important things in financial and business life hang upon percentages of less than 10 or 15 per cent. and the average reduction from normal business during the entire period of a depression may be under 15 per cent. A change in foreign trade representing only 5 per cent. of total commerce may mean a 20 to 40 per cent. loss to some of our important industries. In conclusion he said:

"The welfare of other nations is so closely interwoven with that of the United States that if the question of our foreign trade is to be interpreted with any degree of breadth whatever, it should be considered in the light of the trade of these other nations. There can be no final recovery of the domestic trade in any nation until the normal international trade relations which alone support the great international division of labor can be re-established.

"This conception of the real nature of both domestic and international trade in modern industrial society should prevent us from reverting to the foolishly selfish mercantile doctrine of the 18th century. We should strive to obtain all of the trade of the world that in a fair field with free competition we may gain through our own efficiency. I have no sympathy, however, with those who would wish America to grab more than her proportionate share of the world trade.

"While the first fruits of such a policy might seem to suggest that we were the gainers in an economic sense, it is impossible for us to maintain such trade unless we are fitted to hold it in an open field. Moreover, to the extent that we should attempt to obtain a disproportionate share and to hold it, to that extent would we prevent the most efficient working of the world machine and to that extent must our actions finally redound to our own injury as well as to that of other peoples.

"In the last analysis, therefore, I should rather view this question in its broadest aspect and answer the question as to why we should have international trade by recognizing why the world must have international trade."

The above is a summary of an address delivered by James T. Alexander, president of the National Bank of Commerce in New York, at the Ninth National Foreign Trade Convention, Philadelphia, on May 10.

Never use a guide stick to keep a belt on a pulley. Find the cause of the trouble and remedy it. See that the shafts are properly aligned, the joints of belt properly cut and laced square, pulleys true and correctly crowned.

INDUSTRY IN FORT WILLIAM

Plans have been completed for the construction of a new main yard office for the C. P. R. in Fort William, to replace the one destroyed by fire last February, and the erection of the structure will be commenced immediately.

In connection with the amount of power Port Arthur is expected to absorb, Manager M. M. Inglis, of Port Arthur Utilities commission, states that by next year the total should reach 20,000 horsepower. It is estimated that the paper mill now under construction at the pulp plant of the Provincial Pulp and Paper Co., north Port Arthur, will require 3,000 horsepower. The old Kaministiquia Pulp mill now owned and operated by the Wisconsin Rapids interests, is now using 3,000, and the extension to the Richardson grain elevator will take care of an additional 250 horse-power. The Parrish-Heimbecker elevator now under construction will want 250 horsepower, which will later be increased to 500.

Port Arthur building permits for 1922 to May 1, have reached $850,036 compared to $51,709 for the first four months of 1921.

The John East Construction Co., of Fort Frances, was awarded the contract for the construction of an eight roomed modern school building to be erected on Crawford avenue, west Fort William. The price was $71,183.16 including heating, plumbing and wiring.

The Dominion Engineering Works, of Montreal have been awarded the contract for the building of paper machines for the Provincial Paper mills, Port Arthur, at a price considerably over $125,000. The contract calls for the delivery in six months of one 146-inch paper machine, capable of turning out 500 feet of paper per minute.

Zinc mining is destined to undergo a revival in the Fort William district after almost a quarter of a century of quiescence, by the establishment immediately, at Ozone siding, a point ten miles east of Nipigon upon the C. P. R., of a refining plant primarily intended for the treating of ores upon the claims of the company erecting the plant, and also for the treatment of any other kind of ore that may be delivered to the mill. According to James Lawrence, who recently returned from a trip to Chicago and other points in the states, a company has been incorporated under the laws of the state of Illinois with head-quarters at Rock Island, known as the Ozone Zinc mining and Refining Association. It is capitalized at one and a half million. Mr. Lawrence says that operations will be started immediately, that it is expected that the mill will be producing and shipping inside three months. The property at Ozone is within half a mile of the Canadian Pacific railway, and a mile of a deep water harbor on lake Superior.

With a good quality of babbitt and the proper kind of ladle—one with a small-pointed spout—there is no necessity for a large hole when pouring.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate 3-16 and heavier	6 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B, Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 2 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 00
Castings, copper	16 25	17 00
Tin	34 00	34 50
Spelter	7 50	7 25
Lead	6 75	6 75
Antimony	6 50	6 75
Aluminum	23 50	26 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.81	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 9 50	$ 8 00
Copper, crucible	12 50	10 50
Copper, heavy	12 50	10 50
Copper, wire	12 50	10 50
No. 1 machine composition	9 50	8 50
New brass cuttings	7 00	6 00
Red brass turnings	8 50	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 00
Tea lead	3 00	3 00
Aluminum	12 50	10 00

	Per Ton	Gross
Boiler plate	$ 8 50	$ 7 00
Heavy melting steel	10 00	10 00
Axles (wrought iron)	19 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	22 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	18 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 75	$4 40
Sheets, blue ann., No. 10	4 00	3 75
Canada plates, dull, 52 sheets	5 75	6 00
Can. p'ates all bright	8 25	...
Galvanized sheets, No. 28		5 35
Queen's Head, 28 B.W.G.	7 00	....
Fleur de Lis. 28 B.W.G.	6 75	.....
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 35
Premier 10¾ oz	6 50	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	$24 75	$
1¼ in.	24 50	
1½ in.	24 00	
1¾ in.	26 00	
2 in.	24 50	20 00
2¼ in.	27 75	23 00
2½ in.	32 50	23 75
3 in.	40 00	30 00
3¼ in.	50 00	32 50
3½ in.	52 50	34 25
4 in.	65 00	43 50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal.	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bbls. gal	1 30
Linseed oil, raw, single bbls.	1 05

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets. 24 gauge and heavier, base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored.13

Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$29 00	$27 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	32 00	30 00
Copper sheet, tinned, 14 x 60, 14 oz.	42 00	40 00
Copper sheet, planished, 16 oz. base	42 00	40 00
Braziers', in sheets, 6 x 4 base	30 00	28 00
Copper tubing, seamless		27

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

A certain activity is developing among manufacturers of electrical equipment, due in some measure to the demand for radio equipment.

E. McNevin, of Fegles-Bellows Engineering Construction Co., of Port Arthur, Ont., is on a business trip to Toronto this week.

The furniture factory and planing mill of McCall and Co. at St. Williams, Ont., was destroyed by fire last week; the loss is estimated at $175,000.

Burlington, Ont. The Coldovoid Underwear Co. may soon commence operations in this locality. A site is under consideration, and further plans will soon develop.

T. McKechnie of Nelson, B. C., has been promoted to the position of superintendent engineer of the C. P. R. British Columbia Lakes and River Service with headquarters and office in Nelson, B. C.

Hillis and Sons, of Halifax, iron foundrymen, have taken tenders for the contract of erection of a two story foundry building of concrete construction adjoining their present foundry premises, on Robie Street, this city.

George Waller of Truro, is building a large brick furnace at Beaver Dam, Halifax county, in connection with the concentration plant of the gold mine there operated by E. Gladwin, of Truro, and Mr. Murphy, of Beaver Dam.

The contracting firm of Adkinson and Dill, Vancouver, B. C., have submitted a proposal to the city to construct and operate a central steam heating plant capable of supplying steam heat and power to large buildings in the city. The suggestion will be brought before the City Council.

General Forgings and Stampings Limited, Merritton, Ont., whose new forging plant has been in operation about one year, report that in addition to a seasonable activity in motor car parts, a more diversified general demand is developing, indicating a more progressive industrial growth.

A reflection of the activity in general building operations is seen in the better demand for pipe fittings. International Malleable Iron Co., Guelph, report improvement also in the export market for this line. This company is now employing 250 hands 5 days a week in their foundry and machine shop.

The Parker Motor Car Co., of Montreal have made delivery of their show and demonstration cars to most of their dealers. Operations are going on rapidly at the factory and it is expected that work on a production basis will be in full swing the middle of June. The company is opening up a show room in Phillips Square.

The contract for the masonry, brick and carpentry work for the main building of the civic hospital has been awarded to A. L. Garvock at a figure of $220,884. Tenders for the plumbing, heating, wiring and ventilating will be received up to May 25, for the power house up to May 30 and for the service building up to June 1.

A better demand for taps, dies, gauges and various lines of small tools is reported from some quarters. The Greenfield Tap and Die Co., Galt, say that recent orders indicate a much more encouraging buying tendency and in larger lots. It is interesting that some of these are coming from the Maritime Provinces, when in March the outlook was anything but bright.

The copper output last year in British Columbia was about 39,037,000 pounds, which was nearly 6,000,000 pounds less than in 1920. The corresponding values were $4,879,624 for 1921 and $7,832,899 for 1920. The production of lead amounted to 41,402,288 pounds, an increase in volume of 2,071,070 pounds. Zinc produced was nearly 50,000,000, valued at about $2,000,000.

What is said to be the largest single shipment of freight for any individual automobile factory in Canada, consisting of 304 cars, valued at $350,000, left Oshawa for the Atlantic seaboard, to be re-shipped to foreign ports, including Constantinople, Egypt and New Zealand. The shipment, which represents a little less than two days output, was made by the General Motors, Ltd.

The gypsum areas at Iona, N. S. owned by the Iona Gypsum Co., have been sold at sheriff's sale at Baddeck under foreclosure of a mortgage of $50,000 held by the Montreal Trust Co. The claims were purchased by C. A. Mitchell, of New Glasgow, and associates in that town. The property was knocked down for $10,000. The Iona Company ceased working the property last December.

The Manley Co., York, Pa., manufacturers of labor-saving garage equipment, such as wrecking and underworker cranes, work benches, jacks, presses, etc., have made an arrangement with the L. and P. Manufacturing Co., Niagara Falls, Ont., for the production of their line in Canada. The Canadian Manley Co., will have their head office in Toronto. A. H. Fraser, formerly of Winnipeg will have charge.

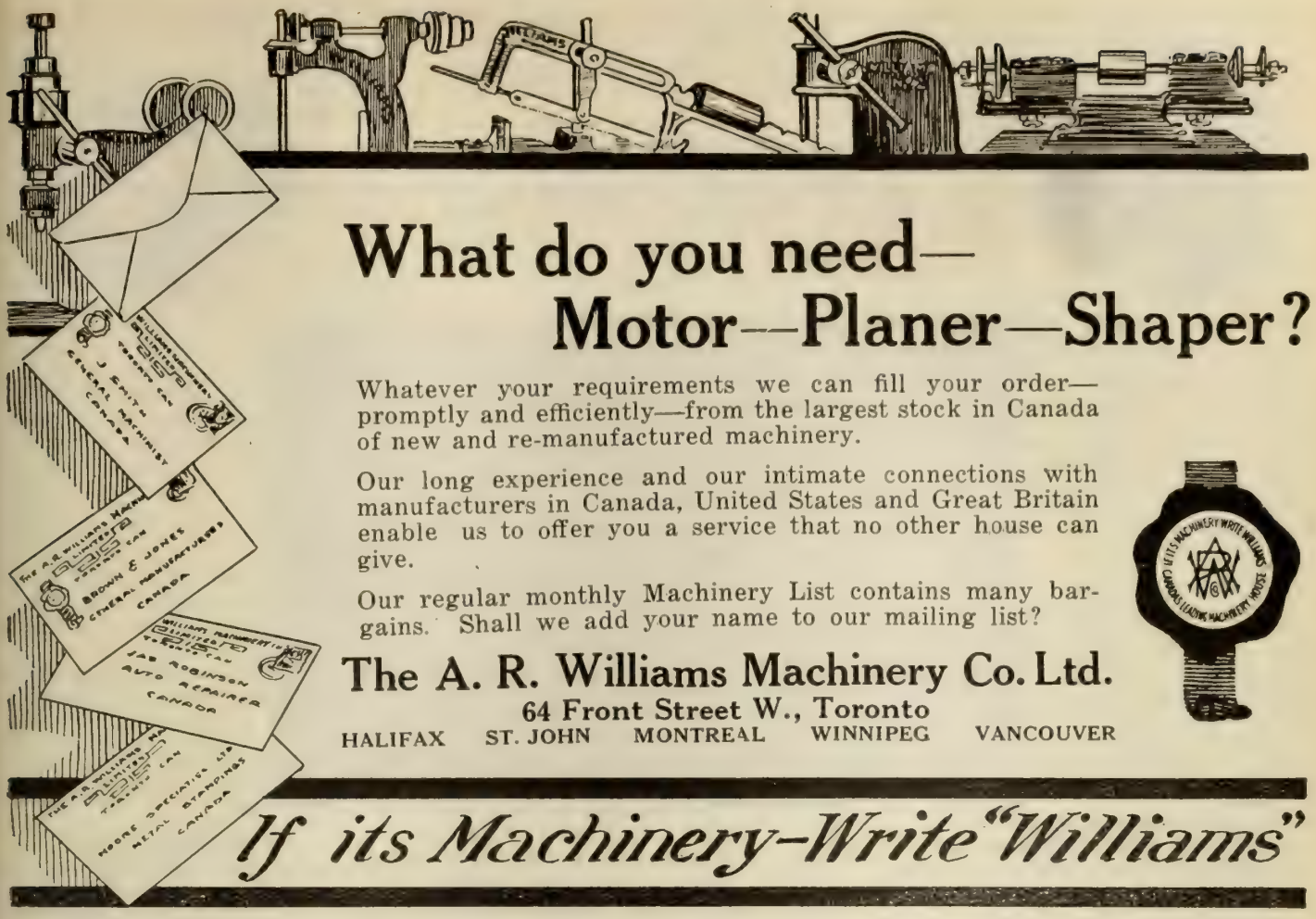
A number of independent steel companies in the States are negotiating with a view of forming an amalgamation of their various interests. Among the firms mentioned are the Midvale Steel and Ordnance Co., the Republican Iron and Steel Co., Lackawanna Steel Co., Youngstown Sheet and Tube Co., Inland Steel Co., Prier Steel Co., and the Steel and Tube Co., of America. The aggregate capital of the Merger would be close to one billion dollars.

A made-in-Guelph exhibition is being held in the Armouries there this week. A very creditable display includes wood and metal working machinery lawn mowers, hardware line, pipe fittings and other products of the foundry, barn equipment and agricultural implements, stoves and furnaces, carpets, linens, women's wear, men's hats, incandescent lamps, pianos and organs, gasoline engines, metal products of various kinds and bacon and pork products.

The Public School Board has approved the recommendation of the building committee that the bulk tenders of the Gilmour Construction company for all trades in the erection of the proposed additions to Cambridge school for $27,297 and for the additions to Glashan school for $34,302.32 be accepted. Authority was given for the calling of tenders for the erection of an administration building at the corner of Gilmour and O'Connor streets, and for an addition to the Kent street school as soon as plans and specifications are ready.

Joseph T. Ryerson and Son, Chicago, announces that Paul H. Peterson, who has been associated with their foreign department for the past six years, will hereafter act as manager of exports. Mr. Peterson will be permanently located at their New York office and H. B. Krant, the previous manager of exports will hereafter act as technical manager of the machinery department. This change is made with the idea of giving the best possible service to the trade. All communications in connection with machinery and steel exports should be addressed to 30 Church St., New York, and the new cable address will now be "Ryson" New York. Several new developments and improvements in design of their lines have been completed recently.

These are the days when municipalities are releasing contracts to local foundries for manhole covers and catch basins. In Galt a considerable stretch of new sewer is being laid, and the contract for castings was let to the Galt Foundry Co., at $2.87 per hundred lbs. There is not a great variation in this figure among other Ontario towns and cities this year, whereas in the piping days of boom the price in some instances ran as high as $8. Of course, material and labor were then comparatively high. While there is not a great deal in it for foundries at present figures, such a contract very often enables them to run their heats with some regularity and thus take on other work which might have to wait or go elsewhere, sometimes to a neighboring town.



What do you need— Motor—Planer—Shaper?

Whatever your requirements we can fill your order—promptly and efficiently—from the largest stock in Canada of new and re-manufactured machinery.

Our long experience and our intimate connections with manufacturers in Canada, United States and Great Britain enable us to offer you a service that no other house can give.

Our regular monthly Machinery List contains many bargains. Shall we add your name to our mailing list?

The A. R. Williams Machinery Co. Ltd.

64 Front Street W., Toronto

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

Don't Keep It--Sell It!

If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
an engine
a compressor

or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

CANADIAN MACHINERY

Classified Advertising Section

143-153 University Avenue TORONTO, ONT.

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

Emery
Glass
Flint
Garnet
Corundum
Carborundum

Paper and Cloth

In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

JOHN OAKEY & SONS

LIMITED

WELLINGTON MILLS
LONDON, S.E. 1, ENGLAND

AGENTS

John R. Anderson
36-38 St. Dizier St., Montreal

Sturgeons, Ltd.
64-66 Richmond St. E., Toronto

Frank Manley
290 McDermott Ave. W., Winnipeg

Sankey & Manson
839 Beatty St., Vancouver

Contracts were recently awarded for the erection of a four room addition to Ogden St. school in Fort William; also a new eight room school at Crawford Ave., the aggregate cost to be about $100,000.

The power plant and tipple of the Callic Mine at Drumheller, Alta., belonging to the Drumheller Land Co., was destroyed last week by fire, with a loss of $125,000.

The W. H. Yates Construction Co., of Hamilton, Ont., have secured the contract for the erection of the new Collegiate Institute and Vocational School at St. Catharines, Ont., the cost to be approximately $420,000.

Announcement has been made that the Shell Oil interests, refiners of oil and gas, with headquarters in Amsterdam, are negotiating for a site in Halifax with the intention of establishing a modern refining plant.

R. P. Ross and Co., Sudbury, Ont., have secured on behalf of the Standard Steel Construction Co., contracts for all the structural steel, for the new separate school, new parish hall and the Laberge Office Building, Sudbury, Ont.

The Hochelaga Cement Co., of Montreal are planning to erect a plant on their property in Montreal East, the capacity of which will be about 2,500 bbls. of cement per day. They will also provide for additional expansion.

The largest single shipment of shingles and copper to leave the port of Vancouver, B. C., went forward on the steamer Melville Dollar for New York a couple of weeks ago. It consisted of 2,500 tons of copper and about 20,000,000 shingles.

A new hydro-electric plant will be constructed this summer at Anyox, B. C. by the Granby Mining and Smelting Co. The cost will be about $500,000. The initial contract for the mammoth water storage dam has been given to Dredging and Construction, Ltd.

The Canadian Ramopo Iron Works, Niagara Falls, Ont., manufacturers of railway switches, crossings, etc., are completing an addition to their storage warehouse. They have just installed a 3½-ton Niles crane, purchased from the John Bertram Co., Dundas, Ont.

The Montreal Bolt and Forging Co., expect to start operations on Monday May 8. The company will produce all kinds of machine, carriage, and other rough finished bolts as well as lag screws, etc. By the end of May all departments will be in operation.

A record has been established at the plant of the Algoma Steel Corporation at Sault Ste Marie, in regard to fatal accidents. It is stated that the past winter has been the first in their history in which no fatality has occurred. A special safety campaign started in October, 1920.

The construction of another large hotel is being considered in Montreal. It is stated that the site selected is in the vicinity of the Windsor Hotel. Plans have been prepared and these call for a main building of ten storeys and two large wings. The value of the hotel will be about $5,000,000.

At a recent meeting of the Toronto Board of Education, the tenders were passed for the construction of the new technical school on Greenwood Ave. The total value of the structure will be $718,719, half of which will be paid by the Provincial Government. The school will be of the most modern type.

By a recent re-organization Wm. Le Bombard retires from the L. and P. Mfg. Co., Niagara Falls. The following new officers have been chosen: President A. W. Patterson: J. E. Kayser, sec.-treas.; Earl Lawson, vice pres. These officers are all actively identified with the operation of the company's foundry and machine plant.

A report from London, Eng., states that the General Motors, Ltd., are establishing new works at Hendon, where they intend to assemble the Buick, Chevrolet, Oldsmobile and Oakland cars. These cars are manufactured from Canadian labor. The General Motors are also carrying stock of spares at Hendon valued at over $500,000.

A movement has been started in the United States, under the direction of Mr. Hoover, by the leading Engineering Societies of the country, to survey industrial conditions and ascertain "what steps have been taken to smooth out the business cycle." The present survey, which has just been inaugurated, represents an extension of the program of public service carried out by Mr. Hoover when he was president of the Engineering Federation, and which his successor, Dean Cooley, aided by a group of prominent engineers, educators and economists, is now carrying on.

Hermas Deslauriers of St. Mary, Montreal, is again making inquiries at Ottawa into the charge made in regard to the Aluminum Company of America using power from the Cedars Rapids. It is stated that this company has not paid any taxes on the power which it takes from this Canadian source and uses in the United States. The question was also asked if this company paid any license fee. If no contribution to the coffers of the Dominion of Canada has been made, it is rightly asked why this firm is exempted from the law in regard to the export of power.

John D. Mantion, of Ottawa, inventor of match making machinery, claims that he has put to a final test a new match making machine that will eclipse all others of its kind. One year ago Mr. Mantion gave a demonstration in Nelson B. C. of his machine as originally devised, and states that it gave a result of 20,000 matches per minute. Since that time he claims that he has improved the machine 100 per cent. and that it now gives 40,000 matches per minute. He states also that the machine points the end of the match and that it is the only machine doing so. Six different grades of lumber in their green condition may be used with this system. It is further stated by Mr. Mantion that he has patented a devise for saw match blocks which will cut 130,000 blocks in nine hours with four men operating the machine. This machine cuts 100 matches out of a block.

Imminence of a building boom in the Capital is further indicated by building permits issued at the City Hall during the past month. For the month of April alone these permits numbered 162 and represented new construction to the value of $905,810, which contrasts very favorably with the corresponding month in 1921 when the figures were 82 permits, the total value of which reached only $593,925. For the first four months of the year permits issued number 272, representing $1,149,945; in 1921 the figures for this period were 149 permits, value $759,235. April 1922 both from the standpoint of permits issued and the estimated value of contemplated construction surpasses by a wide margin any building program that has been attempted in Ottawa for a number of years.

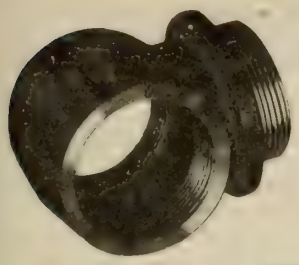
The permit for the new Collegiate Institute was the largest individual permit issued during last month. The estimated cost of the work is shown as $303,000. Next in magnitude comes the addition to the Ottawa University which is to cost $150,000.

NEW BRIDGE PLANT

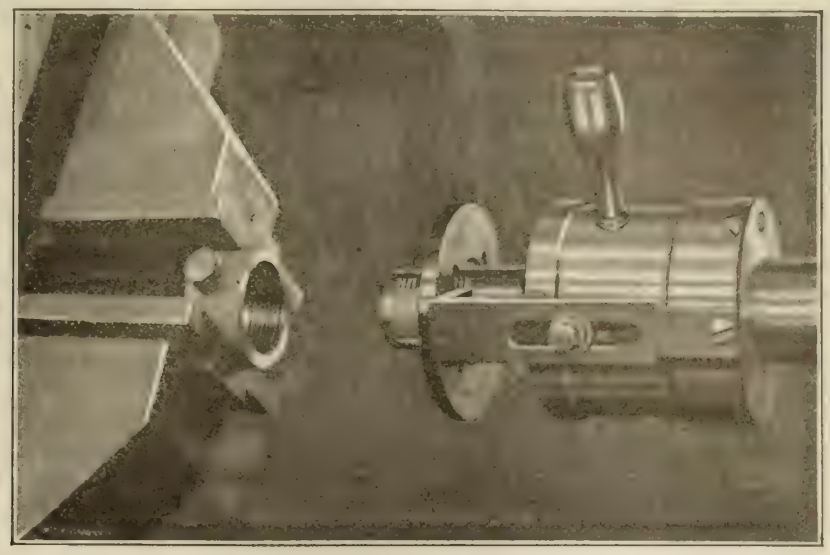
Ground is being broken for the new plant of the London Bridge Works, London, Ont., which will be of modern steel fireproof construction throughout and equipped with the latest machinery for the production of steel structures of all kinds, chiefly bridges and buildings. This plant will be built on an improved factory site formerly owned by the Dominion Canners, located just off Dundas Road on the Grand Trunk Railway, consisting of about three acres, which will give them ample space for the time being. In conjunction with the regular business of fabricating steel, an extensive warehouse will be built and equipped for the distribution of iron and steel products of all kinds, including steel plates, structural shapes, iron and steel bars, black and galvanized sheets, etc. The plant and warehouse, when completed, will fill the long felt want in this part of the province and will render a much needed service to builders and contractors in the district.

The company is incorporated under the Ontario Companies' Act with $100,000, capital and the officers and directors are as follows:—president, T. J. Dillon, Welland, Ont., president of the Standard Steel Construction Co., vice-president, Geo. M. Reid, London, Ont. Directors Philip Pocock, London, Ont., E. S. Little, London, Ont., Col. I. Leonard, London, Ont., C. J. Madgett, Welland, Ont., F. C. Baker, Welland, Ont. C. J. Madgett, formerly assistant general manager of the Standard Steel Construction Co., of Welland, will take up permanent residence in London and be the general manager.

50 Per Cent. More Work With a Geometric Collapsing Tap Than With a Solid Tap







Anyone familiar with thread tapping knows what backing out a solid tap each time means. All the expense and annoyance of tapping screw threads with a solid tap have been overcome by the Geometric.

Special Taps for Special Jobs.

Standard Taps for Standard Jobs.

No doubt you and Geometric Screw Cutting Tools are not strangers. You may not realize, however, the number of styles that there are and the different classes of work that they are particularly adapted to.

Whatever the need in Screw Cutting, there is a Geometric to take care of it.

Adjustment to correct diameter each time a thread is tapped. Then chasers collapse automatically, leaving the thread clean cut and perfect.

The Chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the Tap as efficient as when new.

GEOMETRIC AUTOMATIC THREADING TOOLS

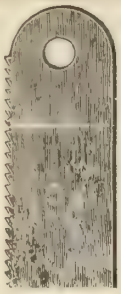
For cutting all classes of Screw Threads, internal or external, of any diameter and form.

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Non-Breaking

Hard Edge
Hack Saw Blades



When you put a Simonds Hard Edge Blade in your Hack Saw Frame you are assured of the maximum of cutting service because these are the blades that cut fast, do not shell teeth and when properly used they are non-breaking.

They are scientifically heat-treated and smoothly finished.

GET SIMONDS HACK SAW BLADES FOR BETTER WORK

SIMONDS

Canada Saw Co., Ltd.

"The Saw Makers"

Montreal, Que.

St. John, N.B. Vancouver, B.C.

Mr. S. S. Shoemaker, representing the Landis Tool Co., Waynesboro, Pa., is on special business in Canada. He is working in conjunction with the F. F. Barber Machinery Co., Toronto, by following up prospective purchasers of Landis equipment.

Brantford, Ont.—The Dominion Dress Goods Co. will erect a new three-story modern factory building, the present premises being found inadequate. As soon as this is completed, double the present staff will be employed. 150 are engaged at the present time.

Sarnia, Ont.—The ratepayers in Sarnia have voted a special assessment of $300,000 for the Dominion Alloy Steel Corporation, also a by-law for expenditure of $40,000 on improvements to present fire department. Officials of the Steel Corporation say that the first sod of the new factory will likely be turned sometime in June. The plant will occupy about 400 acres.

Advices from Point Edward, the distributing point of iron ore, state that a distinct revival in the ore industry can be looked forward to. Many boats are being chartered. Last year but 3,000,000 tons of ore were transported down the lakes, as compared with 56,000,000 the previous year. The record of two years ago is expected to be equaled this year.

Russian exports for January, amounted to $1,250,000, the goods being made up chiefly of oil products, flax, hemp and furs. The shipments went mostly to England, Latvia and Esthonia, a small part being sent to America. The imports for the same month amounted to 88,710 tons, valued at $11,400,000, this being exclusive of the food taken into the country by the several relief organizations. The imports show an increase of nearly six times as compared with January, 1921. The bulk of the imports came from Germany, with England next, then Latvia, the United States and Esthonia in the order named.

Dunnville, Ont.—Contracts for the new waterworks have now been awarded. Following are the firms who have secured work on this project. The Canadian Engineering & Contracting Co. of Hamilton will build the sedimentation basin, 25x60 feet, also the filter. The Arthur S. Leitch Co., Toronto, has the contract to supply the Roberts filter equipment. The Turbine Equipment Co. Toronto, will supply the pumping equipment, and when completed, the system will have a 40-horsepower service pump, pumping 750 gallons a minute.

ASBESTOS INDUSTRY

A protest and a warning against the suggested embargo on the export of raw asbestos from Canada was made at the annual meeting of the Asbestos Corporation of Canada by the president, W. G. Ross. Such suggestions, he declared, were ill-advised and ignorant, and he added that if such "foolish policies" were adopted it would sound the "death knell of the asbestos mining industry of the province of Quebec," for the reason that if such a policy were adopted the world supply of raw asbestos would come from Rhodesia, Russia and the United States itself, and Canada would mine only sufficient to supply such small proportion for her own needs that no mine could operate profitably. He added that at present approximately one per cent. of what is mined would supply the Canadian consumption. Nor could she sell, if she did manufacture, practically anything outside of her own territory.

LIGHT MACHINE TOOLS SHOW BETTER DEMAND

UPON information furnished by his head office in London, England, F. W. Field, H. M. trade commissioner at Toronto tells us that the heavier engineering trades continue to show some improvement in business especially with regard to export trade. The brighter spots of activity are in the locomotive industry, certain sections of the automobile trade, and in textile machinery. There are in addition other less prominent industries which appear to be doing well at the present time.

The Export Credits Scheme instituted by the British Government for the encouragement of export trade appears to be making great headway in the engineering trades and it is reported that a large number of firms are taking up under this scheme contracts which would otherwise prove unattractive.

A feature of the export trade has been the tendency of prices as between the leading manufacturing countries to converge to a common level, and it is generally anticipated that before very long the prospect of meeting competition from countries where the currency has depreciated will be much enhanced.

Light Machine Tools

Several things draw attention to the capacity of the United Kingdom for turning out light machine tools. This description does not refer so much to machine tools of accepted sizes and patterns designed on less heavy lines, but to machines for making small articles and articles requiring great accuracy of workmanship. The British light tool industry, therefore, falls naturally into two classes, the first dealing with tools used in model making and similar small work, and the second with tools used for making small gauges and similar work of high precision.

With regard to the former a great fillip has been given to trade by a recent exhibition in London dealing with model engineering. This exhibition was uncomfortably crowded from the time of opening until the doors finally closed and the number of orders taken was surprisingly high. There is an undoubted demand for small engineering appliances both for the home trade and for export and the prospect of an annual exhibition of this type is viewed with favour in many quarters.

YOU CANNOT AFFORD TO OVERLOOK LOOKING OVER THIS LIST

GARLOCK MACHINERY'S LIST

of Metal Working Machines in Stock for Immediate Shipment. Prices Right.

SHAPERS

No.
653 1 McGregor-Gourlay 24" Shaper, complete.
1 Rae 16" Shaper.

MILLING MACHINES

671 1 Briggs, Type A, 22" traverse Manufacturing Miller.
2089, 1050, 1062, 3 Chicago Pedestal type, Hand Millers.
2088, 2088A, 618 3 Standard Pedestal Type Hand Millers.
1061 1 Garvin No. 2 Pedestal Type Hand Millers.
1072 1 Barber-Coleman No. 3 Tread Miller.
2075, 2086 11 Burke No. 1 Hand Millers, bench type, table 12 x 31½.
2087 1 Toledo Hand Miller, table 23" x 5".
876 1 Plain Dividing Head for No. 3 Miller.
1055, 1056 2 Pratt & Whitney 4½" x 12" Thread Miller with C/S.
642 1 Castellating Attachment for Miller.

BENCH LATHES

1029 1 Hardinge (Cataract) 7" x 32" Bench Lathe with head and tailstock, compound rest, plain rest.
734 1 Hardinge (Cataract) 7" x 32" Bench Lathe, with head and tailstock, compound rest, plain rest chasing attachment.

PRODUCTION LATHES

2005, 2012 8 Leblonde 17" x 8' Heavy Duty with C/S.
1098, 2004 6 Leblonde 17" x 6' Heavy Duty with C/S.
2013, 2016 3 Leblonde 17" x 6" Rapid Production with C/S.
2017 1 Reed 14" x 6" Extra Heavy Duty with C/S.

HACK SAWS

661 1 Peerless 6" x 6".
951 1 Perfect No. 3 6" x 6".
881 1 Millers' Falls 6" x 6".
1 Racine No. 1 Hack Saw.

TURRET LATHES

1036 1 Small Foster-Kimball C/S.
1031, 1040 4 No. 3 Foster, capacity 1 5/8 in. spindle C/S.
1041, 1043 3 No. 2 Foster, capacity 1 1/16 in. Spindle C/S.
2023, 2043 20 16" x 16" Bliss Heavy Duty.
2044, 2054 10 No. 2 Foster with round turret, capacity 1 1/16 in. spindle, C/S.
2055, 2058 3 No. 3 Foster with round turret, back geared capacity, 1⅝ in. spindle, C/S.
2061, 2065 4 No. 3 Foster with hexagon, turret, back geared, capacity 1⅝ in. spindle C/S.
2065 1 J. & L. 15" Turret, round turret, 1¼" hollow spindle.
2067 1 16" x 6' McGregor-Gourlay Turret Lathe.
2068 1 18" x 6' McGregor-Gourlay Turret Lathe.
2069 1 20" x No. 4 Bullard with hexagon turret.
2070, 2070a 2 16" Warner & Swasey Geared Head.
2073 1 17" x 6" Davis Lathe with round turret.
819 1 Oliver 18" Turret with C/S.
818 1 B. & O. 16" Turret with C/S.
815, 816 3 Davis 24" Turret Lathes with power cross feed.
1 Warner-Swasey Turret Lathe No. 6.

GRINDERS

590 1 Bench Type Double End, two stop cone pulley on spindle, no C/S.
1079 1 Wells Toolroom Grinder.
1067 1 Bench Type Double End, single pulley on spindle no C/S.
1069 1 Gardner No. 24 Grinder.
1070 1 Double End Emery Grinder on pedestal, two step cone pulley on spindle, 1" dia. spindle, C/S.
2109, 2110, 2 Perfect No. 6 pedestal Grinders.
2117 1 Sellers 5/16 x 3" Drill Grinder.

GRINDERS—(Cont'd)

898 1 Lafayette Universal Motor Driven Tool Grinder for lathe work.
1064 1 Symington Plain Grinder C/S.

GAP LATHES

656 1 C.M.C. 20" x 38" x 12' D.B.G., Q.C.G. face plate chuck C/S.

DRILLS

1 Reed Four Spindle Drill Press.
1048 1 Barnes 15" Sensitive.
1065 1 Perfect 14" Sensitive.
1066 1 Mechanic's 24" B. G. Drill Press.
1085 1 Perfect 15" Sensitive.
1088 1 Langelier 10" Bench Type with C/S.
1096 1 Ford Smith 22" Back Geared Drill Press.
954 1 Edlund 15" High Speed Ball Bearing Drill Press.
839 1 Fosdick No. 2½ Radial Drill.
675 2 Woodward 4 Spindle Drill Presses.
1 Rockwell 20" B.G. Drill Press.

SCREW MACHINES

1057, 1058, 1059, 3 Acme No. 55 4 Spindle Automatics.
1093, 1094 2 Garvin No. 1 Wire Feed C/S.
2071, 2072, 2 Warner & Swasey No. 6 with geared head, automatic chuck C/S.
1018 1 Warner-Swasey No. 1 Screw Machine.

ENGINE LATHES

1047 1 Cincinnati 16" x 8' D.B.G. screw feed, chuck, 2 face plated C/S.
1073 1 L'Blonde 17" x 6" S.B.G., Q.C.G. rapid production rod feed, chuck, face plate, C/S.
1038 1 13" x 5" Lathe Chuck face plate and C/S not screw cutting.
1078 1 Lodge & Shipley 14" x 6" S.B.G. Q.C.G. chuck, face plates, C/S.
1081 1 Leblonde 16" x 6' S.B.G. Q.C.G. chuck, face plates, Screw Feed, C/S.
1082 1 Hamilton 16" x 8' S.B.G. Q.C.G. screw feed chuck, face plates, C/S.
2018 1 Stevens 16" x 6' Engine Lathe screw cutting C/S.
2019 1 McGregor-Gourlay 16" x 7" Engine Lathe, screw cutting C/S.
2020 1 Stevens 16 x 8 Engine Lathe, screw cutting C/S.
2021 1 Stevens 18 x 8 Engine Lathe, screw cutting C/S.
2022 1 Lodge & Davis 18" x 8' Screw cuttings with C/S.
812 1 Putnam 36 x 18" S.B.G. Screw cutting, face plates C/S.
809 1 McGregor Gourlay 18" x 12" S.B.G. face plate C/S.
810 1 McKechnie-Bertram 20" x 10'. S.B.G., face plates C/S.
666 1 Rae 18" x 8" D.B.G. Q.C.G. face plate C/S.
1 Cincinnati 18 x 8 D.B.G. screw feed, Q.C.G. chuck, face plate, C/S.
639, 643, 646, 3 Speed Lathes.

BUFFING MACHINES

051-3, 3 Perfect 36" Pedestal Type 1¼ Spindle.
627 1 24" Perfect 36" Pedestal Type 1" Spindle.

TAPPING MACHINES

1063 1 Ricker Schaufer ⅜ Friction feed.
733 1 Burke Bench Type, horizontal ¼" capacity.
602 1 Burke Bench Type horizontal ¾" capacity.

PRESSES, PUNCHES & SHEARS

1035 1 Brown-Boggs No. 90 Kick Press.
944 1 Greenard No. 3½ Arbor Press.
742 1 Niagara No. 3 Arbor Press, pedestal type.
741 1 Niagara No. 3½ Arbor Press, pedestal type.
822 1 Stiles No. 172 Punch Press.
1020 1 Bench Type Punch.
1021 1 Bench Type Shear.
2108 1 Toledo No. 57½ Back Geared Power Press, 4 tee rods, 12" stroke, 140 tons cap, 6" Crank shaft, 24½" between uprights weighs approximately 35,000 lbs. Also a number of Bliss Inclinable Presses.

BLOWERS

A number of Buffalo, Sheldon, Soot Blowers of varying sizes and capacities.

PUMPS, ACCUMULATORS

831 1 Vertical 2 plunger, hydraulic 2½" dia x 6" stroke 1¼ inlet and d. charge.
813 1 Northey Duplex, 6" x 4" x 7".
780 1 Goldie McCulloch, 2" suction 1½" discharge.
799 1 Smart-Turner 4½" x 2¾" x 6".
2090 1 West Tire, No. 3, 2 cylinder plunger pump.
2091 1 Gould Triplex Plunger Pump.
2092 1 Perrin Triplex Plunger Pump
2093 1 Small Size Two Plunger Pump.
2119 1 Hydraulic Accumulator, 6 x 8 ram, capacity 10 Imperial Gallons, 1500 lbs.
2137 A number of lubricating pumps for use on Lathes, etc.

MOTORS AND ELECTRICAL EQUIPMENT

1031 1 Lincoln 20 H.P. 3 phase, 60 cycle, 220 volts. 1200 r.p.m. with base and pulley.
660 1 To. and Ham. 12 H.P. 3 phase, 25 cycle, 220 volts 1500 r.p.m. with base and pulley no starter.
634 1 Can. Allis-Chalmers 5 H.P. 3 phase, 60 cy. 550 volts 1200 r.p.m. with base and pulley.
1090 1 Chapman Walker 20 H.P. 3 ph. 25 cy. 550 volts with base and pulley.
2096 1 Robins & Myers ½ H.P. 1 ph. 25 cy. 110 volts.
2097 1 Westinghouse 50 H.P. 3 phase, 25 cy. 550 volts with base and pulley.
2096 1 Chapman Walker 40 H.P. 3 ph. 25 cy. 550 volts with base and pulley. 750 r. p. m.
1 Westinghouse 35 h.p. motor, 3 ph. 25 cy., 550 volts, with base and pulley.

MISCELLANEOUS

2099, 2102, 3 Strong-Carlisle-Hammond Continuous Annealing Furnaces, 22" long x 3" x 2½" opening.
2103 3 Strong, Carlisle-Hammond Furnaces
2106 forheating drop forge work.
2127 1 Brown Pyrometer 2000 Fahr.
2153 2 Southwark Hydraulic Physical Test-
2154 ing Presses, 2000 lbs. per sq. in. pressure, 2 column type fitted with intensifier ram, revolving table guard and suitable drain basin, mounted on pedestal and arranged for single lever control.
2155 Metalwood Hydraulic Testing Press similar to above.
1032 1 Jardine No. 50 Power Hammer.
1019 2 Sand Riddles.
946 1 Bellevue Oil Furnace.
888 1 Gas Furnace, 12" x 15" x 8" two burners, size of door opening 1"x8".
841 1 One-ton Portable Crane.
840 1 Two-ton Portable Crane.
689 1 Gas Furnace 18 x 11½ x 8" 2 burners, door opening 10 x 8.
2113 2 Bertram Stenciling Machines
2114 Steel.
2115 1 Holden Morgan Stenciling Machine.
2116 1 Burring Machine.
2118 1 Four pt. tapalog complete (Wilson-Maulin.)
2121 3 Brantford Counter Scales.
2123, 2124, 2125, 2 LeVilbiss No. 13 S.M. 152 Internal Varnishing machines.
Quantity of Wood Split, Steel Split Pulleys, Hangers, Belting, various sizes.
1 Blacksmith Forge.
1 small Anvil.
1 Barrett 15 ton jack.
1 Garvin No. 1 Slotter.

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Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

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BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (etfm)

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IF YOU ARE LOOKING FOR A HIGH-GRADE firm to handle through the hardware jobbers and consuming trade throughout the Dominion, write us. It will be worth your while to investigate the special features of our marketing proposition. We know what co-operation means. Write to Box 860T., Canadian Machinery.

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

FOR SALE

At Low Price

FORTY TONS BAYONET STEEL 1⅛ x 5-16

Will sell whole or part, write for samples

The

Canada Metal Co. Limited

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Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern Work. Our advice and estimates will save you money. Semi-finishing operations on Lathe or Grill on Castings supplied if required.

ASK US.

THE KATIE FOUNDRY, GALT, ONT.

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Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

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MECHANICAL DRAFTSMAN AND DEsigner desires position, preferably firm where advancement and responsibility is given. Competent chief draftsman with machine shop experience, well educated. Box 810, Canadian Machinery, Toronto. (C.18M.)

MANUFACTURERS' AGENT OPEN TO TAKE on one or two more lines. I call on the Wholesale Jobbers, Wholesale Accessory houses and the large manufacturers. Apply Box 809 Canadian Machinery. (C.15.M.)

MECHANICAL ENGINEER IS OPEN TO consider partnership or interest with manufacturer with a view to producing new high grade lines of engineering equipment. Must have good reputation and manufacturing facilities. Box 808, Canadian Machinery. (C.16M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience, 10 years general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium and heavy work, green and dry sand. Bench, floor and machine molding, melt by analysis, and thoroughly competent on cupola practice. Good reference. Box 804. Canadian Machinery. (C11M.)

FOR SALE

ONE J. & J. TAYLOR SAFE, INSIDE DIMENsions 15 inches deep, 2 feet 6 inches wide, three feet 11½ inches high and fitted with a ouilt in compartment. Price $250.00.

Machinery Wanted

Advertisements under this heading will be inserted once free of charge. Readers are invited to use this department when in need of equipment. Replies may be sent to box number, care of Canadian Machinery, if desired.



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No, we're not shaking hands, but we would like to offer advice.

These columns have sold hundreds of dollars worth of equipment. A large number of men have been paid many times over by using these columns.

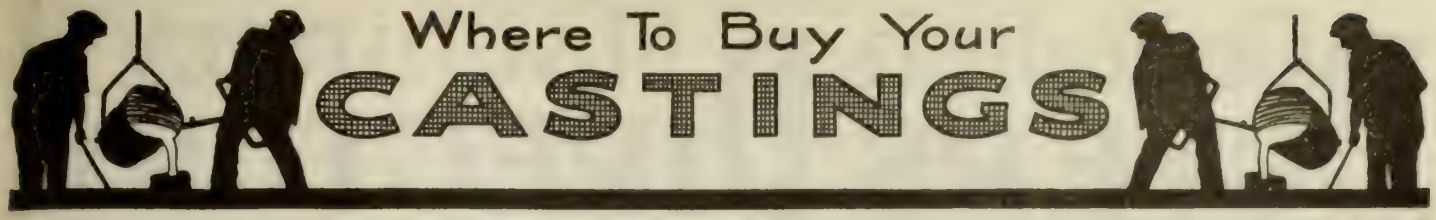
The easiest, quickest and cheapest way to dispose of, or buy new and used equipment.

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149 University Ave., Toronto, Ont

Everything comes to him who waits, but he who does not advertise waits longest.



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Grey Iron.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.,
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Ltd.,
SMITH'S FALLS, ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electro Steel, Ferro-Alloy.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

Abrasive Discs
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John London S.E., Eng.

Abrasive Materials
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E. Eng.

Acetylene, Dissolved
National Electro Products Co., Ltd., Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Angle Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Anvils
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

Anchor Bolts
Steel Co. of Canada, Ltd., Hamilton, Ont.

Arbors
Atkins & Co., Inc., E. C., Indianapolis, I.
Brown & Sharpe Mfg. Co., Providence, R.I
Jacobs Mfg. Co., Hartford, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

Babbitt Metal
Canada Metal Co., Toronto, Ont.

Balls, Brass, Bronze and Steel
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

Barrels, Tumbling
McDougall Co., Ltd., R., Galt, Ont.

Bars, Boring
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Bars, Boring, Portable
Underwood Corp., H. B., Philadelphia,

Bars, Steel
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
United Alloy Steel Corp., Canton, Ohio
Vanadium Alloys Steel, Latrobe, Pa.

Bearings, Ball
Canadian SKF Co., Toronto, Ont.

Bearings, Die-Cast
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Journal
Fisher Motor Co., Ltd., Orillia, Ont.

Bearings, Roller
Can. Fairbanks-Morse Co., Ltd., Montreal.

Belt Cement
McLaren Belting Co., J. C., Montreal, Que.

Belt Dressings and Fillers
Dom. Belting Co., Ltd., Hamilton, Ont.

Belt Fasteners
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

Belt Hooks
Bristol Company, Waterbury, Conn.

Belt Lacing
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

Belt Lacing, Steel
Bristol Company, Waterbury, Conn.

Belt Lacing Machines
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Belting, Chain
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd, Montreal, Que.

Belting, Fabric
Can. Fairbanks-Morse Co., Ltd., Montreal.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

Belting, Leather
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Ltd., Montreal. Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

Bolts and Nuts
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

Bolt Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa

Bolts, Track
Steel Co. of Canada, Ltd., Hamilton, Ont.

Boring and Turning Mills, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Boring, Drilling and Milling Machines, Horizontal
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.

Bronze, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

Castings, Aluminum, Brass, Bronze, Copper, Die-Molded, Ferro-Alloy,

Iron, Semi-Steel, Steel.
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Beardmore & Co., Ltd., Wm., Montreal, Que.
Brantford Brass Foundry Co., Brantford, Ont.
Brown-Boggs & Co., Ltd., Hamilton, Ont.
Canada Metal Co., Toronto, Ont.
Can. Hanson & Van Winkle Co., Ltd., Canadian Mead-Morrision Co., Ltd., Montreal, Que., and Toronto, Ont.
Can. Rumley Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Ltd., Toronto, Ont.
Corbet Foundry & Machine Co., Ltd., Owen Sound, Ont.
Dominion Engineering Works, Ltd., Montreal, Que.
Dominion Foundries & Steel, Ltd., Hamilton, Ont.
Eureka Planter Co., Woodstock, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.
Fittings, Limited, Oshawa, Ont.
Galt Malleable Iron Co., Ltd., Galt, Ont.
Hanna & Co., M. A., Cleveland, Ohio.
Hepburn, Limited, John T.
Hull Iron & Steel Foundries, Hull, Que.
International Malleable Iron Co., Galt,
Katie Foundry Co., Galt, Ont.
Kennedy & Sons, Wm., Owen Sound, Ont.
Langley & Austin, Galt, Ont.
Lindsay Foundry & Pattern Works Limited, Lindsay, Ont.
Maxwells, Limited, St. Marys, Ont.
Machinery & Foundries Limited, Brockville, Ont.
McDougall Co., Ltd., R., Galt, Ont.
Miller Bros. & Sons, Ltd., Montreal, Que.
Mitchell Co., Robt., Montreal, Que.
Manitoba Steel Foundries, Ltd., Winnipeg, Man.
Sully Brass Foundry Co., Toronto, Ont.
Ont.
Tallman Brass & Metal, Ltd.
Vessot & Company, S. Joliette, Que.
Wells, W. W., Toronto, Ont.

Chains, Driving
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chasers
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucking Machines
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Chucks, Drill and Tap
Aikenhead Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Magnetic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Chucks, Planer
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Tapping
William I. Procunier, Chicago, Ill.

For list of Dealers see the last page of This Buyers' Directory

Belts, Abrasive
Oakey & Sons, Ltd., John, London, S.E. Eng.

Bending Machines, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Williams Machinery Co., A. R., Toronto, Ont.

Billets, Blooms and Slabs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Blocks
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Chain (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Blocks, Die
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

Blocks, Pillow
Can. Link-Belt Co., Toronto, Ont.

Blowers
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Boilers, Locomotive
Beardmore & Co., Ltd., Wm., Montreal, Que.
Goldie & McCulloch Co., Ltd., Galt, Ont.

Bolt and Nut Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

Bolt and Nut Machinery, Automatic
National Acme Co., Cleveland, Ohio.

Bucket Carriers, Pivoted
Can. Link-Belt Co., Toronto, Ont.

Buffers
Pryibil Machine Co., New York, N.Y.

Buffing or Polishing Machines (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U.S. Electrical Tool Co., Cincinnati, O

Building Materials
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Burners, Oil and Gas
Rockwell Co., W. S., New York City.

Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Bushings
Fisher Motor Co., Ltd., Orillia, Ont.

Cabinets, Oil
S. F. Bowser & Co., Ltd., Toronto, Ont

Calipers
Brown & Sharpe Mfg. Co., Providence, R.I
Starrett Co., L. S., Athol, Mass.

Cams
Canada Foundries & Forgings Co., Welland, Ont.

Can-Making Machinery (See Sheet Metal Working Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Bliss Co., E. W., Brooklyn, N.Y.

Cements, Iron
Smooth Mfg. Co., Jersey City, N.J.

Centering Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

Chains (See Sprockets and Chains)
Falls, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

Chucks, Drill
Jacobs Mfg. Co., Hartford, Conn.

BUYERS' DIRECTORY

Chucks, Vertical Boring Mill
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Clamps, Machinists'
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Cleaners, Metal, Waste, General
Oakley Chemical Co., New York, N.Y.

Clocks,
Chicago Watchman's Clock Co., Chicago, Ill.

Clocks, Time
Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

Clutches, Friction
Can. Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

Coal and Ash Handling Machinery
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Coal-Storage Systems
Can. Link-Belt Co., Toronto, Ont.

Collars, Shaft or Set
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

Collets
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Compounds, Cleaning
Oakley Chemical Co., New York, N.Y.

Compounds, Cutting, Drilling, Grinding, Screw Cutting
Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Cones, Friction
Norton Co. of Can., Ltd., Hamilton, Ont.

Connecting Rods and Straps
Canada Foundries & Forgings Co., Welland, Ont.

Contract Work
Victoria Foundry Co., Ltd., Ottawa, Ont.

Conveyors and Elevators (See Elevators)
Jones & Glassco, Montreal, Que.

Cotters
Steel Co. of Canada, Ltd., Hamilton, Ont.

Counterbores
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Counters, Revolution
Starrett Co., L. S., Athol, Mass.

Countershafts
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Countersinks
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Couplers, Car and Locomotive
Can. Steel Foundries, Montreal, Que.

Couplings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Couplings, Pipe
Fittings, Limited, Oshawa, Ont.

Couplings, Shaft
Can. Link-Belt Co., Toronto, Ont.

Cranes, Electric
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Cranes, Locomotive
Can. Link-Belt Co., Toronto, Ont

Cranes, Traveling
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia, Pa

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, High Speed
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Milling
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Cutters, Stay Bolt
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Cutters, Thread
Butterfield & Co., Inc., Rock Island, Que.
Landis Machine Co., Inc., Waynesboro, Pa.

Cutting-Off Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago, Ill.

Cutting Oil Filters (See Oil Filtering Systems)
Bowser, S. F., & Co., Ltd., Toronto, Can.

Cutting, Oxy-Hydrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

Dealers, Machinery (See Searchlight Section)
Petrie, Ltd., H. W., Toronto, Ont.

Diamonds, Black and Rough
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond, Carbon and Bortz
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Tools
Can. Desmond-Stephan Co., Hamilton.
Wheel Trueing Tool Co., Windsor, Ont.

Diamond Crossings
Can. Steel Foundries, Montreal, Que.
Ont.

Diamonds, Importers.
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dies, Screw and Thread Cutting
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio.

Dies, Sheet-Metal and Sub-Press (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont
Fisher Motor Co., Ltd., Orillia, Ont.

Dies, Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.

Dies, Self-Opening, Adjustable
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Dies, Threading-Opening
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

Dividing Heads
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago, Ill.

Drafting Materials
American Lead Pencil Co., New York City, N.Y.

Dressers, Grinding Wheel
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Norton Co. of Can., Ltd., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

Dressing Tools.
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ontario.
Wheel Trueing Tool Co., Windsor, Ont.

Drill Holders
Armstrong Bros. Tool Co., Chicago, Ill.

Drilling Machines, Bench
Burke Machine Tool Co., Conneau Ohio.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Electric and Hand
Can. Fairbanks-Morse Co., Ltd., Montreal
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Gang
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drilling Machines, Heavy Duty
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Boring, Drilling and Milling Machines, Horizontal)
Gisholt Machine Co., Madison, Wis.

Drilling Machines, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

Drilling Machines, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

Drilling Machines, Portable
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Radial
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Sensitive
Burke Machine Tool Co., Conneaut, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

Drilling Machines, Turret
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Drilling Machines, Vertical
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Drills, Center
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Combination Centre.
Preston & Schwartz, Galt, Ont.

Drills, High Speed Twist
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Drills, Twist and Flat
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

Drop Forgings
Steel Co. of Canada, Ltd., Hamilton, Ont.

Dust Handling Equipment
Can. Blower & Forge Co., Ltd., Kitchener.

Electrical Instruments
Bristol Co., Waterbury, Conn.

Electrical Supplies
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

Elevating Trucks (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Elevators and Conveyors
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Equipment, Elevator Safety
Jones & Glassco, Montreal, Que.

Emery Wheels (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Norton Co. of Can., Ltd., Hamilton, Ont. Montreal, Canada.

Engines, Capstan
Kennedy & Sons, Wm., Owen Sound, Ont.

Engineers, Mechanical
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

Expanders, Tube
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que.

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Reclofson Elevator Co., Galt, Ont.

BUYERS' DIRECTORY

Fittings, Pipe
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph, Ont.
Fittings, Limited, Oshawa, Ont.

Flexible Shafts
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co. Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Henburn Ltd., John T., Toronto, Ont.

Foundry Equipment
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Thread
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Limited, Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whitan Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ontario.
Henburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd., Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Wheels
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Norton Co. of Can., Ltd., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont.

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Knives, Machine
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que

Knurl Holders
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathe Attachments
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Lathes, Extension and Gap
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Horizontal Turret
Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Relieving
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand
Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand
Blount Co., J. G., Everett, Mass.

Lathes, Spinning
Pryibil Machine Co., P., New York City.

Lathes, Threading
Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Lathes, Wood Turning
Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Linoleum Mill Machinery
Bertrams Ltd., Edinburgh, Scotland

Liquid Air Plants
L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes
Dennis Wire & Iron Works, London, Ont

Lubricants
Oakley Chemical Co., New York, N.Y

Lubricating Systems
Bowser, S. F., & Co., Ltd., Toronto, Can
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Manganese Steel
Can Steel Foundries, Montreal, Que

Mandrels, Expanding
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Mandrels, Solid
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Measuring Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Mechanics' Fine Tools
Lufkin Rule Co., Windsor, Ont.

Metals, Alloy
Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Fisher Motor Co., Ltd., Orillia, Ont

Metal Workers
Parker Co., Charles, Meriden, Conn.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R.I
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence,
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench
Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Vertical
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto Ont.

Motors, Electric
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Nails and Staples
Canada Metal Co., Ltd., Toronto, Ont.

Nipples
Canada Metal Co., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio

Nuts, Finished and Semi-finished
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts (up to 4 in.)
Steel Co. of Canada, Ltd., Hamilton, Ont

Nuts, S.A.E., Plain and Castellated
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que

Oil Filtering and Storage Systems
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Storage Engineers
Bowser, S. F., & Co., Ltd., Toronto, Can

Oil Hole Covers
Can. Winkley Co., Ltd., Windsor, Ont

Oils, Soluble
Brantford Oven & Rack Co., Brantford, Ont.

Oxygen
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can. Fairbanks-Morse Co., Ltd., Montreal
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors
Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patterns, Wood and Metal
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont

Phosphor Tin
Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines
Photostat Corp., Providence, R.I.

Pipe Bending Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia, Pa
Williams Machinery Co., A. R., Toronto

Pipe Cutting and Threading Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Pipe
Canada Metal Co., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

Pipe and Nipple Threading Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Pipe Fitters' Tools
Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads
Landis Machine Co., Inc., Waynesboro, Pa.

Piston-Ring Machines
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planing Machines
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools
Cleveland Pneumatic Tool Co., Toronto Ont.

Polishing and Buffing Machines
J. R. Baxter & Co., Ltd., Montreal, Que.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal

Presses, Foot and Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Presses, Hydraulic
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Stoll Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.

Propellers
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert
American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited Montreal, Que.

BUYERS' DIRECTORY

Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co. Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co. Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co. Ltd., Kitchener.
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co. Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que.

Reamers, Expanding
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Limited, Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto.

Saw Frames and Blades, Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

Screens
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.

Screw Machine Work
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R.I.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
National Acme Co., Montreal, Que.

Screw Plates
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets. O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que.

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steels, Tool
British Empire Steel Co., Montreal, Que.

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont.

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Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que.

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Stud Setters, Self-Opening
Geometric Tool Co., New Haven, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Tachometers
Bristol Co., Waterbury, Conn.

Tanks and Pumps, Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co., Windsor, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwarts, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

Teeth, Dredge Bucket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwarts, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis
Preston & Schwarts, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. B., Toronto, Ont.

Tool Work
Brown Engineering Corp., Ltd., Toronto.

Torches, Blow
National Electro Products, Ltd., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

Trolley Wheels,
Lumley & Austin, Galt, Ont.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Montreal

Unions, Pipe
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

Valves
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ont.

Voltmeters
Bristol Co., Waterbury, Conn.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Toronto, Ont.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products Co., Ltd.,

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Welding Machines, Oxy-Acetylene
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Welding, Electric
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Welding Supplies
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.,

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont.

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, On.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont.

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Shuster Co., F. B., New Haven, Conn.

Wire, Welding
Canada Metal Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Canada Metal Co., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery Co., A. B., Toronto, Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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STYLE HEALD Nº55

REGRINDING HEADLIGHTS

STYLE HEALD Nº65

For Centralized Repair Shops

If you are connected with automobile repair work in any manner such as a small machine shop, welding concern or even a regular garage, you are passing up an excellent opportunity if you do not look into the regrinding of automobile cylinders. Especially is this true if you are in the center of a large number of registered cars, not necessarily in the city but a strategic point in a medium sized town.

It is a new proposition to both repairmen and motor owners but its results are fast becoming known to both and the latter are, in a large percentage of cases, insisting on reground cylinders when overhauling to enable them to get a motor as good as new.

The commission usually allowed to garages is sufficient to make it a worth while proposition for them, especially when they are not in a position to put in the necessary equipment, and by obtaining work from all of these in your working center you will get unusually handsome returns on the investment. Once established you will create a market that now does not exist for there are many owners who do not know of the value of a reground block and still more who do know but neglect having it done owing to the inconvenience of sending the block away.

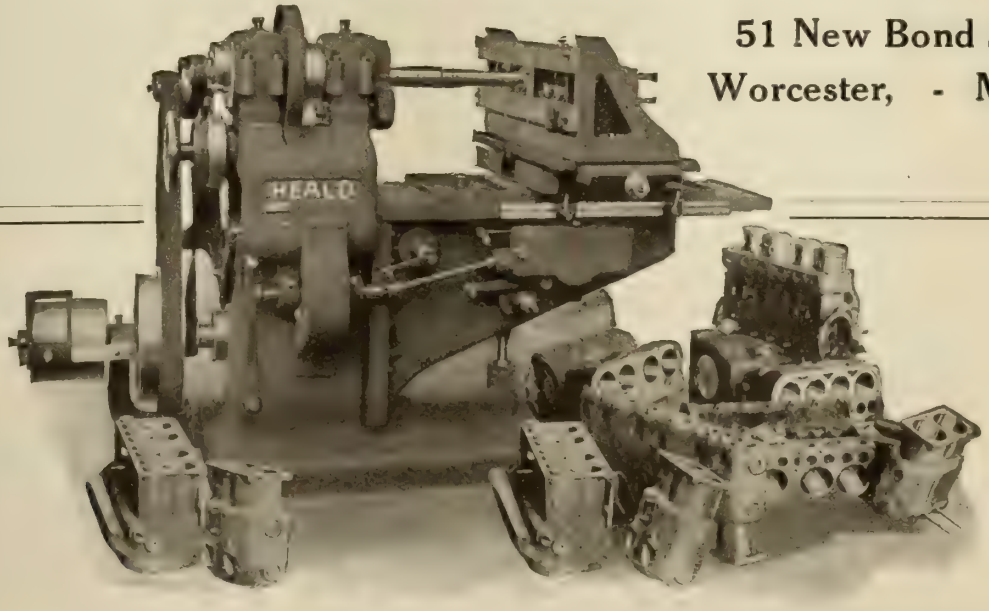
The Heald Style No. 55 was built especially for this class of work, simple, reasonably priced and with a range that will take care of any block that you may have whether it is from a pleasure car, truck, tractor, motorcycle or marine engine. Heald machines are used exclusively by every motor manufacturer that grinds his bores and motor owners who fully appreciate a reground job will insist on having it done on a Heald machine.

We would be glad to talk over the possibilities personally with you, giving you our frank opinion and furnish you with sufficient information to enable you to decide for yourself whether you can make a success of it or not.

Get in touch with us direct or through our branches or agents.

The Heald Machine Co.

51 New Bond St.,
Worcester, - Mass.



Jacobs Super Chuck

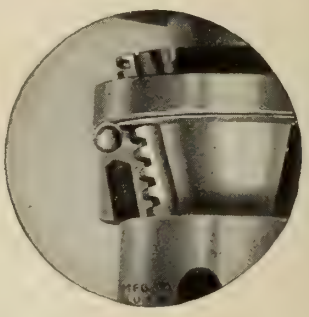


Patented 1909-1915. Other patents pending

A Look Inside

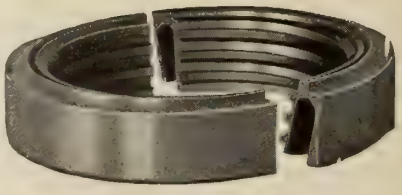
Here are the several parts—carefully designed, exactly fitted, perfectly made—that guarantee the Jacobs Super Chuck to hold a drill tight, to hold it right, and to keep on doing its work indefinitely.











FIRST THE BODY—scientifically casehardened; size limits within .0005", arbor hole ground on a special fixture with six gauges to position it accurately in relation to the hole for the jaw.

THE SLOT FOR THE NUT, correctly located in relation to the jaw holes by means of micrometer gauges, insures a properly fitting thread on the nut and jaws.

NO WEAR ON KEY HOLES because of the deeply casehardened body, result—a well-fitting Gear on Sleeve and Key.

THE JAW, OF TOOL STEEL, has glass hard gripping surface; threads are tough, and all surfaces are ground on centers to within **a quarter of a thousandth** of an inch.

THE NUT, of special analysis steel, is ground after heat-treatment, in correct alignment with thread, tolerance .0005".

THE BALL RACE comes within limits of .0001"; finest grade balls are used. An important point is the pitch of thread on nut—angle is 90 degrees to center line of jaw, so part cannot run over thread of latter.

The Jacobs Super Chuck centers a drill, **accurately,** and will continue to do so after years of use. It saves its cost time and again by preventing drill breakage. Its correct balance preserves bearings of your drilling machine—order a Super Chuck from your dealer.

The Jacobs Manufacturing Company

Hartford, Connecticut, U.S.A.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVII. No. 20 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | May 18, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

ANNOUNCEMENT

GROUND HOBS

NOW

MADE IN CANADA

IT IS no longer necessary to send outside Canada for Ground Hobs—or Hobs of any kind. A large and thoroughly equipped plant has been established by the **Canada Illinois Tools Limited,** at 163-187 Dufferin Street, Toronto, and is ready to take care of all Canadian orders. In this plant Ground Hobs are designed for your requirements and finished complete to your specifications. Made-in-Canada Hobs result in a saving of **time** and **expense** to Canadian buyers.

Engineering Service: Canada Illinois Tools are backed by competent technical service. When a Canadian Manufacturer is confronted with a problem affecting hobs or cutters he is advised to consult our service staff. If necessary we send an engineer right to shop with instructions to stay with the job until the problem is solved.

CANADA ILLINOIS TOOLS LIMITED

Designers and Manufacturers of

CUTTERS - HOBS - REAMERS

163-187 Dufferin Street, TORONTO

Have You Seen These Tools?



DRILL BLOCKS AND CLAMPS No. 278

A recent addition to Starrett sets of drill blocks. These blocks No. 278 are especially made to meet the demand for work requiring V blocks of the highest accuracy. Made of tool steel, with the V's ground central, parallel and square with the ends and sides, and hardened. Set consists of two drill blocks and two clamps. Blocks are 1¼ inches square by 1⅝ inches long. Clamping capacity, 1 inch diameter. Especially recommended for accurate work in connection with drill presses, laying out work, prick punching, milling, grinding, etc. Fully described and illustrated in the new Starrett Catalog No. 223 on page 214. Copy of this catalog sent on request. Write for it.

Every man interested in fine tools should have a copy of the Supplement to the Starrett Catalog. Send for this Supplement showing the latest additions to the Starrett line.

THE L. S. STARRETT COMPANY

The World's Greatest Toolmakers

Manufacturers of Hack Saws Unexcelled

ATHOL, MASS.

42-323

Use Starrett Tools

PRATT & WHITNEY

MILLING CUTTERS

--for better production

High-Speed Steel Milling Cutters, Reamers and End Mills in all standard forms can be supplied from stock and special cutters made to customers' requirements at the shortest notice.

Our "Curvex Cutters"—new formed milling cutters that are spiral fluted and eccentrically relieved—allow the use of a maximum feed and will increase production on form milling from 50 to 100 per cent.

Write to our nearest office for Catalogues and Prices

PRATT & WHITNEY CO.
OF CANADA

MONTREAL
723 Drummond Bldg.

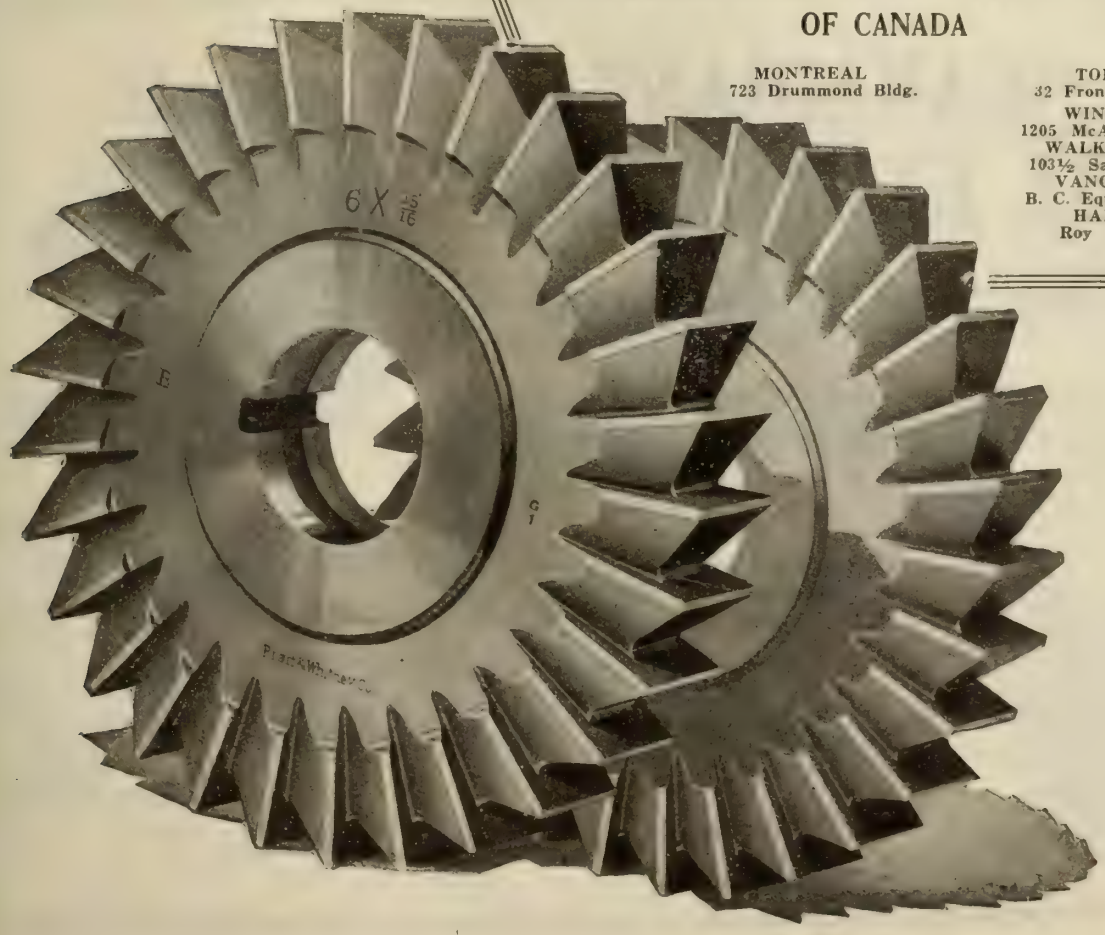
TORONTO
32 Front St., West.

WINNIPEG
1205 McArthur Bldg.

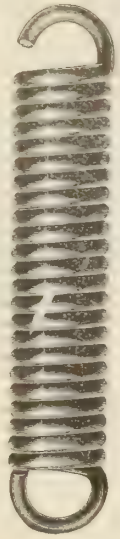
WALKERVILLE
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VANCOUVER
B. C. Equipment Co.

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In Buying Springs—



The Name
"RAYMOND"
Protects You

By always insisting on RAYMOND better-built Springs you get the long service that comes from expert heat treating facilities and modern testing and laboratory equipment. All shapes and sizes of Springs in Carbon Steel, Vanadium Steel Brass and Phosphor Bronze.



Catalogue on request

Raymond Mfg. Co., Ltd.
Corry, Pa., U.S.A.

Buried in the Work and Broke!



Next time a tap breaks below the surface of a large casting, don't let some makeshift method of removing it injure the thread and waste half an hour of valuable production time. Instead—



Walton it Out in a Jiffy

And save the casting.

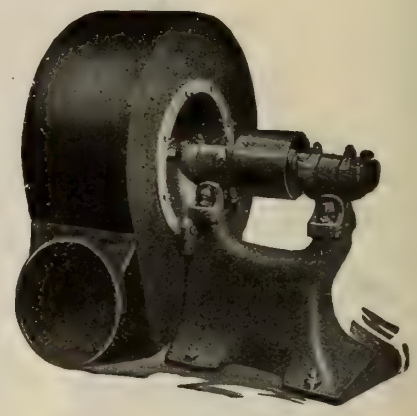
Special analysis steel fingers of the Walton Extractor drop into the flutes of the broken tap—and grip. Then a few turns of a wrench applied to the squared end of the Extractor backs out the buried tap.

Sixty-day trial offer proves the Walton Extractor pays for itself. Write.

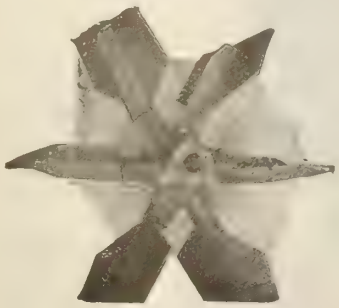
The Walton Co.
Hartford, Conn.

"CANADIAN" MILL EXHAUSTERS

Handle Any Material



The Canadian Standard Mill Exhauster will handle any kind of material efficiently—sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc.

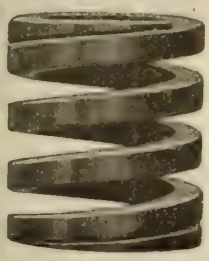


They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

Catalog 410-77—gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co., Ltd.
KITCHENER, ONT.

THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA





Precision Springs

of Highest Grade Materials. Made to Your Specifications.



I made **Harris Heavy Pressure** Bearing Metal before you were born. It will wear out two, three or four other so-called just as good Babbitt Metals, and we only ask a reasonable price—a very cheap one—considering the care, responsibility and service we guarantee.

Send for a box. Its Copper Coat, High Tin and Clean Close Grain will appeal to you. You want advice. Please take this. There is no better all round Babbitt Metal in the world. You would trust us for anything we wanted to buy from you.



Trust us in this

THE CANADA METAL CO., LIMITED

TORONTO WINNIPEG HAMILTON VANCOUVER MONTREAL



MANUFACTURERS OF HIGH GRADE GRINDING WHEELS

"LION" GRINDING WHEELS

Vitrified and Silicate Processes

CANADIAN WHEELS OF QUALITY

ALU-LION
for grinding high tensile material

CARBO-LION
for grinding low tensile material

LION GRINDING WHEELS LIMITED

BROCKVILLE, ONTARIO

Agents for Quebec Province: J. R. BAXTER & CO., LIMITED, MONTREAL

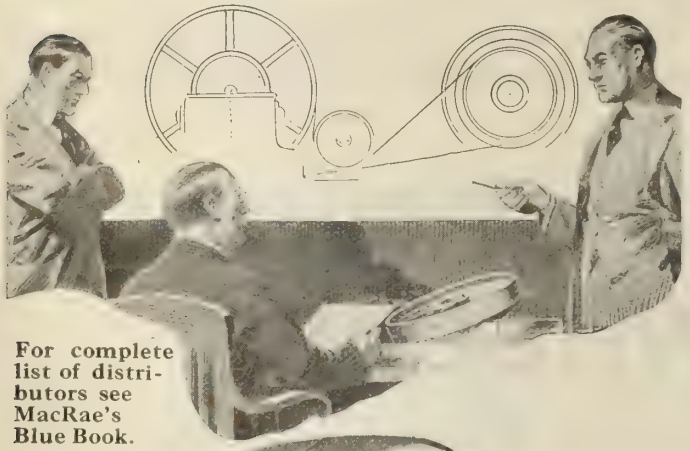
AMERICAN STEEL SPLIT PULLEYS

Let your engineers and ours work together

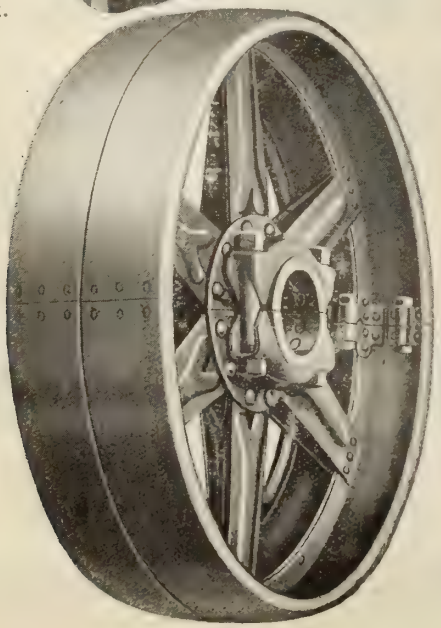
"UNUSUAL" problems in transmission call for unusual pulley service. We are prepared to render that service. Never are we so eager to "sell" as we are to make certain that the "American" Pulley will actually solve a given problem. May we also say that our many years of specialization often enable us to recognize a problem met by us before in what seems to others a new and "unusual" condition.

Service, however, is only one chapter in the story of "American" Pulley success. A book entitled "Getting Maximum Pulley Efficiency" gives the complete account. That book will help you to a greater saving in transmission of power, as it has many others. A copy will be mailed at once, on request.

The American Pulley Co.
Manufacturers of Steel Split Transmission Pulleys, Steel Sash Pulleys and Pressed Steel Shapes
Philadelphia, Pa.



For complete list of distributors see MacRae's Blue Book.



It is just as unreasonable to attempt a filing job with a file that has begun to get dull as it would be to run a machine without oil.

Full service from a file is possible only when the teeth cut keenly.

Discard a file as soon as it ceases to do this, and buy a new one.

To get long-lasting efficiency, specify one of these brands:

Kearney & Foot
Great Western
American
Arcade
Globe

Made in Canada by

Nicholson File Company

Port Hope - Ontario

Kicks from his customers stopped when cleaning methods improved



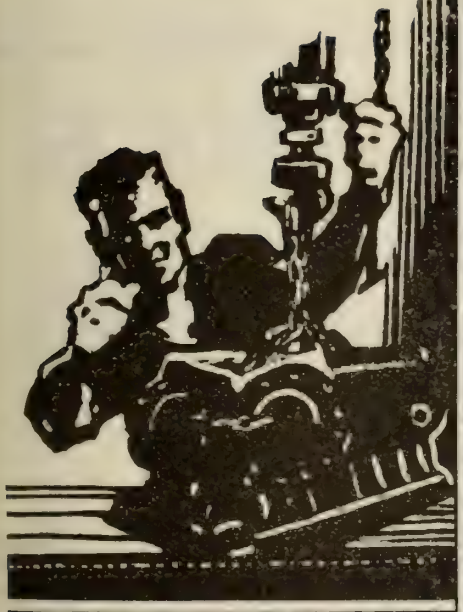
A MANUFACTURER of automobile bumpers met with an increasing number of complaints from motor car owners that the nickel-plating on his bumpers turned rusty soon after purchase. Goods were returned for credit and replacement through trade channels until finally it was found that 21% of the entire output of nickel-plated bumpers was being returned as undesirable and defective.

Naturally this condition seriously affected the favorable reputation the manufacturer had built up through recent years on other auto accessories. Steps were taken to improve matters. Every detail of manufacture was scrutinized. Plating methods were checked and counter-checked. At last the trouble was located. The steel bumpers were not properly cleaned before plating.

In order to insure a chemically clean surface and to neutralize any traces of acid that might remain in the pores of the metal from the pickling operation, they adopted Oakite Platers' Cleaner. The bumpers were then nickel-plated perfectly. Within three months complaints and replacements were practically ended. Labor costs dropped 32% because the work was put through faster and better.

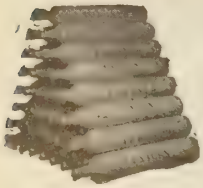
You, too, may be facing complaints about your product that could be traced to wrong methods in the cleaning room. Rejects and replacements often are due to, yet fail to be charged against, improper cleaning.

It incurs no obligation to have a friendly talk with one of our experienced Service Men. Find out what he can do to help you. Out of his broad experience and ability you are sure to get some helpful ideas that will be worth while. Won't you write now?



OAKITE

MANUFACTURED BY OAKLEY CHEMICAL CO. 44 THAMES ST. NEW YORK



OXYGEN AND HYDROGEN
(ELECTROLYTIC)

National Electro Products Limited is the largest manufacturer of Electrolytic (pure) Oxygen and Hydrogen in Canada.

WE PRODUCE GASES EXCLUSIVELY BY ELECTROLYTIC DECOMPOSITION OF WATER. We are, therefore, in a position to furnish Oxygen and Hydrogen far superior to like gases made by any other process.

After Exhaustive Tests We Have Decided to Handle The Well-Known

The Torch for Welders OXYGEN PUROX HYDROGEN Who Want the Best!

WELDING AND CUTTING TORCHES

Our entire organization—technical and sales—is always at your service.

NATIONAL ELECTRO PRODUCTS

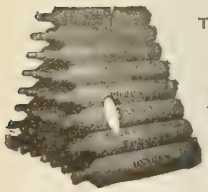
LIMITED

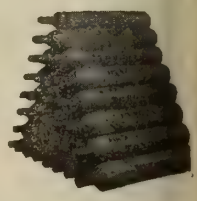
HEAD OFFICE: 80 ADELAIDE STREET EAST, TORONTO

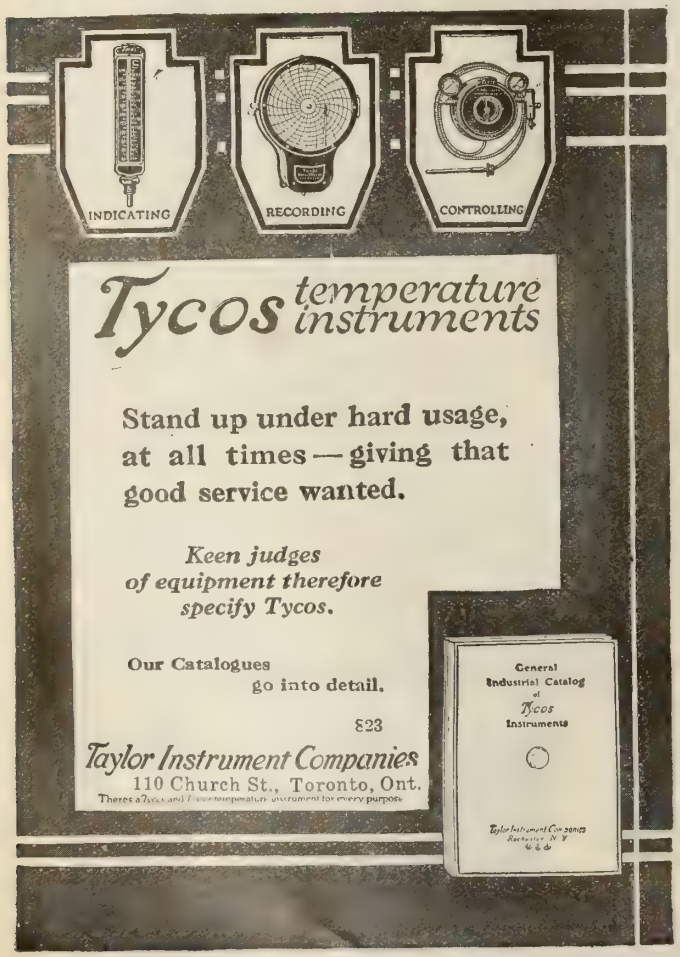
TORONTO SALES OFFICE
80 Adelaide Street East
Main 3167

MONTREAL SALES OFFICE AND FACTORY
149 Moreau Street
Lasalle 508

TORONTO FACTORY
295 Dufferin Street
Park 7656







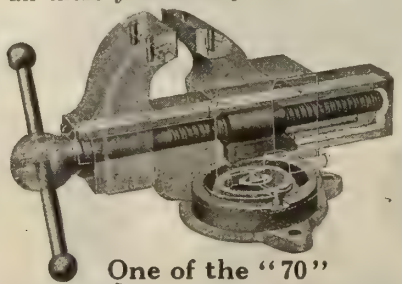
PARKER VISES



Heavier Stronger

They **Grip Like a Grizzly**

A vise may have many improvements, but they are useless if the body of the vise hasn't the stuff in it. Parker Vise bodies are cast in our own foundry from our own time-tested Bessemer Steel and Grey Iron mixture. That is why it has paid to improve Parker Vises all these years—they stand up.



One of the "70"

Write for Folder No. 12

The Charles Parker Co.
Master Vise Makers
Meriden, Conn.
U.S.A.


L'AIR LIQUIDE SOCIETY
Facilities for Service that are unassailable
When you order "Liquid Air" Oxygen or Dissolved Acetylene it is delivered to you at the very time you want it delivered, with no exorbitant costs added for freight or long distance haulage. This is only made possible by "Liquid Air" chain of factories situated at convenient centres all over Canada, operating in conjunction with service stations situated at a point in your own immediate neighborhood.
Wherever your plant or workshop is situated you have a constant supply of Oxygen and Acetylene immediately available and Liquid Air service demonstrators are at your disposal at all times to help and advise you on all matters pertaining to the Oxy-Acetylene Process.
A Coast-wide Service
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Toronto Calgary
Vancouver
LIQUID AIR Co
CANADA

THE JOHNSON FRICTION CLUTCH

As Used on the

TURNER TURRET →

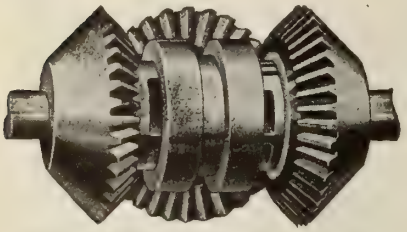


One in the back gears. Another in the tapping reverse.

Size used, No. 5 special double.

"Friction Control" means better machinery.

Courtesy of The Turner Machine Company Danbury, Conn.



Johnson double clutch between bevel gearing.

There is nothing more essential to the efficiency of a machine than a dependable friction clutch. Use the Johnson and take no chances.

Write for our Yellow Catalog and Booklet, "Clutches as Applied to Machine Building"

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER-CONN

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

SHEET METAL WORKING MACHINERY BLISS



"Patented"
Battery of Bliss Automatic Gang Presses in production. Five operations each stroke.

BLISS AUTOMATIC GANG PRESSES

Bliss Automatic Gang Presses in some cases do five operations at each stroke of the press and without handling. This means two things, they secure you economy in production and eliminate danger to the operator. In addition you produce a finished article and do not accumulate quantities from each operation; a saving in floor space.

If you have not looked into this type of press, why not now? It costs nothing to do so and may mean a considerable saving to you.

We build special gang presses for individual requirements.

"For Efficiency and Economy"
"Specify Bliss Presses"
"Standard the World over"

E. W. BLISS CO. MAIN OFFICE AND WORKS BROOKLYN, N.Y., U. S. A.

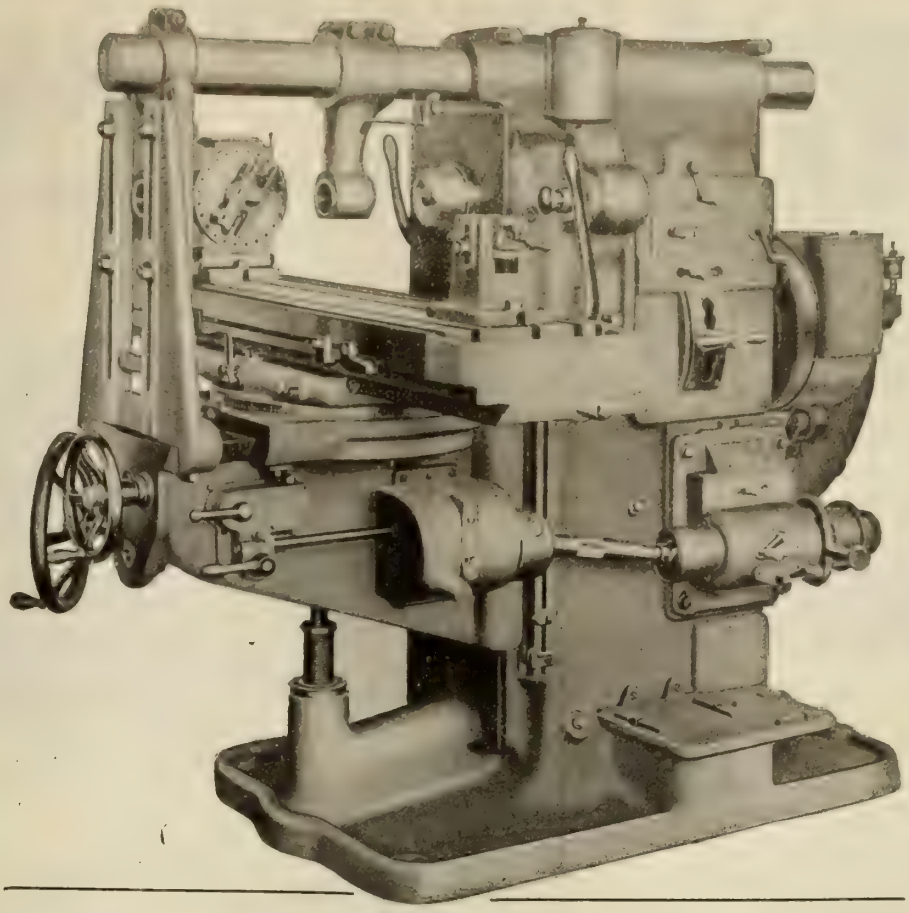
SALES OFFICES DETROIT Dime Bank Bldg. CLEVELAND Union Bank Bldg. CHICAGO Peoples Gas Bldg. PITTSBURGH Keenan Bldg. ST. LOUIS Boatmen's Bank Bldg. BUFFALO Marine Bank Bldg. CINCINNATI Union Trust Bldg. NEW HAVEN Second Nat'l Bank Bldg.

American Factories: BROOKLYN, N.Y. HASTINGS, MICH. CLEVELAND, OHIO. SALEM, OHIO.

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ENGLAND, Pocock St., Blackfriars Rd., S. E., London. Norwich Union Chambers, Birmingham. FRANCE, 100 Blvd. Victor-Hugo, St. Ouen, Paris.

No. 195



BROWN & SHARPE
UNIVERSAL
MILLING MACHINES

The heavy Universal—an adaptable machine

When a new milling machine is added to the shop equipment there is usually some definite job in view for it. It may be a lot of big, heavy castings, followed by another lot of the same kind. Or between jobs there may be a large fixture to mill.

Extremely accurate on large fixtures

As for fixtures—your tool makers may have had difficulties with an occasional big fixture—heavy, bulky—demanding accurate work to close limits. The manner in which the larger Brown & Sharpe Universal Milling Machines handle such tasks reveals their essential strength and precision. They are accurate, handy, thoroughly capable machines.

Always available for production work

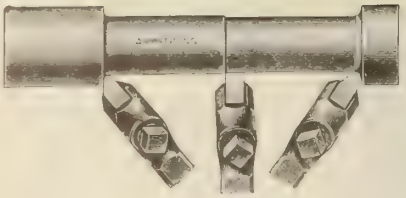
If, when the fixture is finished, another production job is scheduled—there's the machine—put it to work. You'll find it has plenty of strength and stamina for all the work you can give it.

In our complete line is the machine for your work

Your problem may be quite different from the one outlined here. Whatever your problems are, send for our General Catalog listing our entire line, including six styles of milling machines covering a broad range of sizes. Become acquainted with the details and specifications of these machines. Ask for Catalog No. 137.

Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A.

Canadian Representative; CANADIAN FAIRBANKS-MORSE CO., LTD.



One Armstrong Tool Holder Equals A Dozen Forged Tools



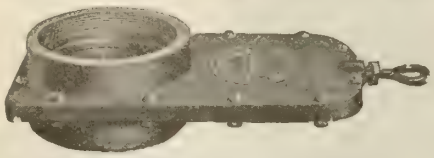
It is apparent that it is the height of wasteful inefficiency to tie up capital in solid high speed Lathe and Shaper tools when less than one-tenth the amount of steel, if used in Armstrong Tool Holders, will do the work and save time and grinding as well.

One Armstrong Tool Holder with a few cutters, which can be quickly and cheaply made from the bar by any machinist, will do any job on the lathe or shaper; roughing, facing, finishing, corner and fillet work. It makes one pound of high speed tool steel equal to 10 pounds in forged tools.

CATALOG ON REQUEST

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 306 N. FRANCISCO AVE., CHICAGO, U.S.A.

ELIMINATE VALVE INEFFICIENCY



NEW AIR-TIGHT BLAST GATE
Light, Strong, Compact, Inexpensive, Quick-Acting. Threaded or Flanged connections.

Carlisle, Penna.
We are using your Blast Gate as an outlet valve on a starch tank. This tank contains a very heavy grade of starch—just liquid enough to flow. This heavy substance clogs the ordinary valve but your blast gate has, to date, given perfect satisfaction.
C. H. Masland & Sons, Inc

Hundreds of former valve users have found the remedy by installing Rockwell New Air-Tight Blast Gates.

This wonderful control device has proved an ideal substitute for expensive, heavy, cumbersome and slow-acting gate and globe valves when used for:

Air and Gases of Various kinds

Blast furnace coal and lime dust
Counteracting back pressures
Distillation processes
Pulverized coal
Chemicals handled through pipes
Gas engine exhaust lines
Soot chutes
Starch

Present industrial conditions make it urgent that you investigate the economy and efficiency of this New Air-Tight Blast Gate. Ask our Canadian distributor for Circular 210-T.

W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
50 Church St. (Hudson Terminal Building) New York
CANADIAN DISTRIBUTOR: Drummond, McCall & Co. Ltd., Montreal
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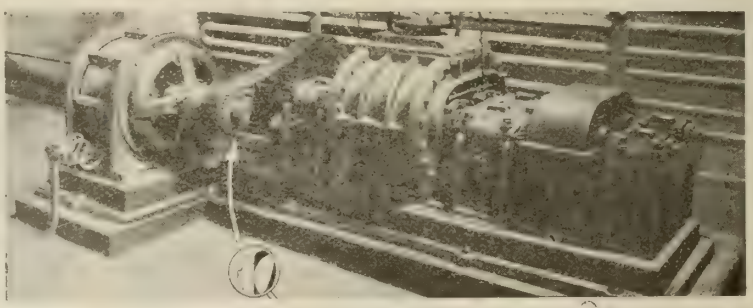
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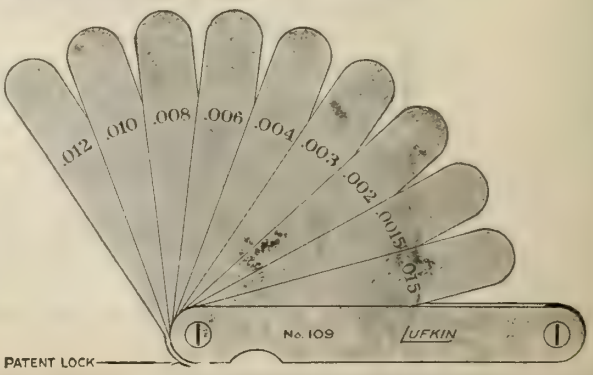
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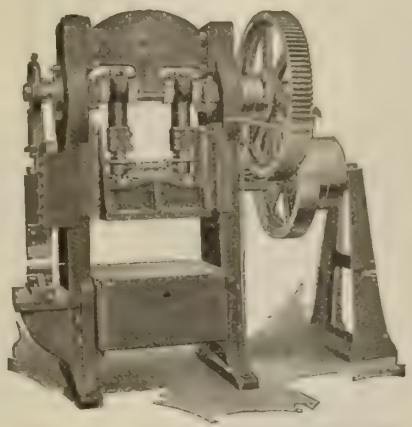
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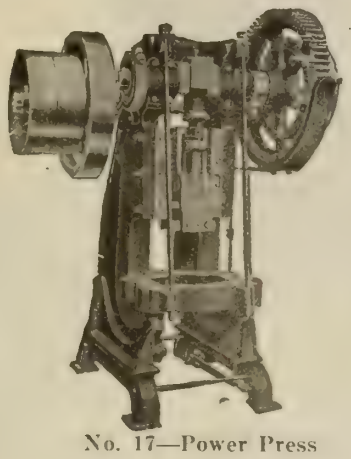
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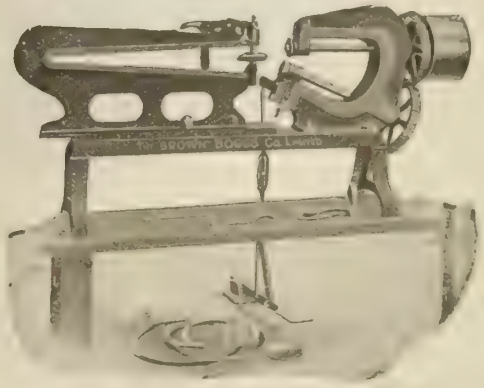
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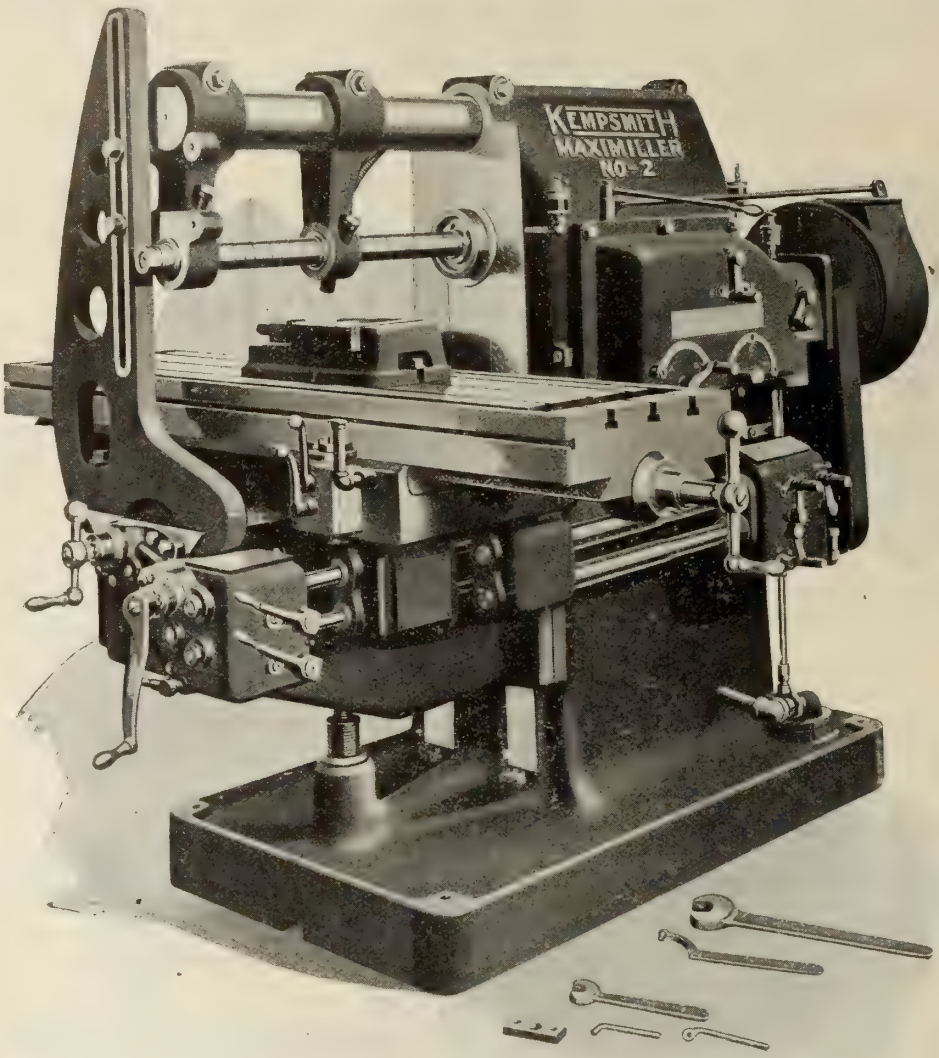
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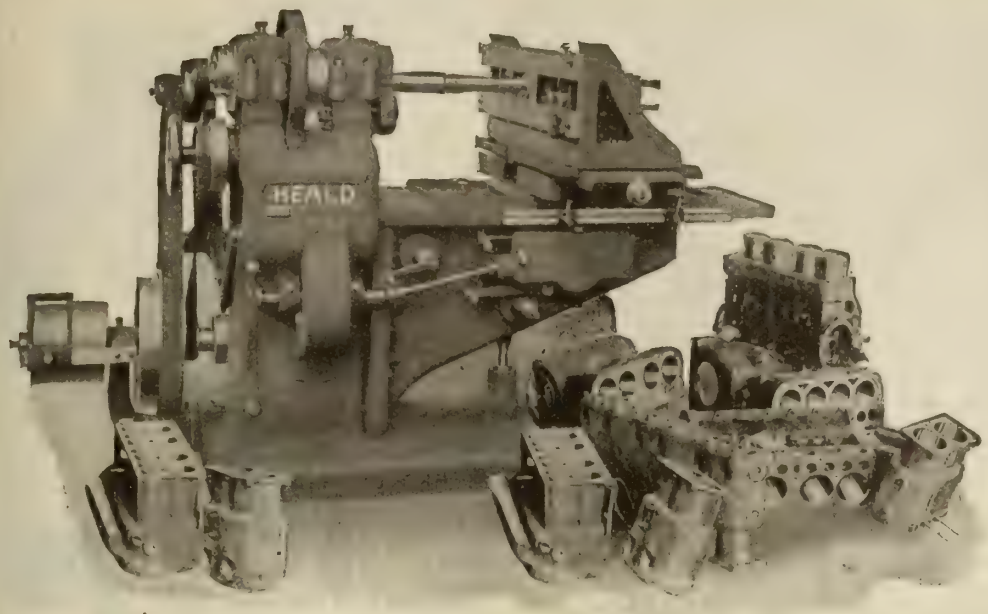
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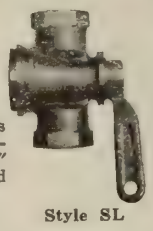
Style A: 30-degree Angle Valve, sizes: ½" and ¾". Inlets and Outlets are Standard Pipe Thread.

Styles A, RA and SL have waste-ports to bleed air from hose.

Style RA: 90 degree Angle Valve sizes ¼" ⅜" ½" and ¾". Inlets and outlets are standard pipe thread.



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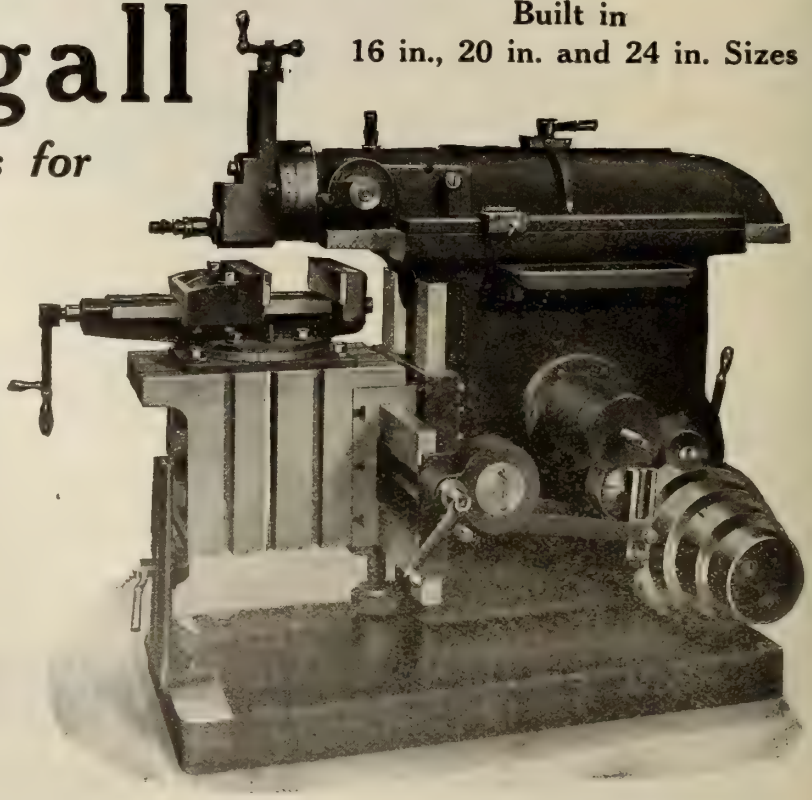
Write for Illustrated Bulletin No. 50

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A Name that Stands for All that is best in Machine Tools



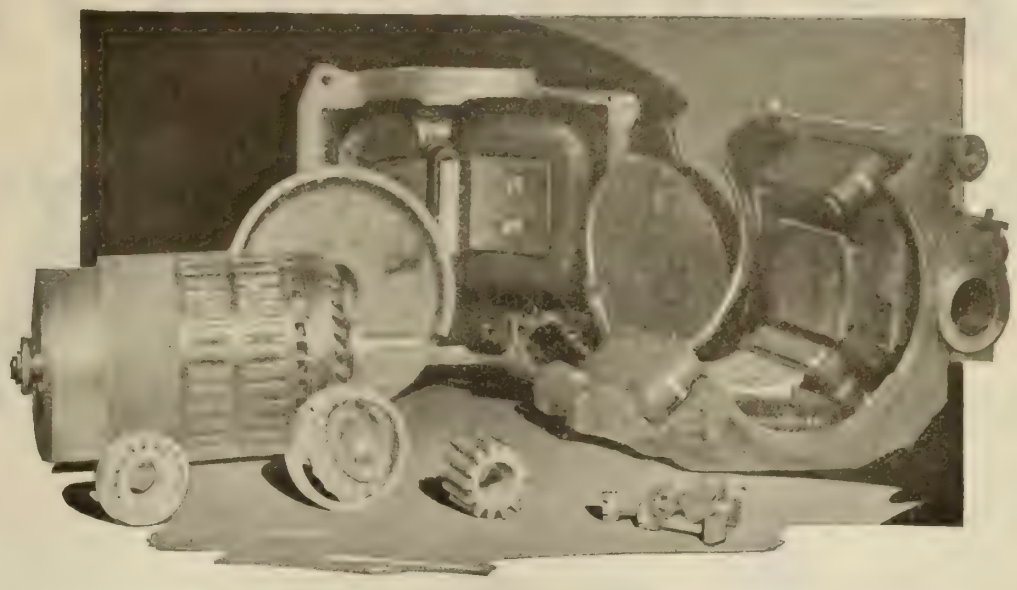
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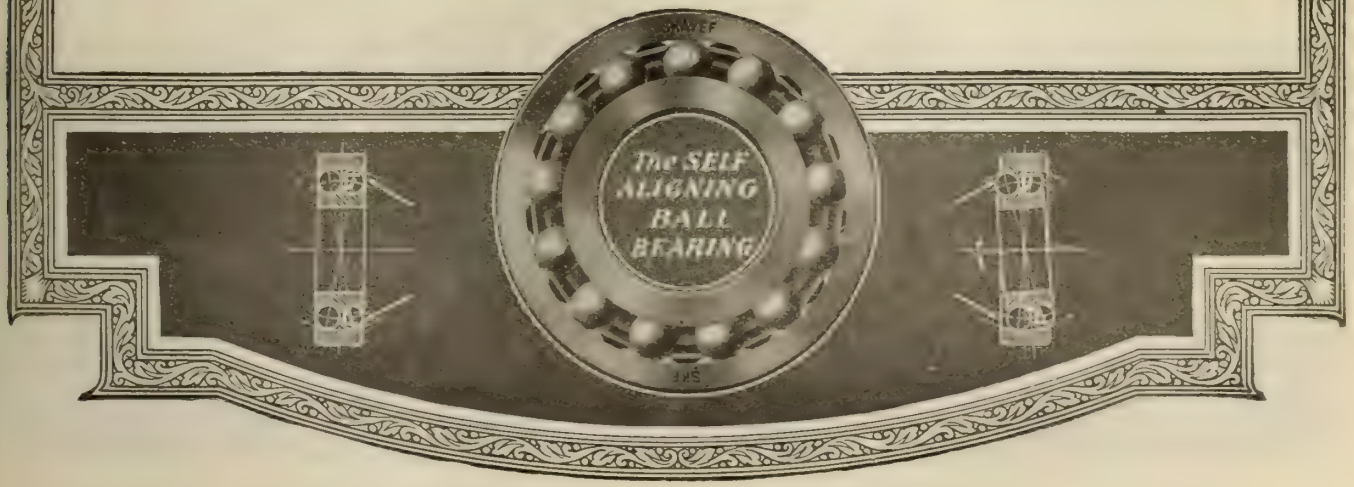
The modern method of mounting mine-locomotive shafts eliminates many motor failures. It provides sealed bearing housings which prevent dust and grit from working in. It displaces plain-bearing installations which permit shaft and bearings to come in direct contact the instant the oil film breaks, thus setting up a wearing, rubbing action which soon causes burnt-out armatures and breakdowns. These troubles frequently occur when locomotives are far underground where they are difficult to get at and work upon.

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GEARS

CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII. No. 20. MAY 18, 1922.

Costs Reduced By Systematic Piling of Goods

Unproductive Labor Effort Should be Controlled—Careful Planning of Storage Space Needed—Convenience and Accessibility Two Important Features—Reducing Manual Effort

By J. H. RODGERS

MANUFACTURING plants of every description are continually confronted with the problem of non-productive time. The character of the elements that make up the total period of this seemingly ineffective effort are often varied and difficult to control but the greater mastery that is achieved in this direction results in an increased balance being shown on the right side at the close of the year's business.

Every detail in connection with the making and marketing of any article is, invariably, essential to its production and distribution. Doubtless there are many incidentals that could be modified, and in some instances, entirely eliminated, but in general every operation, both of a productive and non-productive nature, is needed, more or less, in getting the article into the consumer's hands.

The handling of material both in semi-finished and finished condition is an item that cannot be directly charged to each individual piece manufactured, but the cost must be distributed over a production period of a definite number of months or even years. This handling of goods includes the acceptance of the raw material when shipped in to the plant, its removal from the cars or trucks, its sorting and piling in stock yards or store rooms, the piling and arrangement of the different commodities in readiness to being transferred to the various departments for machining and assembly. Handling also includes the transferring of the semi-finished work from one machine to another, or from one department to an adjoining one and the subsequent delivery to the shipping room, and finally, the placement in cars or trucks for distribution to customers.

Where manufacturing is carried on in a big way and large quantities of raw materials are required, it is essential that ample space be available for the piling of stock. In this respect it is advisable, and likewise economical, to arrange the stock bins or compartments so that only one class of material is contained in each. In this way it may be necessary to provide more space than seems permissible but the conservation of time when delivery is requested will offset any apparent disadvantage of excess yard room. The installation of a crane of suitable capacity is an imperative necessity where heavy material is to be handled, as this is the most convenient method where heavy stock and plant equipment are temporarily stored.

Another important feature in regard to transferring material from the yard to the shop is the relative location of the shop crane to that in the yard. These should overlap in such a way that articles deposited by one crane can be taken up by the other in a straight lift. If an angular lift is made the movement of the material when it leaves its position of rest will result in a swing that may cause serious injury to equipment or workmen. When a crane cannot be located directly over the piece to be elevated, it is always necessary to caution nearby workers, and the interference thus occasioned results in adding to the unproductive time. Not only do such conditions disturb the employee but the thought that danger is imminent often makes it necessary to provide protection to tools he is using, the removal and replacement of which requires time that might otherwise be saved or used in productive effort.

The fundamental idea of manufacturing is to produce on a basis that will give satisfaction to all concerned and at the same time show a profit on invested capital. Successful management means that harmony prevails in all departments. A handicap should not be placed on any individual or department whereby that person or section of the plant must stand aside while the regular duties of others are being carried on. It is seldom that ideal conditions can be established in a factory but it is often well worth while to strive to at-



Fig. 1.—Showing neatly arranged stock warehouse of the Marshall Wells Hardware Co.

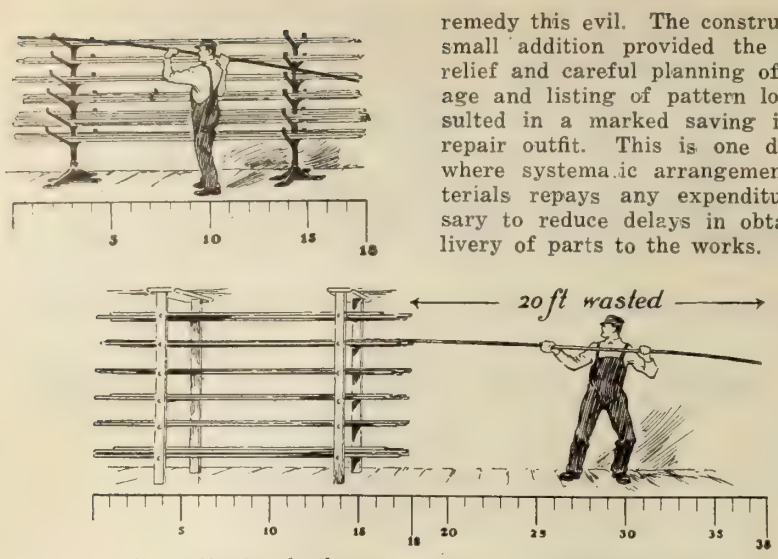


Fig. 3.—Showing the floor space saved by use of open side racks.

tain a higher state of operating efficiency.

One of the greatest sources of wasted time is in the delay often resulting from delivery of material from the storeroom or stock pile to the manufacturing departments. The cause of this may frequently be laid to the inconvenient manner of piling or storing of parts. The writer has in mind one particular instance where a fair sized foundry had only a comparatively small yard in which to store their supply of moulding flasks, and no adequate provision for transferring them to and from the factory. When a fairly large flask was required it was necessary for the moulder and several men to go and dislodge the particular flask they desired. Since that time additional property has been acquired and the yard equipped with a travelling crane and the flasks and other equipment so piled and arranged that a minimum amount of time is required when requisition is made for such material; one man only needs to go to select the piece wanted.

This same firm had many thousands of dollars worth of patterns stored in a loft above the pattern shop, but owing to the growth of the business and the relatively rapid accumulation of patterns the storage space provided was quite inadequate, the consequence being that this department was far from being efficiently conducted. Some attempt was made to regulate the placing of the various patterns but with little real success. When a pattern, that had not been used for some time, was wanted it was generally found that it was not in its accustomed place or that it had been completely covered by others used more frequently. The method usually followed was to take those on top and—none too gently—toss them aside until the one wanted was secured. This practice was more common with the smaller patterns. The maintenance cost, however, on patterns damaged in this way, gradually impressed the superintendent that something would have to be done to remedy this evil. The construction of a small addition provided the necessary relief and careful planning of the storage and listing of pattern location resulted in a marked saving in pattern repair outfit. This is one department where systematic arrangement of materials repays any expenditure necessary to reduce delays in obtaining delivery of parts to the works.

The view shown in Fig. 1 is that of the general warehouse of the Marshall Wells Hardware Co. at Portland, Oregon. This shows a well arranged storehouse where accessibility is one of the outstanding features. The wide assortments of plates are so stocked that one or more of any particular size or gauge can be obtained without disturbing any other plates. Bars are arranged in a similar manner as can be seen at the extreme lower left. Individual racks are provided for each grade and size of bar. The upper deck is subdivided into compartments for the storing of pipes and tubes and so arranged that tubes can be lifted vertically by the crane and delivered to transfer trucks. Pawling and Harmischfeger 5-ton cranes are installed in this building. The hardware firm has found that they can effect big savings in handling material of this description. This is made possible through the reduced labor cost of handling and also because a greater quantity of goods can be piled in the space available and done so with great convenience. Emphasis is also placed on the fact that mechanical piling assures quicker service to the plant or the customer.

Fig. 2 shows a large foundry with a comparatively small yard space, but systematic piling and a P & H 25-ton crane provides sufficient facilities for storage purposes.

Handling of goods is often economically performed by means of conveyors. Where continual movement of articles or material is taking place this practice is found to be of great service as it practically eliminates all labor of transportation purposes, workmen being required only for the placing on and removal of the parts. Much saving of time is effected in this way.

Accessibility is one of the outstanding features of efficient storing or piling of material and equipment. This is especially true where it is necessary to secure the parts many times every day. Careful planning of storage racks in a plant will not only save manual effort and time but will also furnish a means to greater production. The sketch shown in Fig. 3 is a clear way of illustrating this. A common method is to provide closed racks as shown in the lower view, where it is necessary to provide space for withdrawal of the bars equal to their length. The upper view shows the Brown type of stock rack, made in sectional form where the minimum amount of floor space is required for piling and removing the bars. Considerable time can be saved when racks of this character are located alongside such machines as turret lathes and automatics. The advantage of a rack of this kind is that it can be made to accommodate a variety of bars of different materials, and may be located in any place and moved if desired, as the base is so constructed as to be self-supporting.

In planning storage facilities the chief features to consider are those of convenience and accessibility, as they accelerate the movement of material and reduce the unproductive time.

In screw thread practice the term lead is generally understood to be the distance which the screw advances in one turn. The pitch is the number of threads cut in one inch of length, on any given diameter.



Fig. 2.—Convenient piling made posible by means of overhead crane.

House Cleaning In The Industrial Plant

Keen Competition Means That Every Possible Source of Waste Should Be Eliminated—Importance of Daylight—Clean Cheerful Shop means Better Work—Systematic Arrangement Brings Best Results

By G. A. KUECHENMEISTER
Personnel Manager Dominion Forge and Stamping Co.

THE USUAL spring epidemic of house cleaning is once more with us, and has taken a firm hold of the housewives of the country. There will be dust flying, much scrubbing and delving into rubbish heaps and dark corners. The supposed boss of the house comes home expecting a quiet rest in his favorite chair, but finds windows wide open, rugs on the line and furniture piled up in one room.

Spring house cleaning is a necessary part of housekeeping but, as it was formerly known, it is fast disappearing. The vacuum cleaner and other modern home conveniences are changing housekeeping methods and the tendency is away from the old idea of setting aside a period of days each year to revel in the joy of upsetting the entire household.

With the housewife who still clings to the old broom and duster we have no argument. It is her home and she is boss, and if she wants to make life miserable for the men of the house for one or two weeks each year, that is her business, but when a plant manager or superintendent takes the stand that it is not economy to spend money to keep the plant clean from day to day and week to week, we are ready to argue; and it can be argued from the standpoint of safety, health, efficiency and production.

There may be plants still doing business where it is possible to throw raw material, material in various stages of fabrication, supplies of all kinds, cuds of tobacco and rubbish into all the dark corners of the shop and show a profit at the end of the year but, with competition becoming keener each month, the wise man will dig up every penny's worth of material and turn it into the finished product and get cash for it.

To do this it may be necessary to adopt the housewife's method of turning the whole works upside down and getting into the dark corners. If that is the only way to get started the sooner it is begun the better. Many a shop has been turned from a junk heap into a clean, up-to-date plant by installing a proper lighting system. Getting light, daylight or artificial, into the dark corners shows us up, and shames us into keeping the place clean.

Most plants have plenty of windows. When they are first built they are roomy, cheerful, airy places and the owners are congratulated on the splendid building. A year later it is often difficult to recognize the place. The simple process of washing those windows and putting new glass in place of the old rags and sheet metal that have replaced broken panes in the sash, will restore the bright appearance of the place. It makes a good beginning for the cleaning job.

After daylight has been let into the plant the true condition of the place is easily seen. All hands, men and boss, can now be used to good advantage. The boss can tell at a glance whether the material found in the corners is of further use, whether to send it to the store room, to the junk dealer, or what other disposition should be made of it, and the men can put it there.

Right here is the determining point in shop cleanliness. Unless there is a definite place for every article—and scrap, broken machine parts, etc., all need consideration—and unless every man in the plant, responsible for its disposition, knows where each article belongs, there will always be a moving of junk from one place to another. Bins for turnings, castings and other scrap and a platform for broken machine parts can be built in any plant, no matter how small it may be, and are worth many times the cost of construction.

Constant Reminders

These bins should be put right out in the open where the manager and superintendent cannot help but see them. They will be constant reminders and tell-tales of what is being thrown away. The platform for broken machine parts is a real help to the manager. With broken parts up out of the dirt in broad daylight they tell the story of what is going on in the plant. These same bins and platforms also make it easy to dispose of scrap and broken parts to the junk dealer and prevent the selling of much valuable material at scrap prices.

A dark store room is a catch-all for the rubbish of the shop and since it is easier, in many cases, to write a requisition for new material than to dig out the stuff from the bottom of a junk pile in a dark, foul smelling store room, it very frequently happens that a lot of money is kept tied up in supplies.

Especially is this true of store rooms for mill-wright supplies and repair parts. This can be overcome by using wire screen for the walls around the store room. Get the thing wide open so that anyone walking by can see what is inside. It has a wonderful effect on the cleanliness of the place.

Assuming now that you have thoroughly cleaned-up, scrubbed-up and painted-up—and if you have followed the housewife's plan of turning everything upside down and gotten into all the corners with the broom, mop and paint brush—then is the time to solemn-



The efficiency of this foundry was greatly increased by giving the walls a coat of white enamel.

ly raise the right hand and vow, "never again."

Keep it Clean

After an analysis of the whole proposition of maintaining a clean, light, cheerful shop you will find nothing to prevent you doing so. Windows can be kept clean at a low cost. For the small shop it will only require part time of one man to watch them and keep them clean. For the big factory with thousands of lights, a window-washing crew will pay its way. Some factories have worked the thing out on a piece work basis and are keeping the windows clean at a remarkably low cost.

If "light is a tool that makes every other tool more efficient" then surely the money spent to let in the glorious sunshine and help increase the effectiveness of all the tools in the shop, is well expended. Artificial light can also be used to mighty good advantage. If the plant is wired in the hapazard fashion of olden times it is well to have an "illumination survey" made. Properly placed lamps with the right style reflector will help the workmen at their work and will also show up the corners that are likely to be used for rubbish storage.

One-half of 1 per cent. of a man's wages—2½ cents per day for a five-dollar-a-day man—will pay for the installation and power consumption of a proper lighting system in any factory. But electric lamps put into a socket and then allowed to gather a coat of dust and dirt will grow dimmer and dimmer—and continue to consume the same current. The same electrical helper who put them in place can usually find time to keep them clean if ordered to do so.

Then, there is a matter of sweeping and removing waste material. It is not something that can be done once in a while or once a year. It is with us every day in the year and upon the successful solution of the problem depends the cleanliness of the shop.

In the large plants suction systems and well organized corps of cleaners can be installed and maintained, but in the small or medium sized factory there always arises the question of just how much money can be spent in keeping the place clean.

Supervision Necessary

There again we can use the comparison of the housewife who is determined to keep her home clean. If she allows us to drop clothes and other articles wherever we happen to be or if she never complains about the appearance of the wash bowl or bath tub after we have used them she will wear herself out in a few years doing what we have thoughtlessly forced upon her. But if she is on the job and supervises the placing of clothes and the cleaning of wash bowls it will be comparatively easy for her to keep a clean house. With the help of a woman once a week or twice each month the home can be kept so that the old fashioned house cleaning will not be necessary each spring.

And so it is in the plant. With a sweeper in each department or one for several departments devoting his entire time to keeping the place clean and with the workmen ordered to throw waste material not into the corners but into bins or at least into the open from where it can easily be removed, there is no need for a shop to get into a filthy, unhealthy condition. Laborers and yard men—even the truckers—can help keep the aisles clean and clear of rubbish and it will all make for a safer, healthier, happier shop.

In plants which are particularly difficult to keep clean because of manufacturing conditions it may be well to adopt the "woman once a week plan." Shops that are operating five days a week can use Saturday mornings to do the extra cleaning and under present industrial conditions Saturday afternoons can be used for the work without greater cost than on other days.

Every factory or shop has its own peculiar problem, but each and every problem can be solved. The burden of solving the problem of maintaining a clean house falls upon the "housekeeper"—the big boss. If he wants it clean he can have it clean and it need cost only a fair share of the overhead of the plant.



Cleanliness a feature of this mill room.

THINKS OUR VIEWS ABSOLUTELY CORRECT

By David James

YOUR recent article and editorial on the noon hour problem appearing in April 27 issue is a very timely one. As I write this I can look through the office window and see the men and boy coming off the football field with the sweat streaming down their faces. Some of them in a state of exhaustion from the strenuous game, or perhaps I should say "rough house" they have just been indulging in. Now anyone knows that this state of affairs is a bad thing from every view point. To indulge in such violent exercise immediately after dinner, must have a bad effect on the men themselves to say nothing of unfitting them for duties for an hour or so. I wonder what would happen if the firm were to ask for such strenuous exertions? To my mind a cafeteria run on a non-profit basis is certainly a great boon to the worker.

There are many workers who live about 20 minutes walk from their work. Whether they use car, bicycle, or walk it uses up a large amount of nervous energy which a well-ordered cafeteria would avoid. A rest and reading room with comfortable chairs, not a straight backed bench made up in a hurry at the carpenter shop, would be a great benefit. A few trade papers and newspapers with an occasional lecture or musical entertainment for half an hour would be a great asset. I have seen several shops where the game of checkers was introduced and it had a beneficial effect as the apparently simple game of checkers is a great brain trainer. This simple little game is ever new and none have fully mastered all its intricacies. Or, if the weather is such that you feel you must be out of doors, nothing could be better than a large bowling green. It is a fine skilful game, cultivates good comradeship and is an added beauty to the environments of the factory.

Let us have welfare work at all costs, but let us conduct it on safe and sane lines and those lines should tend toward the developments of the mental rather than the physical.

The addition of a small percentage of silicon to nickel shot produces a silicon-nickel shot which is said to be superior in many ways to other materials now in use. A new method of polishing and burnishing metals with the tumbling process has been developed. Nickel-silicon shot is used in this process and is said to have the advantage of longer life, does not corrode, always remaining bright and clean. It may be used in conjunction with acids in which case it removes scales; the polishing water does not become dark or slimy, rendering articles difficult to clean after polishing. It is non-magnetic and therefore can be used in process using magnetic tumbling barrel for iron and steel articles.

Overhang of Work Affects Machine Accuracy

Unusual Jobs Require Special Methods of Machining—Arrangement of Work Should be Carefully Considered—Counterbalancing Good Practice—Avoid Excess Strains in Machine Parts

By J. HENRY HAMIL

WHEN a job comes along that is beyond the normal range of a machine it is the general practice to adopt some impromptu method of performing the work. Few men like to admit that they cannot handle the odd job and it is only an exceptional case where work is turned away for the reason that it is beyond the capacity of the shop. Not only is this true of the ordinary jobbing shop but very often the same conditions apply to the manufacturing concern accustomed to doing regular lines of work. It is often remarkable the class of work that is sometimes undertaken and successfully accomplished in cases of emergency when the plant superintendent or foreman, or even the workman, is endowed with the necessary initiative.

In planning work out of the usual run of the shop, the actual performance of the required machining is not the only matter that should be given consideration. Too frequently, when doing work of unusual character the workman is liable to neglect to take into account the resultant effect upon the parts of the machine performing the work. All tools are designed to function properly within their specified range and when required to go beyond this limit stresses are created that were not figured on in the building of the machine. Therefore, it is always advisable to determine, as far as possible, what will take place when abnormal work is being machined.

Cause of Strains

In some cases the machine may be operating inside the working range, but due to the shape of the piece being machined certain sections of the tool may be subjected to temporary stress which eventually may seriously affect the accuracy of the movable portions. The proper distribution of weight is the most important detail in connection with the machining of work, especially when the latter is required to move while the tool is cutting the metal. When a heavy casting or forging rests upon the table or bed of a machine the table should move almost as freely as when loaded with a lighter weight. The slides should be well lubricated and if possible the weight located so that centre of gravity is as near the centre of motion as is convenient to perform the necessary operation. This, however, is not always possible, for if it was we would probably be working within the machine range.

Special Practice

The unusual job calls for unusual methods and it is because it is out of the ordinary that other facilities than those generally adopted have to be applied to meet the changed conditions. Out of range work is that where the work is extremely large or exceptionally long. We recall a job some years ago where, in order to accomplish the work, it was necessary to raise the head stock of a gap lathe about six inches. The lathe was fitted with ordinary change gears and an auxiliary stud was made for connecting the train. The job was the frame and trust ring—the latter 7 ft. dia.—of a large tire setter. This had to be mounted on the face plate but trouble was experienced almost before the tool was advanced to the work. The rear cap bearing screws failed to hold and it was only because the ring was just clear of the floor plate that serious damage was prevented. Repairs were made and to assist in sustaining the alignment of the spindle a heavy scantling was placed between the rear bearing and the ceiling. The work was started but excessive chatter necessitated the delay of a day or two while rollers and brackets were made and located on the floor plates to take the excess weight of the ring and heavy portion of the frame, which together weighed over one ton. With these fitted in place no further difficulty was experienced.

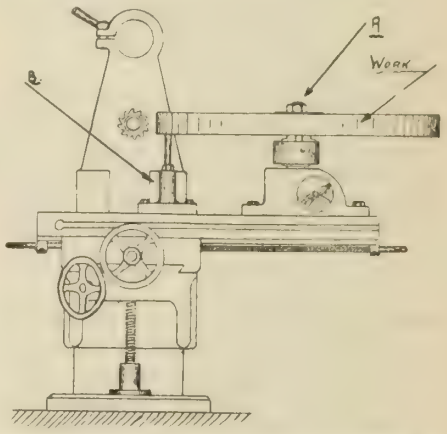


Fig. 1.—Overhang should be counterbalanced by suitable weight.

Die Sinking Job

On another occasion we had a large die to sink and were forced to use a small die slotter and miller that was considerably below that on which the work should have been performed. It was first necessary to make an auxiliary plate to act as an extension to the regular table, to provide adequate support to the work. After struggling with the feed screws for a short time it was decided to adopt some method of taking care of the surplus weight. Owing to the constant movement of the work, both vertically and horizontally it was impossible to provide a floor support, so it was decided to locate a small grooved pulley in the ceiling over which a small cable could be used. The counterbalancing weight was located at the rear of the machine where it did not interfere with the movements of the operator. It was found that the slides moved almost as freely as when working without load. The cable and counterweight became a permanent accessory of the machine and was used advantageously many times.

Cutting Large Gear

A typical example of excessive strain caused by overhang of work is shown in Fig. I. This illustrates the cutting of

(Continued on Page 23)



Fig 2.—Showing where counterbalance would work to advantage.

Greater Production by Use of Special Fixture

Device Attached to Turret Operated from Overhead Shaft—Wide Face Machined by Short Tool Movement—Appliance May be Adapted to Various Purposes

THAT the efficiency of turret machines can be greatly increased by the use of special fixtures is shown in the accompanying illustration. This attachment has been placed on the turret of a Libby lathe and is operating successfully at the automobile plant of the Studebaker Corporation. The device is designed for the purpose of facing and forming fly wheels, flanges and discs, the object being to machine a wide area by a relatively small travel of the cutting tools. As can be seen from the illustration the appliance is driven from a special countershaft overhead by means of a telescope shaft, this being necessary owing to the lateral movement of the turret head.

The line drawing gives some idea of the construction of the device. The shank, which also carries a steady bar, is clamped in the turret in the usual manner, a portion of the bar, B, being cut away to allow of vertical travel of the tool slide. The body of the fixture C, which extends above, carries the feed screw, D, keyed to which is the large worm wheel, E, and the hand wheel, F. The worm wheel is driven by the worm, G, this in turn being operated through a train of spur and bevel gears from the overhead countershaft. The screw, H, operates in the bronze nut, J, the thrust being taekn by th eball bearing, I. The nut, J, is fixed to the tool slide, K, the fan of which is slotted to receive the various cutting tools.

The left hand view of Fig. 2 shows a horizontal section through the driving gears. The telescopic shaft, M, carries a two-way clutch that may be engaged with either upper or lower bevel gear, N, to mesh with gear, P, the clutch lever being shown at O. On the rear of the shaft, Q, is the small spur gear, R, that meshes with gear, S, on the worm shaft, T. For hand feeding the worm may be disengaged by movement of the handle, U, which, in a power feed position is held in place by the lathe, V. This is clearly shown at the front of the fixture in Fig. 1. A sketch of the piece being operated on is shown in Fig. 3.

CRANK SHAFT GRINDING

When the plain cylindrical grinder is applied to crank shaft grinding the grinding wheel encounters one of its hardest tasks. The wheel is fed direct to the work, and in order to grind the fillets it must hold up on the corners. The condition of the pins and the finish required determine the grit and grade of wheel to be selected for the job. A cam shaft is another instance of the wheel engaging the full width of the work. For grinding automobile and aircraft cylinders special skill is demanded.

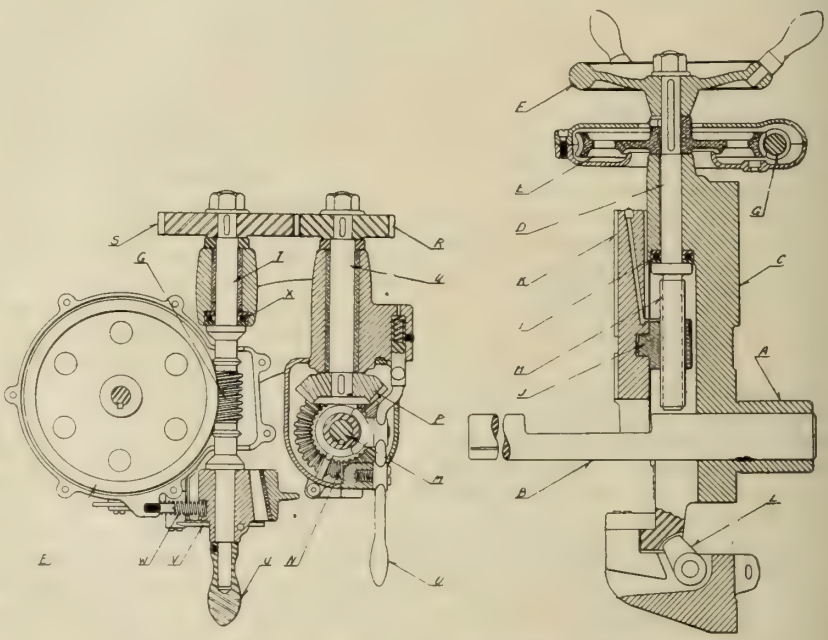


Fig. 2.—Sectional views of the special facing attachment.

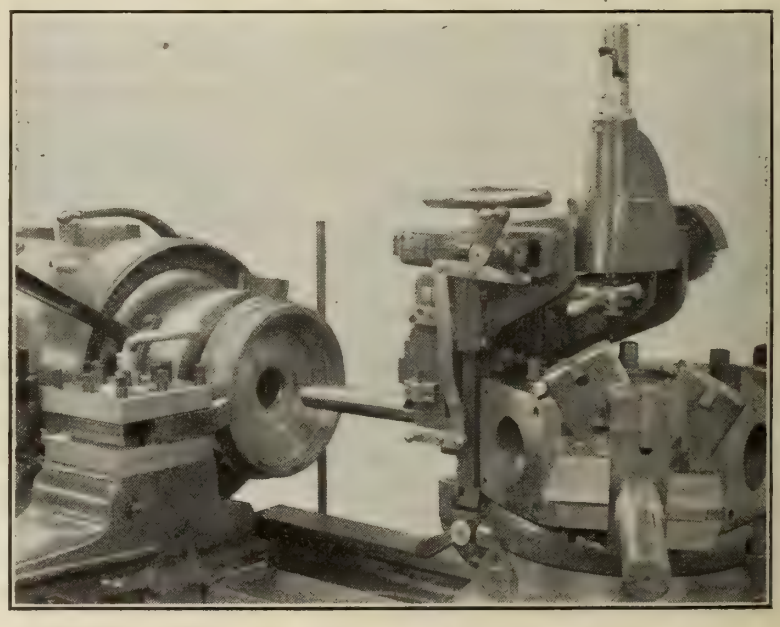


Fig. 1.—General view of turret fixture.

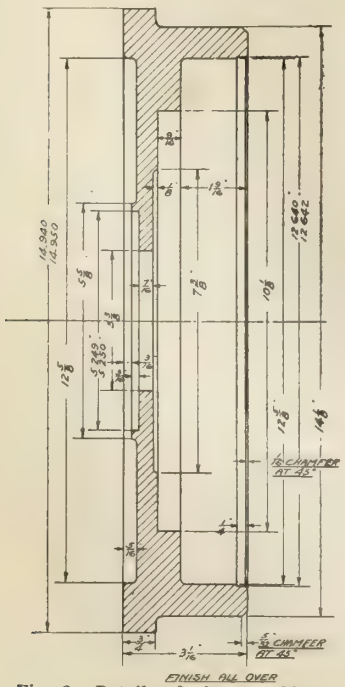


Fig. 3.—Details of piece machined.

Maximum Speed Reduction By One-Tooth Pinion

Interesting Method of Tooth Formation—High Working Efficiency—Perfectly Uniform Motion—Deflection Remains at Low Limit—Slight Sliding Action on Teeth

SPEED reduction in gearing has always been a problem to mechanical engineers. To obtain a great ratio it has been necessary to use a system of gearing, owing to the fact that it was inadvisable to utilize pinions with a small number of teeth. The double helical gearing here illustrated and described, in which a pinion of one tooth is the essential feature, will be of special interest, not only to the student and those on experimental work, but, as stated in The Engineer, the makers, the Power Plant Co. of West Drayton, Eng., claim that it will be of wide practical utility.

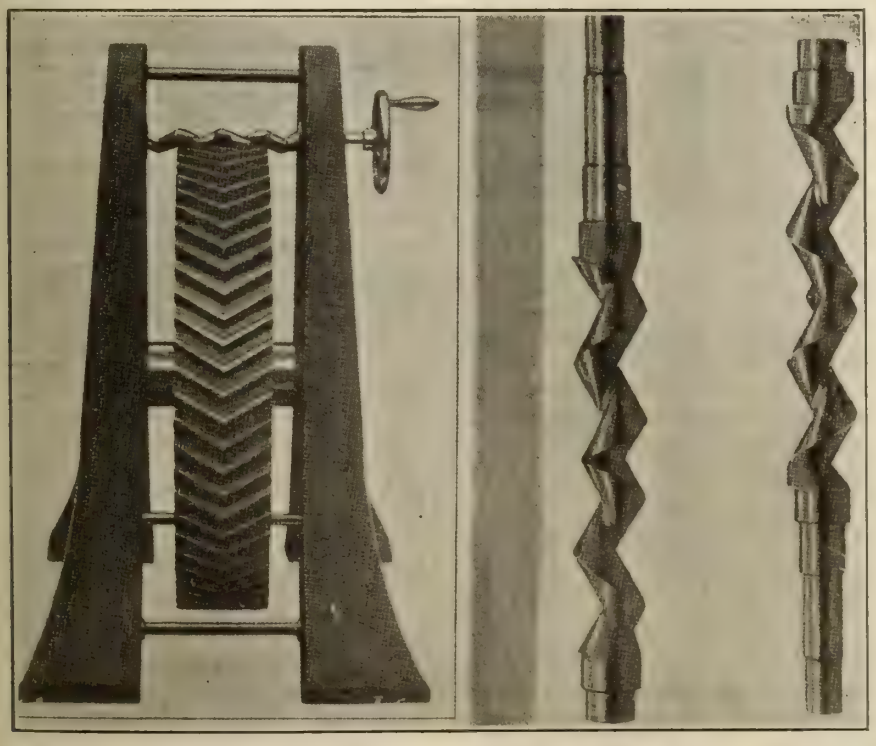
The particular example shown will shortly be placed in the South Kensington Museum, while a similar set will be made and put into actual service by the company. Under a power test over a considerable time the gearing transmitted 10 horse-power at a pinion speed of 1000 revolutions per minute without showing any signs of wear. With the pinion as the driver the makers believe that the efficiency is as high as that of any other double helical gearing, that is to say, that it is probably between 97 and 98½ per cent. In this connection it may be remarked that the gearing is said to work satisfactorily with the wheel as the driver. As for its practical utility, it is pointed out that it is much more compact, more efficient and cheaper to produce than double-reduction gearing of the same ratio.

The production of a one-tooth double helical pinion such as that illustrated has only recently become possible.

The example shown was made on a Sykes No. 4 patented generating machine with standard equipment and cutters. The same machine and the same cutters were used for producing the wheel. The teeth of both the pinion and the wheel are continuous, and at the junctions of the right and left-hand portions there is no departure from the true involute shape.

In order to obtain very high gear ratios, straight-tooth pinions with three teeth have been used in the past. With helical teeth, however, it becomes practicable to design the pinion with one tooth in such a way that the transmission is positive and perfectly uniform. In contrast with a high-ratio worm gear drive the one-tooth helical pinion and wheel should show a greatly increased efficiency.

The example illustrated has a ratio of 63 to 1, since the wheel has 63 teeth. Other data connected with the design are as follows:—Pitch circle diameter 0.508in. pinion, 32.004in. wheel; Outside diameter 1.756in. pinion, 32.210in. wheel; diameter of shaft 1½in.; pitch 1.968 D. P. or 1.595in. circular pitch.; face width 6in.; centre distance 16.26in.; pressure angle 22 deg. 10 min.; ratio of pitch diameters 63 : 1; ratio of outside diameters 18.28 : 1.



Left—One-tooth pinion meshing with large herringbone gear. Right—Two views of one-tooth pinion.

It will be noticed from the line engraving that although the pitch circle of the pinion is only a shade over half an inch in diameter, the abnormally large outside diameter gives the pinion a section which—or so it is claimed—is such as to enable the gearing to transmit the designed power without undue deflection. The action of the tooth contact is almost entirely of the "recess" kind, that is to say, it takes place when the pinion is going out to engagement with the wheel. This condition, it is claimed, promotes efficiency and assists good lubrication, because it results in the oil being drawn into the line of contact. It has been suggested by some engineers who have examined the gearing that there is excessive sliding action between the teeth. The makers contend, however, that the results of the test on the gearing prove that whatever amount of sliding action there may be is not harmful, and that, providing such action takes place in recess, it is apparently an advantage.

OVERHANG OF WORK AFFECTS MACHINE ACCURACY

(Continued from Page 23)

the teeth in a large gear on a small planer, described in a recent issue of Canadian Machinery. It will be quite obvious that the table slide is under considerable stress when working under these conditions, and the vertical movement necessary in cutting the teeth will demand extra pressure on the lower portion of the right slide and on the upper end of the left. Of course, it is realized that this is an exceptional case but at the same time it is a condition that affects the general accuracy of the machine and one that should be avoided whenever possible. In this particular instance the overhang could have been neutralized by using a counterbalancing device of some kind.

Another example of overhang is illustrated in Fig. 2. Here an extension has been placed on the front of the milling machine knee to provide a pivot for milling the proper arc on a piece of work. Another case where the strains could be minimized by proper counterbalancing.

Experience has shown that for steel and annealed malleable iron the aluminous abrasive wheels should be used and that for gray iron, brass, bronze and unannealed iron, silicon carbide wheels should be used. Aluminum castings are snagged successfully with both types of wheels.

News From the Welding Field

Overcoming Defects and Failures in Welding

Allowance Must be Made for Expansion and Contraction—Methods of Eliminating Distortion of Welded Parts—Causes and Remedies—Making Calculations in Advance

By M. PIETTE

IN ALL cases where bodies are subjected to alterations of temperature, expansion and contraction must be constantly taking place. Although in many cases this effect may be ignored it is of the highest importance in welding operations to make proper allowance for their effects and to take such steps as will reduce the effect to a minimum.

One of the greatest difficulties to be contented with in welding is the control of expansion and contraction due to differences in temperature of different parts of the piece welded. In the case of ductile materials, like iron and steel, warping, distortion or buckling will inevitably take place if expansion and contraction are not properly allowed for. In non-ductile materials, such as cast iron or materials whose strength are low when near the melting point, as for example aluminum, aluminum alloys and copper, the strains produced may cause the metal to crack or fracture. Further in many cases although distortion or fracture have not taken place the expansion and contraction effects have produced serious internal strains which only require a slight addition to exceed the strength of the metal and thus produce failure. It is for this reason that many welded articles which appear to have been successfully welded prove to be failures shortly after being put back into service.

In this series of articles, it is proposed to deal with the subject of expansion and contraction mainly with regard to the distortion and warping effects commonly observed in welding iron and steel, and to explain their causes and remedies in such a manner that the beginner, who is usually discouraged by the surprising effects he obtains with the blowpipes, may easily understand the phenomenon accompanying expansion and contraction.

Expansion and Contraction

It is necessary to repeat over and over again to welders that it is useless to attempt to arrest or control by force the expansion of metals raised to a high temperature and which return more or less to their original dimensions when the heat, which has produced the expansion, diminishes and finally disappears. In other words, the forces of expansion and contraction are irresistible and if attempts are made to control them by force—the use of clamps, jigs, etc.—distortion, serious internal strains, or failures will result. Everyone is familiar with the fact that this property of expansion and contraction is taken advantage of in engineering such as, for example in the shrinking of tires and angle-iron rings and that it has to be allowed for in railway lines, casting, steam-pipe joints, girders.

When metallic bodies are heated they expand in every direction; and conversely a decrease in temperature causes the bodies to contract and the volume and linear dimensions decrease. In many practical cases we are only concerned with the increase in length. Increase in length is referred to as "linear" expansion, and increase in volume is called "cubical" expansion. Metals are very susceptible to this change in volume, each metal, for a definite rise of temperature, expanding a known amount. It is convenient to calculate the amount of expansion to be expected from a rod of the metal of unit length when it is raised through one degree of temperature. This amount is called the "coefficient of linear expansion" of the material. It is easy to see that—Coefficient of Linear Expansion =

$$\frac{\text{Increase in length produced by Rise of Temperature}}{\text{Original length} \times \text{Rise of Temperature.}}$$

In dealing wtih cubical expansion the word "volume" is substituted for length.

From the following table it will be seen that the coefficient of linear expansion is always a small number.

Metal	—Coefficient of Linear Expansion.— per degree Cent.	per degree Fahr.
Wrought Iron ..	0.0000125	0.0000069
Cast Iron	0.0000107	0.0000059
Steel	0.0000113	0.0000063
Aluminum	0.0000231	0.0000128
Brass	0.0000188	0.0000104
Copper	0.0000168	0.0000093
Lead	0.0000292	0.0000162
Nickel	0.0000128	0.0000071

The amount of expansion for 1 degree Fahr. is 5-9 of that which takes place for 1 degree Cent. The figures in column 3 are therefore 5-9 of the corresponding figures in column 2. The values given in the table represent the average coefficient between 0 degree and 100 degrees Cent. At higher temperatures the expansion of metals is not directly proportional to the rise of temperature. Of the metals most commonly welded it will be noticed that lead expands the most, aluminum next, then brass, copper, nickel, wrought iron, steel and cast iron. It will be seen that aluminum expands almost twice as much as iron or steel.

Force of Expansion

Although the amount by which most substances expanded for a rise of one degree is very minute yet the force exerted by the metal on expanding is considerable and, as already mentioned, will, if resisted in welding operations, easily distort or lead to the fracture of the expanding body. The actual force brought into play during expansion can be calculated from the fact that it is equal to the force required to stretch the material, mechanically, by the same amount. Suppose a bar of length l is heated t° Fahr. and c is the coefficient of expansion of the material. Then unless prevented, the length of the bar will become $l(1+ct)$, that is the increase in length will be $c\,t\,l$. If the bar is rigidly fixed so that the expansion cannot take place, then there will be in the bar a strain equal to $c\,t\,l$. This strain will produce a compressive stress equal in the case of mild steel to a stress of 0.085 tons per square inch for each degree of temperature. Taking a range of temperature to say 150° Fahr., which is very low, the stress due to temperature is equal to 1 275 tons per square inch. This is greater than the safe stress for mild steel. In other words, if a bar ½ inch in diameter is heated through 150° Fahr. the force exerted as a result of the expansion effects is equivalent to 65 tons. This simple calculation should bring home to the welder the enormous forces which are capable of being brought into play as a result of expansion not being properly taken care of.

For calculating the deformation brought about by contraction effects it is useful to know what contraction usually takes place when certain metals have been welded and the line of welding subsequently cools down. The following are the usual shrinkage allowances for each foot of length:

Paper prepared for Acetylene Journal by the author, who is engineer to the Chamber Syndicate de la Soudure Autogene. The material has been translated and added to by Capt. D. Richardson, R.A.F.

Cast Iron—thin material = 1/16 inch
Cast Iron—thick material = 3/32 inch
Steel ..... = 1/4 inch
Copper ..... = 3/16 inch
Malleable Iron ..... = 1/5 inch
Aluminum ..... = 1/5 inch
Brass ..... = 3/16 inch
Lead ..... = 5/16 inch

Consider for a moment that two plates are to be united by a line of welding. The edges of the plates may be or may not be bevelled. It is always necessary to raise to the melting point a length of metal which, in the case of plates that are not bevelled, consists mainly of the edges of the plates, and in the case of bevelled plates is supplied by the filling material or welding wire. In both cases, the result is the same, a certain volume of metal is melted along the line of welding and on cooling becomes integral with the parts welded..

It is easy to comprehend that if it were possible to raise the whole line of welding to the melting point at a particular moment the length of this line would depend upon the coefficient of expansion of the metal and, on cooling, a contraction would take place which would equal the amount of expansion; the final length of the line of welding would always be equal to that of the line of welding before the operation. In this case there should be no deformation of the plates in a longitudinal or transverse direction. Unfortunately, in obtaining welds with the blowpipe the conditions described do not take place because the line of welding is obtained by a successive series of small molten baths which cool off as the work proceeds so that the phenomenon of contraction and expansion is taking place continuously in small sections and it is this factor which brings about distortion and warping of the plates.

In considering the effects of expansion and contraction in welding operations it is necessary to thoroughly grasp the fact that the line of welding, made in the usual way, is shorter after welding.

Size of Weld

The size of a weld also plays an important part in distorting or warping the parts as they cool. The shape and size of the molten bath constituting the weld, varies with the thickness of the metal. Its size and shape can be clearly brought out by means of etching tests.

In Fig. 1 the welded zone is clearly

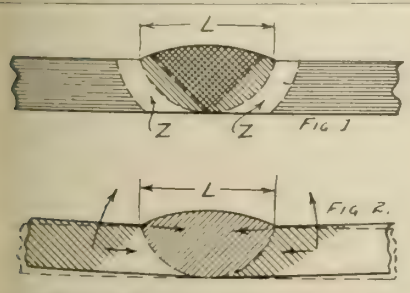


Fig. 1.—Welding zone clearly shown.
Fig. 2.—Showing warpage effect.

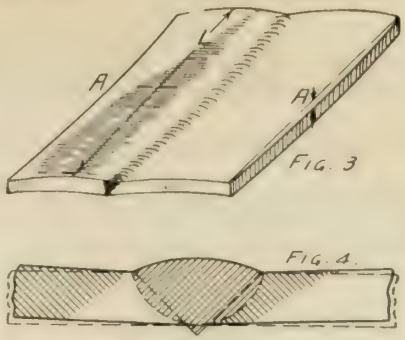


Fig. 3.—Final shape of plate.
Fig. 4.—Effect of contraction.

shown and, during the welding operation, the length of the base line of the "B" increases to the dimension and L consists of metal which has still to cool down and consequently to contract. It is also necessary to consider the contraction effects of the two zones Z and Z situated on either side of the bevelled faces. These zones, at the moment of welding, are expanded and on cooling will contract so that this contraction effect must be added to that of the molten bath itself.

The result of these two contractions is to produce a warpage effect as shown by full lines in Fig. 2. The final shape of a plate with a longitudinal weld is shown in Fig. 3. The contraction effects mentioned bring about the results (1) a shortening in length of the plate as measured along the line of welding produces a convexity at the edges A, A (2) the transverse contraction of the molten bath and surrounded zones produces a very obtuse angle, in other words the two parts welded together are not in line.

It is easy to calculate the longitudinal contraction of a line of welding but the determination of the transversal contraction, with its resulting deformation, is practically impossible for several reasons. In the first place the contraction is not confined to the surface of the bath but extends throughout the mass of melted metal. It is for this reason that overlapping of the edges takes place where the plates are not tacked or sufficiently separated. This contraction throughout the mass is shown by the distortion at the lower edges of the bevelled faces which, as a result of the very high temperature, are strongly pressed against each other under the contraction effects of the preceding portion of the weld in process of cooling.

Effect of Contraction

Fig. 4 shows this characteristic effect of contraction on the lower edges of a joint. The dimensions of the plates, on each side of the weld, have an influence on the contraction effects, not as a result of conductivity, which is small, but in consequence of its mass or weight which tends to resist the contraction of the molten bath and diminishes to a certain extent the effects of contraction. The net result is to increase the value of the internal strain in the mass of solidified metal. This is verified in practice as one finds that in welding plates of the same thickness and under the same conditions, that the angle formed by the two plates after welding is less in the case of large plates than in small plates such as, for example, test pieces. The distortion and warping effects consequently are proportionately less in thick plates than in thin plates.

The question arises as to whether it is possible to calculate in advance the value of the deformation which will be produced. In certain cases, when welding horizontal plates or tubes, for example, where the linear contraction is known, it is possible to determine the deformation. In the majority of cases, however, it is impossible because a whole series of factors intervene which influence and vary the effects of contraction in the welded pieces. The method of welding may, for example, vary from one shop to another, the thickness of plate, the welding with or without bevelling, the angle formed by the blowpipe used, blowpipe manipulation, the direction of the flame, the degree of penetration, the speed of welding, the internal shape of the molten bath, whether backward or forward welding is applied, the overcharging of the weld, stoppages during the welding operation, etc., are the main factors that influence the contraction effects.

It is not possible, in the majority of cases, to apply the results which have been obtained on simple pieces welded in large quantities. On the other hand, experienced welders find a solution for a large number of cases from long practice in analogous work, and such men often possess a strong sense of anticipation in dealing with expansion and contraction effects and consequently prepare their work accordingly.

It is proposed to examine a number of common difficulties in welding operations brought about by expansion and contraction effects and to suggest methods of preparation and welding which will eliminate or correct these effects. There are many ways of taking care of expansion and contraction, but the four principal methods are as follows:

(1) Arrange the lines of welding and weld in such a manner that the effects of contraction are distributed and divided up so as to neutralize their effects.

(To be continued.)

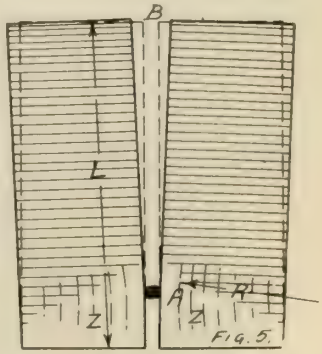


Fig. 5.—Welding of two plates.

Practical Ideas for Shop Executives

STRIPPING SMALL SHELLS FROM PUNCH

By Chas. E. Hall

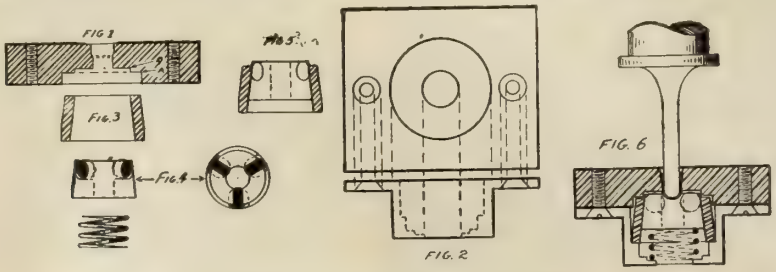
AN UNUSUAL form of stripper for drawn work, is shown in the accompanying drawings. In drawing brass shells for the well-known Bull Dog guards for tie pins, trouble was experienced by the shells remaining on the punch and coming back through the die, on the upward stroke of the press. As a dial feed was used, with the press running continuously, this was a decided inconvenience, as sometimes two, or even three would be forced through the die on top of each other before the operator could stop the machine.

Besides slowing up production, there was great danger of damage to the tools; consequently a stripper of positive action had to be devised. The superintendent decided to use the principle of the Bull Dog guard itself, using three steel balls instead of two as in the guard. A new drawing die was made and the back turned out as shown at Fig. 1. A cold rolled steel holder, the size of the die, and ¾ in. deep was turned down and bored out to contain the working parts as shown at Fig. 2. A hardened steel sleeve, Fig. 3, slightly tapered inside and out and 9/16 in. high, was made to fit freely in the recess A, Fig. 1. Next a cold-rolled cage containing three ¼ in. steel balls was made with a taper to conform to the inside taper of the sleeve. This was 7/16 in. high and projected through the top of the sleeve about 1/16 in., Fig. 5, and fitted freely in the recess B, Fig. 1. The steps shown in the section of holder, Fig. 2, were for the bottoms of the sleeve, cage, and spring respectively and shown in the assembled drawing, Fig. 6. The holder was screwed to the back of the die as shown at Fig. 6 only two balls are shown as it more clearly illustrates the action of the stripper.

When the punch descends with a drawn shell on it, there is no resistance except that of the spiral spring which is depressed; but on the up-stroke of the press, the balls grip the shell at the top edge on one side, and the tapered wall of the hardened sleeve on the other, and holds the shell rigidly while the punch is being withdrawn, and when out, the shell drops through. The balls make slight marks, but as they come near the edge of the shell, the trimming removes them.

In marking a stripper of this kind, care must be taken to see that when the cage is up to the limit on the up-stroke of the press, that the space between the balls and the punch is just sufficient to grip the shell, but not enough to leave any chance of seizing the punch, Fig 6, where the solid black on the end of the punch represents the shell being drawn.

This stripper has proved very positive in its action, and can doubtless be applied to advantage where similar trouble has been experienced.



Stripping small shells from punch.

STANDARDS OF RIM THICKNESS FOR GEARS

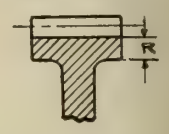
By Robert Mawson

One of the bothersome jobs for the draftsman when designing gears is to know how thick to make the rim under the tooth so that it will be strong enough and yet not be heavy in section. Most gear designs now only show the outside diameter of the gear and perhaps a dotted line to represent the pitch line of the part, it being considered a waste of time to show the tooth outline on the design. Under these conditions it is rather difficult for the man on the board to visualize when the correct rim has been called for as the true shape of the gear is not shown. Of course the designer might draw out one of the teeth and show the rim and thus obtain the proportions, but this is time spent which could be used perhaps to better advantage, at any rate in many drawing offices this procedure is objected to by the chief.

With this in mind we recently compiled the table shown in the illustration and it has proved not only a time saver but also ensures gear designs uniform in their nature and yet strong enough for service. The first column gives the pitch of the tooth, the diametral system being expressed, but of course this can be easily converted to the circular pitch for shops using the latter system and then the nearest figure for the pitch given would be used. The second column expresses the proper thickness for the desired rim for any pitch in question, for example when designing a 7 diametrical pitch gear the thickness of the metal under the tooth would be ¼ inch.

Knowing this factor the draftsman has only to take the total depth of the tooth, which can be obtained from any text book dealing with gears, and adding these two quantities together he has

PITCH	R
2	1
2½	29/32
3	19/32
3½	1/2
4	7/16
5	3/8
6	5/16
7	1/4
8	3/16
9	3/16
10	5/32
12	5/32
16	1/8



FORMULA

$R = \frac{1.769}{P}$

P = DIA. PITCH

Gear rim data.

the thickness of metal from the outside of the gear to the under side of the tooth where the rim meets the arms or web. I have also incorporated in the table the formula as shown so that if the draftsman finds it necessary or advisable to add other pitches of gears he may easily do so by using the given formula. As an example, taking an 18 diametrical pitch gear and desirous to obtain the dimension R, divide 1.769 by 18, and .098 is the result and as 3/32 of an inch is .0938 this would be considered close enough and would be used as the thickness of the rim under the tooth.

EFFICIENCY

By I. N. B.

What is efficiency? The Romans invented the word, it means getting the most out of things. In almost any shop may be found instances where improvement can be effected by a little study of the conditions. Take the twist drill, one of the most common tools used in machine shops. And it is safe to say there is no class of cutting tool used that receives so little consideration as the twist drill. Most every tool room has a box of broken drills, tangs twisted off, split down the center, etc., and it is generally accepted that the cause is unavoidable. It is largely due to the fact that the drill can be bought ready for use. As a result the mechanic is likely to assume that the manufacturer has produced a tool ready for use, but which is capable of remaining in good condition with very little attention.

As a matter of fact the proper grinding of a twist drill is of the utmost importance, and unless the drill is ground

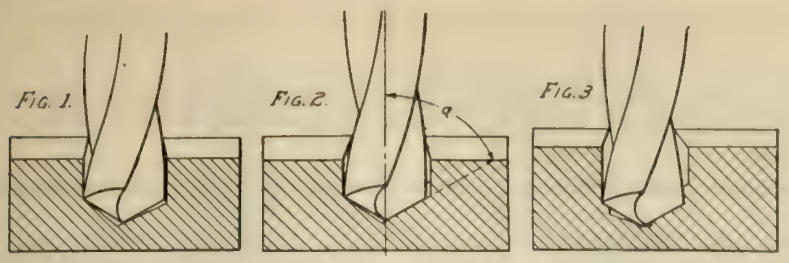


Fig. 1.—Lips of different inclination. Fig. 2.—Lips of different length. Fig. 3.—Lips of different length and inclination.

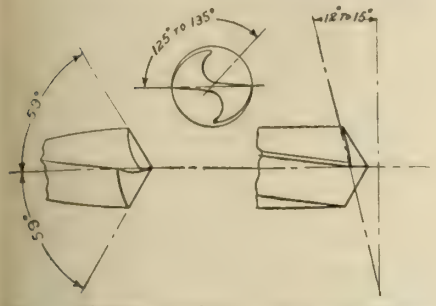


Fig. 4.—Showing angle of rake and clearance.

to the proper shape its cutting efficiency is seriously impaired, notwithstanding that the drill manufacturers have furnished the information how to grind drills to get the best results. Different manufacturers have made a series of tests that prove if the proper precautions are taken in grinding and the feed used as specified the results as claimed will be maintained. Improper grinding not only causes unnecessary breakage but produces spoiled work, which adds to the cost of production. To cite one instance: The drill operator had a lot of pump cylinders to drill for studs. The drawing specified the right size of drill to use for the tap drill. He received the right size from the tool room but in grinding he got one lip longer than the other, the result was that the drill cut over size, so that when they came to be tapped there was only stock enough for less than a half of thread. It became necessary to redrill and use a larger stud and re-drill the cylinder covers.

The only sure way to prevent the occurrence is to grind the drills on special drill grinders which are so designed that they assure the producing drill points that must be of the same angle with the center of the drill, both cutting lips must be of the same length. The drill point must have the proper lip clearance and this clearance must be the same for each side of the drill. All of these factors are imperative if satisfactory results are to be obtained. In the accompanying sketch, Fig. 1 shows action of drill with the lips of different inclination, Fig. 2 shows lips of different length, Fig. 3 shows lips of different inclination and different lengths, Fig. 4 shows angle of drill point, clearance, and angle made by chisel point with the cutting edges of drill. While it is possible to grind drills by hand it is not the most efficient method, where much drilling is done the drill grinding machine will give good returns on the investment.

SPEED CHANGING BY WORM GEARING

By Nick Andrew

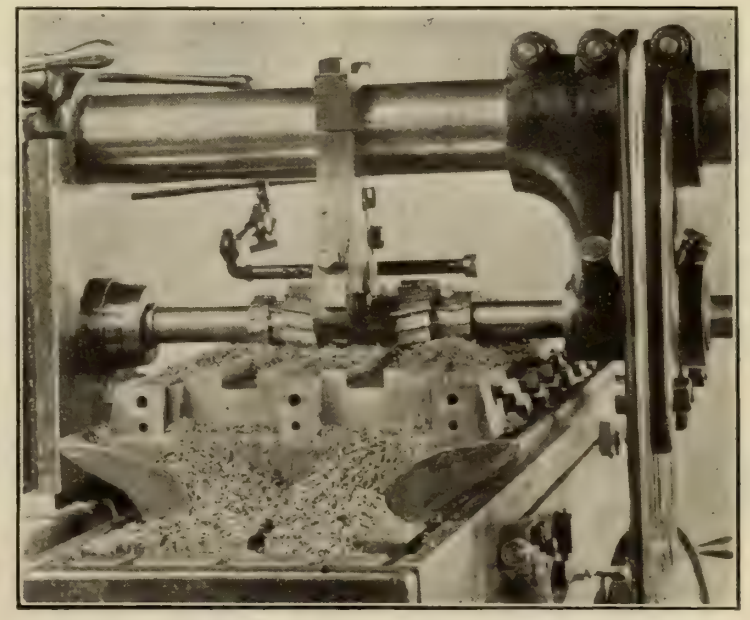
James Watt was a strong advocate of the worm gear, but owing to the difficulty of making this gear in efficient form it was not very largely used during the 19th century. Of late years, however, engineering practice has advanced so much that it is possible to make worm gears of the highest quality at a moderate price. Many engineers have therefore reverted to the principles laid down by the famous inventor, and we find worm gears recommended and used for vehicle driving and other purposes where they were once regarded as hopelessly inefficient. In view of the interest recently taken in worm gear, it is really remarkable that the first patent for the use of the worm gear for speed reduction and speed changing has just been taken out. A British inventor has obtained patents all over the world for this application. In his device the usual spur wheels are entirely absent, and nothing but worm wheels are used. In his speed reduction gear, the first shaft carries a worm which drives a worm wheel on a second shaft at right angles to the first. This second shaft in turn carries a worm driving another worm wheel on a shaft at right angles to the second shaft. This third shaft in turn carries a worm wheel on a shaft at right angles to it, the final effect being that the fourth shaft is in line with the first shaft and is driven by it at a speed reduced three times. This type of gear has been applied already to the driving of a mechanical stoker and to motor car accessories. In the case of the mechanical stoker the reduction is in the extraordinary ratio of over 27,000 to one—a result which could not possibly be obtained by means of ordinary gearing unless it were made of preposterous dimensions. In the case of motor car speed changing gear several ratios can be obtained with remarkable simplicity. The distinguishing feature of the gear is its small size in relation to the high reductions it provides. The inventor claims that the gear has an efficiency between 80% and 90% where the reduction is less than 250 to 1.

GANG MILLING OPERATIONS

By H. James

The accompanying illustration shows an interesting operation being performed on a Herbert horizontal milling machine. As can be seen from the cut a special roller steady bracket is employed as an added support to the cutter arbor. This steady is firmly secured to the overhead arm and the roll holders are adjustable. A finger extends down from the front of the bracket and contained in this rod is a small pin with a felt insert for brushing chips and dirt from the arbor so that a clear path is presented to the rollers. The material operated on is steel bars of from 35 to 40 tons tensile strength. In the gang of cutters two are operating on the side and two on the face, the latter being 5½ in. in dia. The spindle speed is 25 r. p. m. and the feed one in. per minute.

Sliding parts of machine tools should be well lubricated—not over lubricated. Oil on a part not subjected to friction may do more harm than good.

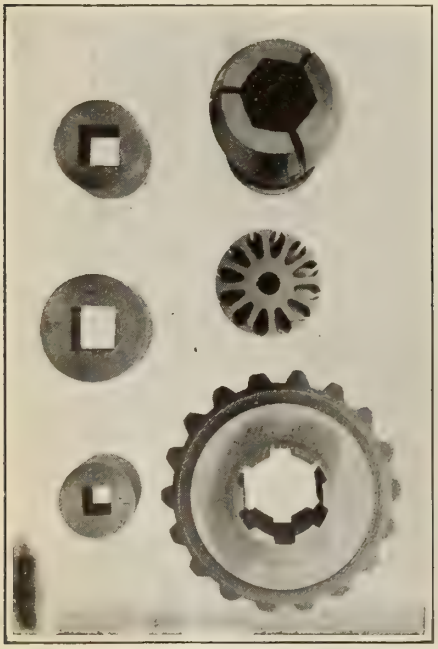


Steady support for milling machine arbor.

New Things in Shop Equipment

STAYBOLT THREADING MACHINE

There has appeared on the market recently a machine intended for threading staybolts in railroad shops. The machine is really one of the standard turret lathes that the firm manufactures, but instead of the turret on the carriage there is located the staybolt threading attachment. When not required for staybolt threading, the attachment may be replaced by the regular equipment. The machine is capable of cutting any size of thread on crown, button-head, and swivel staybolts up to 40in. in length. Self opening die-heads are supplied to meet the particular requirements of the shop in which the machine is installed. In an operation on upset button, head forgings, which were taper-formed under the head and on which a thread was cut both under the head and on the opposite end the production rate was one staybolt per minute. The attachment has two cam-operated die heads on the carriage of the machine. The rough forging is passed through the forward die-head into the square collet of the automatic chuck, located in the spindle of the machine. The die-head has an enlarged hole in the shank, and the chasers open exceptionally wide to enable the staybolt to be chucked in this manner. After the staybolt has been chucked, the staybolt carriage is fed forward until the extended end of the bolt is supported in the steady-rest between the two die-heads. The head end is then formed by a cutter on the cross-slide, after which the staybolt carriage is again fed forward during which time the die-heads being operated by cams at the rear, close automatically and cut the threads. When the die-heads have passed the cams the dieheads again open. The carriage is then returned to the back end of the machine. As the action of the heads is dependent on the contour of the cams, the latter are made to suit the job. The threads on both ends of the staybolt are cut in a continuous lead, the thread on the extended end being cut without any previous machining. The machine and attachment are manufactured by the Warner and Swasey Co. of Cleveland, Ohio. The machine on which the attachment is mounted is the regular No. 4 turret lathe made by this firm.



Showing various parts produced by broaches.

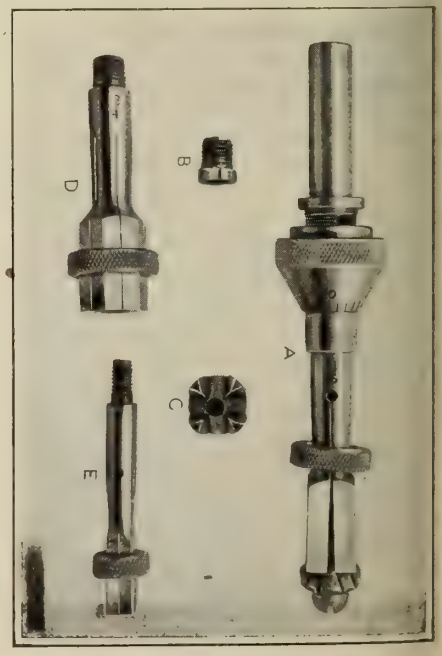
ADJUSTABLE BROACHES

A line of tools that can be used for the broaching of square and hexagonal holes, splines, keyways, and round grooves, in small lots, has been recently placed on the market. The broaches are adjustable. They are intended to be attached to the spindle of a drilling machine, the ram of a shaper or arbor press, the tool post of a lathe carriage, or other machine members suitable for traversing a tool without rotating it. The broaches are made in various styles, the square and hexagonal types being made regularly in all sizes from ¼ to ¾ in. across the flats. The broach is held in a holder that has a micrometer adjustment. Each broach is hollow, the front end being ground to the shape of the hole to be produced, and split. The rear end is threaded to screw into the holder. A rod extending through the hollow broach has a pilot screwed on the forward end after the broach has been assembled. This pilot is of the same diameter as the hole to be machined, and thus serves to keep the entire unit steady in an operation. The pilot is provided with ribs that engage the splits of the broach and keep the cutting edges free of the tool from swerving sideways. The pilot is also employed for adjusting the cutting edges. Prior to the first cut, the ribs of the pilot only slightly engage the splits of the broach. Then after the broach has been given one pass through the work, the pilot engages the splits to a greater amount thus expanding the broach. To thus engage the tapered ribs of the pilot in the splits of the broach, the knurled member of the holder is revolved the desired number of graduations. Each graduation represents .001in. Each broach is provided with a ring gauge to set the cutting edges properly for the first cut. An adjustment is required after each cut is taken. The tools are made by the Edward Hollander Tool Co., of Newark, N. J.

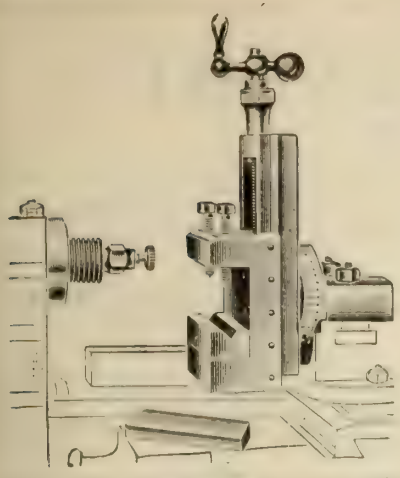
HIGH-SPEED PLANER

A special planer 26 x 32 x 18 in. intended for high-speed operating has recently been developed. The table operates at a speed of 150 f. p. m. on both the cutting and return strokes. A unique feature in the design is responsible for a very smooth running machine. The shaft, carrying the tight and loose pulleys, passes entirely through the bed, and carries on its other end a small pulley, which drives a larger pulley by a belt on which the tension is maintained by means of an idler. The power is then transmitted through a helical pinion and gear, which together with the belt drive just mentioned, are on the outside of the planer bed. On the helical gear shaft is mounted the pinion that engages the steel rack under the centre of the table. The bed of the machine is cast in one piece. The table contains three "T" slots, but no holes are provided. The steel rack extends the whole length of the table. Thirty inch driving pulleys are provided.

Two heads are mounted on the cross rail, and both of these heads operate on the one screw. The minimum distance between the tools is 12 in. The material, which the planer is designed to handle, consists of composition brass screen plates about 30 x 13 in. in size. The machine is manufactured by the Whitcomb-Blaisdell Machine Tool Co. of Worcester, Mass.



Details of adjustable broach.



Lathe milling attachment set up for cutting keyseats.

LATHE MILLING ATTACHMENT

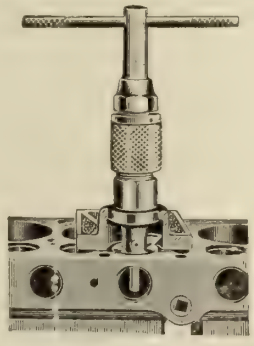
The attachment here illustrated has just been placed on the market. It is a handy device that can be used for light milling work on the lathe, squaring the ends of shafts and auto axles, sawing, splining shafts, and a variety of other small jobs. The attachment is secured to the top of the compound rest and in such a position that the centre of oscillation is at a low point, making it extremely rigid. Graduation is provided so that accurate angular setting is readily obtained. The device is manufactured by Hinckley Machine Works, Hinckley, Ill.

RACK-CUTTING AND INDEXING ATTACHMENTS

There has recently been placed on the market a rack-cutting and indexing attachment which is designed to operate on heavy duty milling machines. The rack cutting device is securely attached to the face of the column and is further supported by the overhanging arm at a point directly above the spindle where there is the greatest strain. The attachment is driven through a shank held in the machine spindle by means of a tang and a draw-back. A hardened spur gear keyed and pinned drives a second gear keyed to the same shaft on which a double lead worm is mounted. The latter engages a worm wheel which is located on a shaft that with two spur gears keyed to it, one on each side of the worm wheel. These transmit power to the attachment spindle through gears cut solid on this member. The spindle is made of alloy steel, and runs in bronze taper bearings that have means of adjustment for wear. The rack indexing attachment is fastened to the left-hand end of the table by means of the central T-slot. It consists of a bracket carrying an indexing and locking disc and change gears. This device permits of cutting rack teeth and making other settings without relying on the usual dial. Various gear combinations enable racks of different pitches to be indexed by making one half, one, or two turns of the locking disc. The cutting of racks to the following diametral pitches is possible by means of eighteen change gears furnished:—3 to 6 by half pitches, all pitches from 7 to 16, and all even pitches from 18 to 32. Racks having circular pitches of from 1/16in. to 1in. may also be cut. A special rack vise is provided having jaws 30in. long which have a maximum opening of 5⅝in. The attachment is manufactured by the Rockford Milling Machine Co., Rockford, Ill.

VALVE RE-SEATING AND BORING TOOL

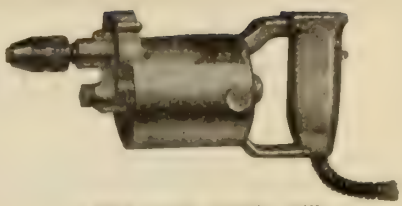
A very important factor in the overhauling of motors and pumps is to see that the valves seat properly and to do this they must be in perfect alignment with the valve guides. A device for performing this has just been placed on the market. This appliance does not depend on the small pilot end to guide the cutter, but the latter is guided by a large accurately ground bearing above the valve seat. A screw feed is provided and the tool is held steadily to the work, and no digging in or chatter takes place. When refacing valve seats top and bevel are both faced so that a narrow and effective seat is always presented to the valve, thus aiding in expelling the carbon. Cutters are made of high speed steel and shop and garage men can resharpen and keep them in shape. The set consists of three boring bars, with 5/16in., ⅜in. and 7/16in. pilots; two valve seating cutters, 45 deg. angle; one knurled handle; two boring cutters and wrench. All incased in mahogany finished chest. Weight, 18 lbs. It is manufactured by the Hinckley Machine Works, Hinckley, Ill.



Valve reseating tool.



Valve reseating and boring set in mahogany case.



High speed electric drill.

SMALL ELECTRIC DRILL

A small but highly serviceable electric drill has just been offered to the trade. It is extremely compact and has remarkable strength for drilling ¼in. holes in steel. It weighs only four pounds and can be supplied with either 110 or 220 volts motor, suited for direct or alternating current. It is amply provided with oiling and ventilating facilities, and is fitted with bronze bushings and gears. The drill can be held and operated with one hand, and chuck and drill are always in view of operator. The Lovejoy Tool Works, Chicago, Ill., are the makers.

HIGH-DUTY DRILLING MACHINE

There has recently appeared on the market a redesigned heavy-duty drilling machine, where simplicity has been the keynote and aim of the designers. The machine has a capacity for drilling a 1-½ in. hole through solid steel. Nearly all the operating members are contained in the head, which is very accessible and lends itself to dismantling. The head is bolted to the vertical face of the heavy box section upright. When these bolts are removed the head can be taken away by means of a crane. The upright, base, and jackshaft support are cast integral to insure rigidity. All operating levers are located at the front of the head. The single screw of the table permits a 12 in. vertical movement of this member without providing a hole in the floor for the screw. The machine has a single pulley drive, and the power is applied through the medium of a friction clutch. Nine spindle speeds, ranging from 75 to 610 r. p. m. are provided. There are three feeds of .006, .012, and .026 in. per rev. and these are available through sliding change gears. Helical gears are used to transmit power from the pulley shaft to the spindle. The spindle feed consists of a double rack and two pinions in order that all side thrust be eliminated. Roller bearings are supplied in all driving shaft bearings and ball bearings take care of the spindle thrust. The speed change gears run in an oil bath while the feed gears are lubricated by a splash system. The upper driving helical gears and their bearings are packed in grease. One packing is usually sufficient for several months running. Some of the principal dimensions of the machine are —from centre of spindle to face of column, 10in.; maximum distance from nose of spindle to top of table, 28-⅝ in.; length of power feed, 12 in.; and the approximate weight of the machine is 2,700 pounds. The machine is manufactured by the Foot Burt Co of Cleveland, O.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Can We Simplify Machine Tools?

"SIMPLIFICATION is a program much more far reaching than most business men, I believe, yet realize," said Mr. Parsonage, general manager of the John Deere Wagon Works, not very long ago.

Secretary Hoover, who requires no further introduction, for we know the wonderful work he has accomplished for the United States, is also a firm believer in simplification. When addressing a brick makers conference recently he said, among many other things, that the simplification proposal they were making was not a new idea, but was exceedingly worth while because in this case it was inspired by the manufacturers themselves.

These two prominent men do not believe in simplification as a theory, but practise it themselves. Mr. Parsonage admits there was a time when manufacturers of implements made practically every variation in style that buyers felt they wanted. What they wanted was usually determined by what they had previously been accustomed to. To show how simplification pays, here is what one implement dealer experienced. In 1913 he listed fourteen sizes of implements, carrying not more than three of each kind. After simplification, his last order called for only four sizes, with not less than five of each kind, and his assortment of implements was equally complete.

The brick makers in their conference, decided that the manufacturers ordering fire brick would not lose any efficiency in their furnaces, were the makers to simplify and reduce the sixty-six varieties then manufactured. The result is almost beyond belief. After careful investigation it was found that the manufacturer could be equally well served with eleven varieties in place of sixty-six. Not only that, but the brick maker could produce at a lower cost, and sell to the consumer at a proportionately lower figure.

What can be done in these two lines, and many others which we could mention, can be accomplished in machine tool circles. There is no need for so many varieties. The difference in some cases is very slight, and simply a talking point. If machine tool manufacturers would get together, allow their designing staffs to collaborate, a standard style of drill, lathe or miller as the case might be, could be designed which would embody all necessary features, yet reduce machining costs to a minimum.

Various sizes of such tools would have to be made in order to accommodate different classes of work, but not the enormous mixture now on the market. An objection which would likely be raised to this suggestion is "Why should a large manufacturer give a small producer of inferior grade tools the benefit of his experience?" This is not intended, for when we say "Get together" we mean only the recognized tool builders. Certain patented features might be adhered to, but even at this point it might be well to waive claims on the idea, giving designers a free hand, when a better and improved design might result. This suggestion is very idealistic, and would take a long time before it would become an established fact, but nevertheless there are great possibilities in it, if tackled in the proper spirit, viz., one of striving after simplification.

Both the manufacturer and consumer would eventually get the benefit. Those concerns who are almost making a tailor built tool would have to give way to simplified modern manufacturing methods. There will, of course, always be certain groups which must continue, such as engine lathes, automatic lathes, continuous millers, etc., but each of these lines can be simplified in order to lower the cost to both the consumer and the manufacturer.

Protecting the Worker

AT OTTAWA the other day a resolution was moved, urging that in addition to the accident insurance now available, parallel protection should be afforded to all workmen contracting sickness while performing, or due to the performance of their work or trade. Later on the motion was withdrawn because of the principle that workmen's compensation acts were within the sphere of provincial legislation. In other words, each province had a right to arrange matters for themselves.

At present the term accident does not, according to law, include sickness or desease, even though the latter may be the direct result of some work performed daily. Take for example the making of matches. It is known that in many cases constant work in this industry has resulted in the loss of eyesight and contraction of tuberculosis and that although several notable improvements in working conditions have taken place, a danger from a health standpoint still exists.

Match factories are not the only traps in which health can be impaired, because we have pickling rooms, tanneries, bronzing rooms, chemical factories of some kinds, foundries, etc., all of which in some form or other eat away the vitality of the worker. To look at some of the present day molders will perhaps make one doubt that the industry is unhealthy, but examine their lungs, and see what you discover.

How far we could safely go in the awarding of sick benefits could not be arrived at in a day, but through careful research by competent medical men, the industries could be arranged in groups according to their health hazard.

When a workman devotes his energies to some unhealthy trade he deserves compensation when his useful period is over. It would be a splendid forward step were the different compensation boards to take this matter up with the manufacturers, thus adding still another link to the chain of welfare work, existing between the employer and employee. Such investigation might lead to the removal of the danger, which would be the best form of protection.

ON ANOTHER page of this issue appears a short comment on an article and editorial we published on April 27. We are glad to note the subject has caused comment and we feel that many other manufacturers could to advantage express their views.

Iron and Steel Market Continues Firm Tone

Increase in Business Reported by Steel Merchants—Galvanized Sheets Advance—Small Tools and Supplies Active—Machine Tools Holding Their Own—Non-Ferrous and Scrap Metals Quiet —Pig Iron Demand Tapers Off

INCREASE IN PRICE OF GALVANIZED SHEETS

CANADIAN markets generally are firm. Demand is keeping up as well as can be expected, and with a few exceptions, there is no cause for complaint. The iron and steel section is showing decided signs of strength, and the volume of business closed so far this month indicates that it is by far the best this year. Dealers were looking for improvement in May, and in the majority of cases, the volume of added business is satisfying them. Galvanized sheets are particularly active, and the price is now $5.60 in place of $5.35.

Roofers are exceptionally busy, and in some cases cannot accept further orders. A well-known Canadian representative of a large American concern, states that if Canadian consumers do not place orders for their steel requirements in the near future, they will be sadly disappointed in delivery dates, for the American steel mills are booking a large number of orders ahead. Railroad material is in heavy demand in the States, but Canadian markets will not show strength in this respect until the government decides to spend money on track material. Such a move is unlikely at present.

Non-ferrous and scrap metals are very quiet. Pig iron has also tapered off. Consumers of pig seem to be pretty well covered, and until the rate of melt is increased in foundries throughout Canada, no added interest can be expected.

Small tools and supplies continue to be in fairly good demand. Enquiries are general, this applying both to goods and locality. Machine tools are holding their own, but large orders are not being closed. Single machines are usually asked for but several good prospects are, according to dealers, nearing the closing point. The general tone of this section has improved and dealers are not discouraged, although the volume of business actually closed is small.

Steel pipe is very firm, and deliveries are becoming more extended all the time. Oils, waste and greases are in good demand. Oils dropped slightly in price over the week, but nothing to speak of, but it shows that the tendency is downward, not upward. To prove that some things can go up, gasoline took a jump of 1½ cents per gallon during the week, but whether the rumor of a still further advance will take place is very questionable.

Conditions in the steel market in the United States show still further improvement. The April report of the American Iron and Steel Institute places the production rate of steel ingots during last month at about 35,500,000 gross tons per year. This is ahead of March, the average rate for that month being 32,500,000 tons.

A few sources predict that steel production will fall off around July, but from present indications this does not seem feasible, because several steel companies have large orders booked ahead, and are in some cases accepting rush business at premium prices. In the short period of three months, the steel market has changed from a buyers' to a sellers' market, and from information received, the source of which we cannot divulge, the steel companies themselves are confident the present strength will continue.

Some firms are finding it difficult to secure coal, owing to the strike, and are moving this commodity unusual distances in order to meet the situation. No relief is expected for some months to come.

Connellsville coke presents a very narrow market, both offerings and enquiry being extremely light. Foundry coke is also quiet. Connellsville coal has advanced slightly, eastern buyers having entered this market. Steam grade is selling from $3.25 to $3.50 per ton.

Pig iron shows high prices but few purchasers. One or two forced purchases brought a price of $25 valley, an advance of $1 over a week ago, and an actual market of $18 April 1. Bessemer is quoted at $26 valley. Foundry remains at $23 valley, but consumers are staying out of the market as long as they can owing to these high prices.

Toronto

May 17,

CONDITIONS locally remain steady. The steel market is particularly firm, and an advance in price has been made in galvanized sheets.

Iron and Steel.—Bars, shapes, and sheets are active the latter being strongest of all. The building trade is responsible for the activity in galvanized sheets this material being used for metallic roofing, eavestroughs, etc. The price has now advanced to $5.60 for 28 gauge and this quotation is being held to quite firmly. From present indications, May business will show a decided advance over April, and in the majority of cases, dealers are satisfied with the volume of business showing. A local representative of a large American steel company states that spikes, angles, and other railroad material is in heavy demand in the United States. He claims that his company is booking a large amount of orders ahead, and that delivery is getting to be an important factor. To show this is a fact, several important letters were read to the writer, everyone of them bearing out the statement that the mills confidently expected the strength and demand to continue. According to our informant, several Canadian consumers are hanging back, thinking all this talk of demand is propaganda, but as he puts it "the result will be that they will be unable to secure material except on delayed delivery.

The rumor persists that iron and steel bars may go up in price, but at present the quotation is still the same. Until competition in these lines diminishes, it is unlikely that an advance will be made. Quotations follow:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Non-Ferrous Metals.—This is a weak market, the demand being practically negligible. Prices remain the same, and following are the present quotations:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	6 75
Aluminum	26 00

Scrap Metals.—This is another quiet market. Until foundries show more activity, we cannot expect much improvement. Following are the quotations:

Copper, light, per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Medium brass	4 50
Yellow brass turnings	4 75
Light brass	3 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	16 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	6 00

Pig Iron.—This market has tapered off somewhat during the last two or three weeks. When the recent advance in price was rumored, everybody rushed for cover with the result that the market is now rather stagnant. The rate of melting in foundries does not seem to have increased lately, so that stocks of pig must be rather high in

some foundries. It is unlikely that there will be much improvement in this market for another month at least. The present quotation of $29.15 still holds firm in spite of small demand.

Machine Tools.—The smaller sizes of tools are selling at a fair rate, but the demand is not very brisk in the heavier machines. No large orders have been closed, mostly single tools being asked for. More interest is being taken in the market, however, and several good prospects are on tap. Dealers are not downhearted but feel the improvement, while rather slow, will be steady.

Small Tools and Supplies.—This section of the market shows good signs of strength. May business will be ahead of April if the present demand continues. One large dealer handling many lines reports exceptionally good business and he is taking some men off slow moving lines, such as agricultural machinery, in order to get all there is going in other fields. The sections particularly active in his case are, pumps, taps, reamers, etc., plumbers' supplies, hand tools of all kinds, and other miscellaneous supply lines.

Oils and Greases.—The demand for oils and greases remains good. Prices in oils have dropped slightly. The new quotations being as follows:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	0 20
Palacine	0 23
Machine oil, per gal.	0 33
Black oil, per gal.	0 17½
Cylinder oil, Capital	0 61½
Petroleum fuel oil, bbls., net	10 40
Pure turp., single bbls. gal.	1 35
Linseed oil, raw, single bbls.	1 00
Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bls.	1 10

Miscellaneous.—Waste is selling at a steady rate, and the demand for leather belting is fairly good. Steel pipe is very firm, deliveries being more distant. Prices are steady, and the mills, not the buyer, now do the dictating.

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	11
Mixed colored	14		

Montreal

May 17

TRADING in iron and steel on the local market has been about the same during the week as for some time past. The same lines that were active last week continue to move freely. This is particularly true of all building supplies. In common with this demand there is a fair amount of business being done in structural steel. No large orders have been booked, but there is a quantity of small orders, which run into a fairly good tonnage.

Steel prices have not undergone any change during the week, but there still remains a fairly stiff tendency on all quotations. Sheets, particularly British galvanized sheets, are in excellent demand. Pig iron and non-ferrous metals are quiet. Machine tools are being aggressively pushed and sales are slowly responding. Machine shops report that a little more business is in evidence and that conditions are improving.

Iron and Steel.—For some weeks past, reports would indicate that quotations on steel products were to undergo an upward revision. This belief still persists, but the base price of $2.75 remains unaltered. Even this base price is shaded for attractive orders, so that while these facts seem ambiguous and contradictory, they nevertheless exist. The coal strike is the explanation. If the strike is of long duration, prices will naturally advance. On the other hand should a settlement be effected it is questionable if an advance would be made. Buying has been stimulated by this uncertainty, also the strong stiffening tendencies in the United States before the strike materialized.

Merchant bars are moving satisfactorily. Orders are for the most part small, but they come from all parts of the country. Jobbing shops are receiving more business and are coming into the market. The demand for structural steel still continues in small lots. Galvanized and blue annealed sheets are moving in good quantities. The mills in the United States have been falling down in their deliveries locally, the result being that firms handling British sheets have been enjoying a greatly increased demand. One jobber stated that he was not only sold out, but that he had sold two consignments which were at present in transit from England. Plates, however, are very dull.

The railway companies are not placing any rail orders so again the mills are disappointed in this respect. Local quotations are as follows:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Machine Tools and Shop Supplies.—Sales in machine tools have slightly increased, but only in small and single tools. Wood-working tools are still moving in a small way and dealers are disappointed in the way the market has responded to their intensive sales campaigns. General metal working tools are in fair demand only, while the supply business is improving as local shops are getting more business. There are no marked features other than the fact that the turnover was larger in most cases than last week.

Pig Iron.—Buying still continues quiet, although a fair number of single car orders were received during the week. No changes in prices have been announced. No. 1 pig is quoted at $31.80 per ton. There is an undercurrent of firmness to all quotations and is reflected in the ruling that no iron will be sold for delivery later than thirty days. Volume of production is diminishing in the United States as many furnaces are commencing to feel the shortage of coke.

Non-Ferrous Metals.—Everything continues quiet in the non-ferrous metal field. There are no price changes, and the small volume of business passing does not appear to be increasing. The stiffening in price in foreign markets was followed by a slight local increase, but this factor made no impression on the demand locally. The present prices are:

Lake Copper	16 75
Electric Copper	16 50
Castings, Copper	16 25
Tin	34 00
Lead	6 75
Spelter	7 50
Antimony	6 50
Aluminum	23 50

Scrap Metals.—The demand for scrap in the United States, does not appear to materially increase the demand locally, although it did have the effect of sending up the price to a point that was sufficiently high to turn away any business that might be offering. The following list contains the local quotations, but business passing is taken at a somewhat lower scale, which is regulated entirely on the special transaction that is being made:

Copper, light per 100 lbs.	9 50
Copper, crucible	12 50
Copper, heavy	12 50
Copper wire	12 50
No. 1 composition	9 50
New brass cuttings	7 00
Red brass turnings	8 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	12 50
Boiler plate, per gross ton	8 50
Heavy melting steel	10 00
Axles (wrought iron)	9 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	22 00
Pipe, wrought	7 00
Car wheel	17 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	18 00
Cast boring	3 00

Pittsburg

May 17

ON ACCOUNT of the possible effect of the coal strike upon the steel industry, the April report of the American Iron and Steel Institute, giving the output of steel ingots by the 30 companies that make monthly returns, was awaited with unusual interest. From the report it may now be computed that in April the production by the whole industry was at the rate of about 35,500,000 gross tons of ingots a year. March showed an average rate of 32,500,000 tons, the rate probably being about 30,000,000 tons at the beginning and 35,000,000 tons at the end of the month.

Thus, on the whole, production has increased since the coal strike began, even though the previous rate was a very high one, considering the general industrial and commercial situation, and that production in 1921 was only about 19,500,000 tons.

In the last analysis, however, the low production in 1921 is probably the best explanation of the high rate now. Buyers were liquidating stocks in 1921, while of late they have been replenishing stocks. It is hardly to be supposed that they are accumulating abnormally high or speculative stocks, but merely replenishing stocks, or bringing them up to normal working level. Even this would require quite a lot of steel. Production of steel decreased a trifle in certain districts in April, this being made up, with a margin to spare, by heavier production elsewhere.

The probability is that the rate has run between 36,000,000 and 37,000,000 tons a year right along since April 1. The present prospect is that production will increase somewhat in the next few weeks, although it usually falls off somewhat in July and August. Whether this year will furnish an exception remains to be seen.

Making Steel.—It is not easy for some of the companies to make steel just now, for with some of the usual sources of supply shut off by the strike, coal has to be moved unusual distances in some cases, and stocks are being drawn upon freely.

Precise figures are not available, but from various estimates and reports a rough picture of the coal situation may be given, which is sufficiently close to furnish a clear idea. In round figures there is bituminous coal producing capacity in the United States of 16,000,000 net tons a week, of which 10,000,000 tons is union and 6,000,000 tons non-union. Production has never been at full capacity throughout the country even for a single week, between 12,000,000 and 13,000,000 tons being a high rate. Consumption is between 7,000,000 and 8,000,000 tons a week at present and production, all non-union, is a trifle above 4,000,000 tons, leaving 2,000,000 tons idle non-union capacity, of which say half is idle on account of no market, and the other half is idle through strikes, brought about by the United Mine Workers.

Stocks April 1 were estimated at 63,000,000 tons, and consumption of stock is at between 3,000,000 and 4,000,000 tons a week. Part of the idle capacity that is not on strike is in small high cost mines which will operate in an emergency, and the major part is in districts remote from the heavy consumption. Such coal is being bought now, to be moved unusual distances.

The regular coal strike is likely to last for several months, while the strikes in non-union districts, instead of playing out in a few weeks as was at first expected, may last nearly, if not quite as long. The operators are making no effort to force the situation, preferring to get coal where they can, and at whatever expense is involved, letting the strikers wear themselves out.

Steel Market.—This section is very strong throughout. The actual turnover is not as heavy as in March or April, but mills are well sold up, at the present rate of production, for the next couple of months, and consumers in turn are well covered, there being some demand now for early deliveries, with buyers not entirely unwilling to pay delivery premiums. Quite a few buyers are offering mills third and even fourth quarter contracts, and when the mills have no regular quotations for those deliveries, buyers in some cases are willing to take the contracts and let the price be set later by the mills. In other words, the market has turned wholly in favor of sellers, whereas until quite recently it was a buyers' market, and it is hardly three months ago that the lowest prices were being made, there having been slight advances since then.

There are divergent views as to how long the present strength of the steel situation will last. Some expect a strong market throughout the year and even into the new year. Others think that much of the present strength depends on the coal strike, and that in the course of a very few months the strength will wear off. These observers do not think actual consumption is as heavy as current production.

Bars, shapes and plates remain quotable at 1.50c as the basis of the market, but the Steel Corporation is almost alone in quoting this price, and even the Steel Corporation makes it only on the most desirable business. In sheets, regular prices are 2.40c for blue annealed, 3.15c for black, 4.15c for galvanized and 4.50c for automobile sheets. At least half a dozen independent mills are quoting $5 to $7 a ton higher, but whether they will get much business at these prices remains to be seen. Steel pipe is very firm at 71 per cent. basing discount. Nails are still quoted at $2.40 by the Steel Corporation, and $2.50 by the independents. Tin plate is $4.75, but some of the independents have been thinking about advancing their prices.

Connellsville coke presents a very narrow market, offerings being light as well as inquiry. Furnace coke is quotable at $6.50 and only occasionally will a buyer pay this price. Foundry coke is $6.75 for standard grade, with occasional buyers. Connellsville coal has advanced, chiefly on account of the appearance on the market recently of eastern buyers, and is quotable at $3.25 to $3.50 for steam grade.

One or two forced purchases of basic pig iron have brought out a price of $25, valley, against a nominal quotation a week ago of $24, and an actual market April 1 of $18. Bessemer, by relation, is quoted at $26, valley. Foundry remains at $23, valley, with occasional transactions. In general, consumers will stay out of the market as long as they possibly can on account of the high prices.

CONDITIONS SHOW STEADY IMPROVEMENT

ACCORDING to reports from London, England, trade and industrial conditions in Great Britain are slowly but steadily improving. No big revival has materialized, but there has been a continuous betterment of conditions, a seemingly healthy growth, that has satisfied traders more than any sudden revival. An outstanding indication of the trend of affairs is that money is easier and more is being loaned, which indicates confidence in the trade situation generally.

Encouraging reports come from various trades, including coal, textile and pig-iron. General living conditions have improved, commodities haping dropped in price, and there has been a decrease in unemployment, although it is still large.

The Manchester Chamber of Commerce says that the hopes of a moderate revival of trade with India have been realized and that inquiries from India and China have been numerous. Egypt also has placed a fair number of orders. South America continues quiet. India, for many years the great market for British cotton goods, has become herself a manufacturer of such goods.

China has become more or less a manufacturing country, absorbing about 100,000 bales of American cotton last year. South America, notably Argentina and Brazil, have begun to manufacture textiles and generally all countries give signs of interest in domestic manufacture. While this shifting of production from one place to another creates certain difficulties, on the other hand, far from indicating depression it suggests the reverse condition.

Trade figures between Great Britain and the United States show some significant facts. For the three months ending March 31, 1922, declared exports from London to the United States aggregated £7,870,399, plus merchandise valued at $1,272,589, which was invoiced in American currency only, as against exports for the same period in 1921 amounting to £7,201,675.

If we remember how prices have dropped since a year ago, concludes the chamber, we shall see at once that not only has there been an increase in values, but a still greater increase in quantities. The large single items of these exports which show increases are: leather, precious metals, gums, linens, scrap metals, aluminum, linseed oil and copper concentrates.

An essential in die grinding is that the dies in a set be ground uniformly.

The Page Steel and Wire Co., of Bridgeport, Conn., have just issued a new handbook describing and illustrating developments in the welding industry. The book is full of instructive information on the production of iron and steel, and Page-Arinco welding rods and electrodes.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate ¼" and heavier	5 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 2 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 00
Castings, copper	16 25	17 00
Tin	34 00	34 50
Spelter	7 50	7 25
Lead	6 75	6 75
Antimony	6 50	6 75
Aluminum	23 50	26 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividng Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.83	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 9 50	$ 8 00
Copper, crucible	12 50	10 50
Copper, heavy	12 50	10 50
Copper, wire	12 50	10 50
No. 1 machine composition	9 50	8 50
New brass cuttings	7 00	6 00
Red brass turnings	8 50	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 00
Tea lead	3 00	3 00
Aluminum	12 50	10 00

	Per Ton	Gross
Boiler plate	$ 8 50	$ 7 00
Heavy melting steel	10 00	10 00
Axles (wrought iron)	19 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	22 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	18 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 40	$4.40
Sheets, blue ann., No. 10	3 80	3.75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 25	...
Galvanized sheets, No. 28		5 60
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 35
Premier 10¾ oz	6 00	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	21.00	$
1¼ in.	21.50	
1½ in.	22.00	
1¾ in.	23.00	
2 in.	22.00	17.00
2¼ in.	26.00	18.00
2½ in.	30.00	20.00
3 in.	34.00	25.00
3¼ in.	43.00	27.00
3½ in.	47.00	28.00
4 in.	58.00	35.50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	20
Palacine	23
Machine oil, per gal.	33
Black oil, per gal.	17½
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	10.40
Pure turp., single bbls. gal	1 30
Linseed oil, raw, single bbls.	1.10

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets, 24 gauge and heavier, base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored 13

Mixed colored 14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$29 00	$27 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	30 00	28 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	35 00
Copper sheet, planished, 16 oz. base	42 00	40 00
Braziers', in sheets, 6 x 4 base	30 00	28 00
Copper tubing, seamless		27

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

The Union Iron and Metal Co., Toronto, have made an assignment for the benefit of their creditors.

The Longhead Machinery Co., Sarnia, are making industrial trucks, and report good business.

The Coca Cola Co., 65 Bellwoods Ave., Toronto, are considering the erection of a manufacturing plant. George A. Porter is Toronto manager of this concern.

The Toronto Motor Car Co., 52 Jarvis St., Toronto, will soon erect a garage, warehouse office and service station on Adelaide St.

The Thorton Blanket and Woolen Co. Dundas, Ont., will erect a factory costing $18,000. Major E. H. Greenwood, has been awarded the general contract.

The Thomas Knitting Co., Bowmanville, Ont., will proceed with the erection of a factory costing $100,000. H. L. Quinn has been awarded the general contract.

Windsor, Ont.—Stores and apartments costing $12,000 will soon be erected for A. L. Hamilton, 482 Church St., Nicholas, Sheppard and Colthurst, architects, in the Dowler building are preparing the plans.

The Superior Wrench and Tool Co., of Toronto are just completing an order for $1,200 worth of wrenches which will be shipped to an English purchaser before the close of the month.

A foundry building costing $50,000 will be erected for Hillis and Sons, Halifax, N. S. The Nova Scotia Construction Co., Halifax, and Lockwood, Green and Co., of Canada, Montreal, have been awarded the contracts.

Effective at once, Mr. K. O. Shepard, is appointed Roadmaster of the Newport and Orford subdivisions, in place of Mr. L. Hebert, reports the Canadian Pacific Railway, office of the superintendent.

Fort William, Ont.—The northern Engineering Co., were unfortunate enough to experience a fire on May 9, the stores and workshop sections comprising the newest wing of plant being destroyed. The loss will be about $25,000.

According to Frans de Boer of Heemstede, Holland, his country may soon have a building at the Canadian National Exhibition, Toronto. Mr. de Boer, who is at present visiting Toronto, says that Dutch merchants have been discussing closer trade relations with Canada.

The P. Lyall and Sons Construction Co., Montreal, have just closed a contract for $250,000 worth of marble work and other improvements to the Windsor hotel of that city. Another contract for about the same amount of work is expected in the near future.

Tenders for the masonry, brick and the Ottawa civic hospital will be received up to 2 p. m., 30th May, by the chairman of the board of trustees, city hall, Ottawa. Tenders must be submitted upon forms furnished by the architects. An accepted check for 2 per cent. of the bulk tender price, together with a bid bond, must accompany each tender.



F. J. Macdonell.

Hamilton, Ont.—F. J. Macdonell, who for the past three years has been branch manager here of the Victor Saw Works and Clemson Bros., Inc., and has been for seven years associated with that firm has resigned to accept the Canadian management for Millers Falls Co. of Millers Falls, Mass., and will cover Canada personally for a time in the interests of the latter firm.

A local report states that a Canadian National freight train of 102 cars, claimed to be the largest on record, arrived in Winnipeg from the West on May 11th. This train, of which 96 cars were loaded with wheat, was drawn by a single engine, and made fast time. The wheat was destined for the head of the lakes. The length of the train was approximately 4,000 feet and the tonnage was in excess of 5,000 tons.

London:—The prospects of a trade revival in great Britain were discussed by two prominent business authorities the other day, and here is how they summed up the situation. Reginald McKenna, banker, said movements in bank advances marked the earliest stage of a trade revival. Manufacturers are now requiring more money to finance their operations. Their turnover is more rapid, more trade bills are coming for discount and there is a greater demand for bank acceptances to finance foreign trade. All these movements which bankers are now experiencing, pointed to increased activity. Stanley Baldwin, president of the Board of Trade, gave a similarly hopeful survey in the House of Commons. He said Britain was slowly climbing out of the appalling pit into which she fell at the collapse of the war boom.

The Hamilton Cotton Co., Hamilton, Ont., are having an addition made to their present factories. These improvements will cost $20,000. Stuart and Sinclair, 17 Jackson St., E., have secured general contract. The Hamilton Bridge Works, Hamilton, A. B. Ormsby Co., Toronto, and John E. Ruddel and Son, Hamilton, have received contracts for steel lintels, sash, roofing, etc.

"Increased advertising by Canadian manufacturers in Canadian publications is absolutely essential to make a 'made in Canada' movement a success," remarked Russell T. Kelly at a meeting of the Toronto Advertising Club a few days ago. Mr. Kelly pointed out that 60 per cent. of the advertising in Canadian magazines at present is American, so that a large slice of business was therefore getting away from Canadian business houses.

H. N. Cowan, of the Cowan Co., Toronto, has been elected president of the Confectionery, Biscuit and Chocolate industry in Canada. E. D. Littler, Montreal, has been made first vice-president; F. McCormack, London, Ont., second vice-president: Colin Currie, Toronto, treasurer and C. J. Bodley, Toronto, secretary. The executive committee consists of: C. Monahan, Halifax; J. S. Pluard, Joliette, Morden Neilson, F. O'Connor, C. E. Edmonds, W. Robertson, Toronto; F. W. Bean, Woodstock; C. C. Wardrobe, Winnipeg, and D. S. McFarlane, London.

The automotive industry is experiencing great activity at the present time. Experts in close touch with the situation predict that May will set new high production records, and Percy Owen, president of the Liberty Motor Co., says that he believes good business is going to extend over the balance of the year, principally for the reason that people are feeling better. "It is unlikely that the tremendous spurt now on will be continued," says Mr. Owen, "for buying of motor cars has come back with a rush after a long continued void. We must recognize, however, that the buying today is the buying following an almost total cessation over a period of months and for that reason is not normal."



Save from One-Third to One-Half on Machinery

That is what you save when you secure a Williams Remanufactured machine. Moreover, we guarantee all machines re-manufactured by us to be equal to new for all practical purposes. No matter what piece of machinery you want, we either have it, or can get it for you at an advantageous price, and you can buy from Williams with full confidence that you will get bigger value for your money than you can from another house.

If you are interested in receiving our monthly Machinery list, write us and we will put your name on our mailing list.

The A. R. Williams Machinery Co., Ltd.

64 Front Street W., Toronto

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

At the annual meeting of the Canadian Railway Club in Montreal a few days ago, a very successful business and social session was held. The retiring president, Mr. Arthur Crumpton, turned over the reins of authority to the newly elected president, Mr. G. M. Wilson, superintendent of motive power shops, Grand Trunk Railway System, Montreal. The other officers elected were: first vice-president, H. R. Taylor, assistant manager, Angus Shops, Canadian Pacific Railway; second vice-president, C. E. Brooks, mechanical superintendent, Canadian National Railways, Toronto; executive committee, E. R. Battley, superintendent of motive power, G. T. R., eastern lines, Montreal; J. A. Shaw, general electrical engineer, Canadian Pacific Railway Company, Montreal; W. U. Appleton, mechanical superintendent, Canadian National Railways, Moncton, N. B.; R. J. Needham, mechanical and electrical engineer, G. T. R., Montreal; John Burns, workshop manager, Angus Shops, Montreal; W. C. Hunter, air brake inspection, Canadian National Railways, Moncton, N. B.; Auditors, C. F. Needham, assistant to general superintendent, motive power and car departments, G. T. R., Montreal; J. W. Fontaine, chief clerk to the department of stores and mechanical accounts, C. P. R., Montreal; J. D. Brandon, representing the American Arch Company, Montreal. Secretary W. A. Booth, engineer locomotive construction, G. T. R,. Montreal. Treasurer, P. P. Reynolds, chief clerk to chief of motive power and rolling stock, C. P. R., Montreal. The retiring president, Mr. Crumpton, was presented with a jewelled emblem as souvenir of his term of office on behalf of the executive and membership generally, the presentation being made by Wm. M. Macnab, chairman of the valuation committee of the G. T. R., and one of the past presidents of the club.

CONTINUE GOOD WORK

THE National Screw Thread Commission has had its term extended to March 21, 1927, and during that time, will go into the standardization possibilities of the subjects mentioned below:—

Sheet metal and wire gage numbers; tap-drill sizes; bolt, nut, and rivet proportions; bolt-head, nut and screw-head standardization; standardization of instrument threads and those cut on brass-tubing; standardization of acme, square and other special threads, a study of tolerances and stock sizes for cut and rolled threads, etc.

Arrangements have been made for co-operation between the National Screw Thread Commission and the sectional committee of the American Engineering Standards Committee which is studying bolt, nut and rivet proportions. The sub-committee which will work with the American Engineering Standards sectional committee on the matters pertaining to bolts, nuts, rivets and screw-heads, is composed of F. O. Wells, E. H. Ehrman, and Commander J. N. Ferguson. A sub-committee consisting of Dr. Stratton, Commander Ferguson and Mr. Wells will make a tentative study of the standardization of instrument threads and brass tubing threads. Another sub-committee composed of Major J. O. Johnson, R. E. Flanders, Lieut.-Commander C. A. Jones and Earl Buckingham will take up a study on acme, square and other special threads.

At the meeting held in Washington recently a report on tap drill sizes was submitted, and with certain changes this will be submitted to the industries interested for comment and criticism before any final action is taken to make the new suggestions a national standard.

In connection with the study being made of sheet metal and wire sizes, Col. E. C. Peck submitted a decimal system in accordance with the proposal made by the American Society of Mechanical Engineers in 1895. At that time the mechanical engineers recommended the discarding of all gage numbers with the idea that wire and sheet metal could be described better by decimal parts of an inch—the number of thousandths of an inch indicating the gage number as well as the exact size.

The Shredded Wheat Co., Niagara Falls, Ont., will erect two storage buildings at a cost of $152,000.

The town council of Hanna, Alta., are considering the purchase of an electric lighting plant.

F. S. Mallory, 165 Bay St., Toronto, is preparing plans for a garage to cost $50,000.

Prince Rupert, B. C., may be the site of a new grain elevator. The proposed structure will cost $500,000.

The board of education, Whitby, Ont., is contemplating remodelling their school at a cost of $15,000.

Toronto, Ont.—Tenders for the installation of one four million imperial gallon centrifugal pump at the Island pumping station will be received up to June 13.

Windsor, Ont.—The Haymon Construction Co., of London, will erect freight sheds for the C. P. R. at an approximate cost of $200,000.

A service station and plant costing in the neighborhood of $18,000 will be erected by the Imperial Oil Co., 56 Church St., Toronto in the near future.

Electric mine lamps are being installed in the collieries in Cape Breton, replacing the old "Glanny" lamps, which are oil burners.

A station will be erected at Sarnia, Ont., for the Pere Marquette Rlys., the cost of which will be approximately $40,000.

The Shawinigan Water and Power Co., Shawinngan Falls, Que., have had plans prepared for electric lighting system to cost $10,000.

The York Sandstone Brick Co., East Toronto, are in the market for flat topped steel cars for use in sand and lime brick manufacture.

C. W. James, Jnr., 95 King St. E., Toronto has been awarded general contract for erection of apartment house to cost $50,000 on Neville Park Blvd. He is now calling for tenders from all trades.

Toronto, Ont.—A recommendation to spend $6,000 to rebuild one of the furnaces at the western incinerator, pending the construction of a modern garbage destructor has been made by street commissioner Wilson.

During the month of April the Scotia collieries produced 53,163 tons, with Princess leading with 21,615 tons—534 tons ahead of Florence, which came next in the running.

Sault Ste. Marie.—Permits totalling over $50,000 have been issued in this city since the first of May. At present the demand for permits is exceptionally great.

London Ont.—A concrete bridge costing $25.000 will be erected on the North River Road for the G. T. R. Chas. Forester, Supt. is interested, and plans for both the steel and concrete work have already been prepared.

W. G. Murray, Dominion Savings Bldg., London, has plans for the erection of a school at Brownsville, Ont., which will cost around $10,000. Tenders are being asked for and no closing date is set so far.

The Standard Oil Co., of New York, have advanced the price of gasoline one cent a gallon in all its territory. A similar advance has been made in the price of varnish makers' and painters' naptha.

Dr. J. W. Ross, trade commissioner in Shanghai, will arrive in Canada some time in August next. He will make a tour of the towns and cities in which exporters are located who are interested in the trade of China.

The Sydney Mines, N. S., school board has appointed a committee to call for plans for a new school building at a cost of about $75,000. The Bank of Nova Scotia is to erect a one and a half story bank agency building at Sydney Mines, work to commence about June 1st.

Dundas, Ont.—The Canada Crushed Stone Corporation intend reconstructing the portion of their plant recently destroyed by fire as soon as possible. Mr. Buckbee of Chicago, the company's consulting engineer is at present looking after this work.

Pembroke, Ont.—Sealed tenders will be received up to the first of June by Findley Watt, for the supplying of all materials and the construction of a dam near Waltham, Que. The dam has to be completed according to plans and specifications prepared by J. L. Morris, Pembroke.

A. W. Swan, assistant secretary of the Engineering Institute of Canada, Montreal has resigned and sailed for England. He intends to reside there permanently, and while in this country was associated with the Canadian Ingersoll, Rand Co., Sherbrooke, Que., before branching into editorial work for the Institute.

Major G. B. Johnson, trade commissioner in Glasgow, will arrive in Canada about August next and will tour those towns and cities which contain exporters interested in the trade of either Scotland or Ireland. Major Johnston is at present making a tour through Ireland.

Halifax, N. S.—Work has started on the new foundry building for Hillis and Son of this city by the contractors, the Nova Scotia Construction Co. The building will be of concrete and brick, and of fire proof construction throughout. The plans are by Lockwood, Greene and Co., Montreal.

The general contract for the erection of Riverdale Technical School has been awarded to Witchall and Son, 156 St. Helens Ave., Toronto. This is valued at $577,370, and the additional contracts are, W. G. Edge, Ltd., ventilating, plumbing and heating $112,000, Canadian General Electric Co., electrical $24,700, and Ryrie Bros., time clocks valued at $1,870.

Sydney, N. S. W.—Before trade with Germany reopens on August 1st precaution will be taken to guard against the dumping of goods here at the expense of British and Australian manufacturers. A tariff board has been appointed to impose penalties in any case where its members are satisfied that local industry is likely to suffer.

Acceptance of a new street lighting contract for Sydney, N. S., drawn up by the Cape Breton Electric Co., and recommended by the street lighting committee, has been decided upon by the aldermen of the council, though they were not unanimous. The matter of urging the federal government to proceed with construction of the Sydney terminal wharf is to be considered by the council.

A recent 80 ton test of quartz from the Brookfield Gold mine at Brookfield, N. S., proved a yield of $13.45 gold per ton, while $10 per ton was recovered by crude stamp mill methods. A cyanide process is soon to be installed. The company operating the Mine at Brookfield the King, Fissure Mines, Ltd., have purchased the surface property of the Switzer Mining Co., at Fifteen Mile, and are removing the machinery and material to their own property, and will add ten stamps and an air compressor. Since the test they have started to sink another hundred feet to open up more ore.

The Canadian Engineering Standards Association, Ottawa, Ont., have made the following changes in the personnel renominations of members of the main committee. Sir Alexander Bertram, replacing Mr. Tye. Mr. C. W. Lafebvre, replacing Mr. A. Surveyor. Dr. L. A. Hardt, renominated. Dr. R. A. Ross, renominated. Prof. P. Gillespie, renominated. Mr. T. E. Sutherland, renominated. Mr. A. R. Goldie, renominated and Mr W. A. Bowden having been nominated as a member of the main committee by the department of railways and canals, replacing Colonel Monsarrat, it was decided to co-opt Colonel Monsarrat as a member so as to retain his services on the committee.

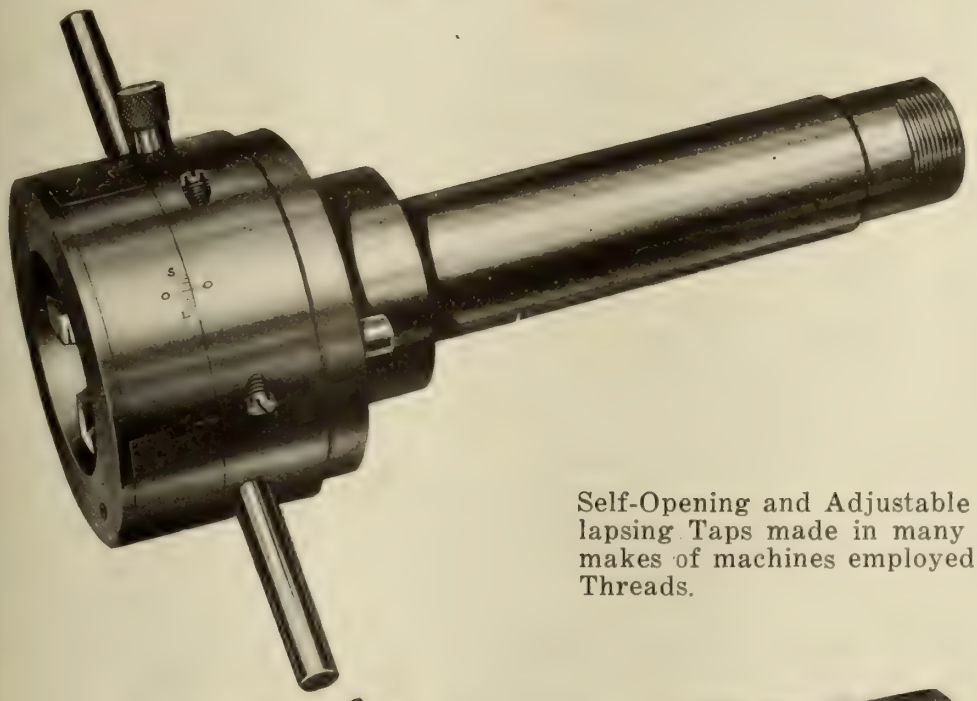
The Purchasing Agents' Association of Toronto, have sent about 30 members to Rochester to the annual convention of the National Association of Purchasing Agents, which is being held from May 15th to 20th. Keen interest is shown in the national elections, as one of the Toronto members, Major J. R. Bell, of Business Systems, has been nominated for vice-president. The promotion of standards will be one topic to which the National Association will give considerable discussion. The standardization committee of the national body has been at work on standard forms of various kinds for the last two years, and as a result of their efforts the Bureau of Standards of the Department of Commerce at Washington has obtained the co-operation of producers in reducing the number of styles and sizes of many commodities.

GEOMETRICS

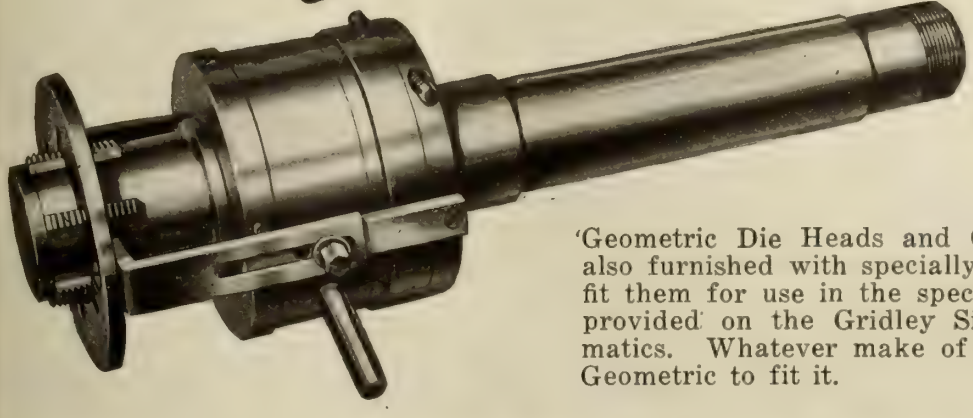
For Cutting Screw Threads

GEO MET RIC

Right on the Lead



Self-Opening and Adjustable Die Heads and Collapsing Taps made in many styles for the many makes of machines employed in producing Screw Threads.



'Geometric Die Heads and Collapsing Taps are also furnished with specially threaded shanks to fit them for use in the special threading fixture provided on the Gridley Single Spindle Automatics. Whatever make of machine, there is a Geometric to fit it.

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents:

Williams & Wilson, Ltd., Montreal. A. R. Williams Machinery Co., Toronto, St. John, N.B.; Halifax, N.S.

C. M. A. ELECT OFFICERS FOR YEAR

During the recent Toronto meeting of the Canadian Manufacturers' Association, a resolution was passed which states that the association is in favor of a system of preferential tariff within the Empire, similar to the preference now contained in the customs tariff of Canada, but as the Canadian tariff is already a generous one, they do not favor any further lowering of the British preference at the present time, on account of the damage it would do to Canadian industry, and they felt it would be unfair to Canadian firms to ask for further preference, in view of the fact that the British preference is slight, compared with the Canadian preference to Britain.

The meeting also went on record as favoring the lowering of freight rates, to the same extent that farmers and others have reduced their operating costs.

Following are the officers elected:—Chairman, Ontario division, Col. Arthur F. Hatch, Hamilton; vice-chairman, George Brigden, Toronto. Toronto branch, chairman, R. H. Easson, re-elected; vice-chairman, Melville F. White.

Ontario division.—Members of the division executive council: James Arnold, Brockville; Henry Betram, Dundas; John M. Campbell, Kingston; E. J. Davis, Newmarket; Geo. D. Forbes, Hespeler; W. C. Franz, Saulte Ste. Marie; W. M. Gar shore, London; W. T. Goodison, Sarnia; Lloyd Harris, Brantford; Fred Hatch, Whitby; F. S. Hodgins, Kitchener; E. H. Jones, St. Catharines; R. W. Leonard, St. Catharines; R. O. McCulloch, Galt; G. W. McLaughlin, Oshawa; E. D. Smith, Winona; W. C. Springer, Belleville; R. Thompson, Carleton Place; C. H. Waterous, Brantford; D. M. Wright, Stratford.

Ontario division, members of the division executive committee.—W. R. Breyfogle, Peterboro; George Brigden, Toronto; G. C. Cockshutt, Brantford; H. W. Fleury, Aurora; Fred Hatch, Whitby; T. A. Hollinrake, Toronto; J. G. Hossack, Toronto; William Inglis, Toronto; C. B. Lowndes, Toronto; B. J. McCormick, Welland; C. H. McGhie, St. Catharines; J. F. McKay, Ingersoll; W. H. Marsh, Hamilton; F. E. Mutton, Toronto; J. D. Payne, Welland; H. D. Scully; W. H. Shapley, Toronto; John Taylor, Guelph; H. J. Waddie, Hamilton; C. R. H. Warnock, Galt.

Toronto branch executive council.—L. L. Anthes, E. M. Ashworth, Thomas Bradshaw, George Brigden, C. H. Carlisle, F. S. Corrigan, W. C. Coulter, Gordon C. Crean, E. J. Freyseng, E. Holt Gurney. R. Harmer, Sam Harris, T. A. Hollinrake, William Inglis, W. C. Laidlaw, C. B. Lowndes, J. S. McLean, T. F. Monypenny, W H. Shapeley, J. O. Thorn, G. W. Watts.

Even the best excuse for being late is not half so good as being on time.

Annual Meeting of Quebec and Montreal Division, C. M. A.

THE annual meeting of the Quebec Division and the Montreal Branch of the Canadian Manufacturers' Association was held in the Windsor Hotel, Montreal on May 11th. Advance in every line of work was shown in the reports submitted. About one hundred delegates were present, representing the Quebec Three Rivers, Sherbrooke and other branches of the Association, as well as the local branch.

The reports showed that general business had more than doubled during the year, and that all sections had increased their membership and activities. After addresses from the retiring chairmen, the main business was the reception of reports and the election of officers. The result of the election of officers was as follows:

Montreal Executive

Chairman, Julian C. Smith; vice-chairman, A. O. Dawson; committee, W. S. Atwood, Howard Bird, Archibald Baillie, Kenneth Dawes, H. T. Diplock, W. A. Eden, W. S. Fallis, R. H. Gillean, W. R. Granger, D. E. Hamilton, John Lowe, W. H. Miner, N. C. Poison, Jr., Alph. Racine, Lyon Cohen.

Representatives on executive council, Jos. Beaubien, Jos. Daoust, R. M. Davy, Art. Harries, Geo. Henderson, M. Hirsch, F. H. Hopkins, A. D. Huff, T. P. Howard, John Irwin, R. H. McMaster, A. Neighorn, S. F. Rutherford, Paul Sise, N. M. Yuile, F. R. Whittall.

Quebec Division

Chairman, F. W. Stewart; vice-chairman, Paul E. Joubert; committee, E. C. Budge, Leslie Drake, A. S. Ginger, Raoul Grothe, Michael Hirsch, Norman Holland, F. W. Knowlton, A. McA. Murphy, Walter, Ramsay, A. Edgar Robertson, Robert Ryan, Albert Tetreault.

In his annual report, the sec'y, R. W. Gould, said that many unexpected changes had occurred during the year, the volume of business having more than doubled in twelve months, in order to meet the growing demands of the members. Two and a half years ago the division had a staff of a secretary and stenographer. Now they have a secretary and some fifteen employees engaged in the different departments. The large number of circulars, notices of meetings, letters, and election campaign work was referred to. The activity of the branch in the Made-in-Canada campaign was reviewed. It was further mentioned that all circulars sent out from the head office at Toronto had been sent out from the Montreal office, but in this case the circular had also to be prepared and sent out in French.

The important feature of the year was the inauguration of a transportation bureau in charge of G. P. Ruickbie which had been made use of continually by the manufacturers throughout the province. A number of other trade organizations had also joined with the C. M. A., working with it, thus increasing its membership and volume of business. In spite of the fact that this was a period of trade depression the work of the branch has grown steadily. It appeared that all British and American firms desiring trade information had seen fit to make use of the services of the C. M. A.

Mr. F. G. Daniels of the Quebec division reported a net gain in membership from that quarter in spite of the fact that the trade depression has been the cause of several resignations. The recently established Export Club of Montreal had been a great assistance to the Association and helped to increase membership. W. R. Grainger presented the report of the municipal affairs committee outlining its activities in connection with the governmental system of Montreal, and the movement to secure the building of another bridge from Montreal to the South Shore.

B. W. Coughlin, the retiring chairman, pointed out the difficulties under which the manufacturers had been operating during the past year, everyone having felt the pinch of changing conditions. During the year the depth of depression had been reached and he felt confident that now there is a stable move in the right and upward direction. Manufacturers during the year had learned a sharp lesson and should capitalize it. Many firms, wholesale, manufacturing and retail, had taken their losses and readjusted themselves on a new basis, which showed a healthy condition of business. This movement had been retarded by the fact that business conditions in Canada were dependent on those in other countries, many of which were much more disturbed than the Dominion. Caution and thrift had been the watchword among manufacturers during the past year and he urged that the same safe and sane policy be practised during the coming twelve months. The meetings closed with votes of thanks to the retiring presidents and other officers.

The St. Lawrence Hotel Building Port Hope, was lately sold and is at present being remodelled into an up-to-date knitting plant. The company which has bought the building and will operate the plant will be known as the Amalgamated Knitters, being composed of several knitting companies. The building is large enough to combine all the plants into one, and should be one of the finest knitting works in Canada. The Port Hope business is developing rapidly and although only in its infancy, has grown to be known from coast to coast as producers of fine grade knit goods.

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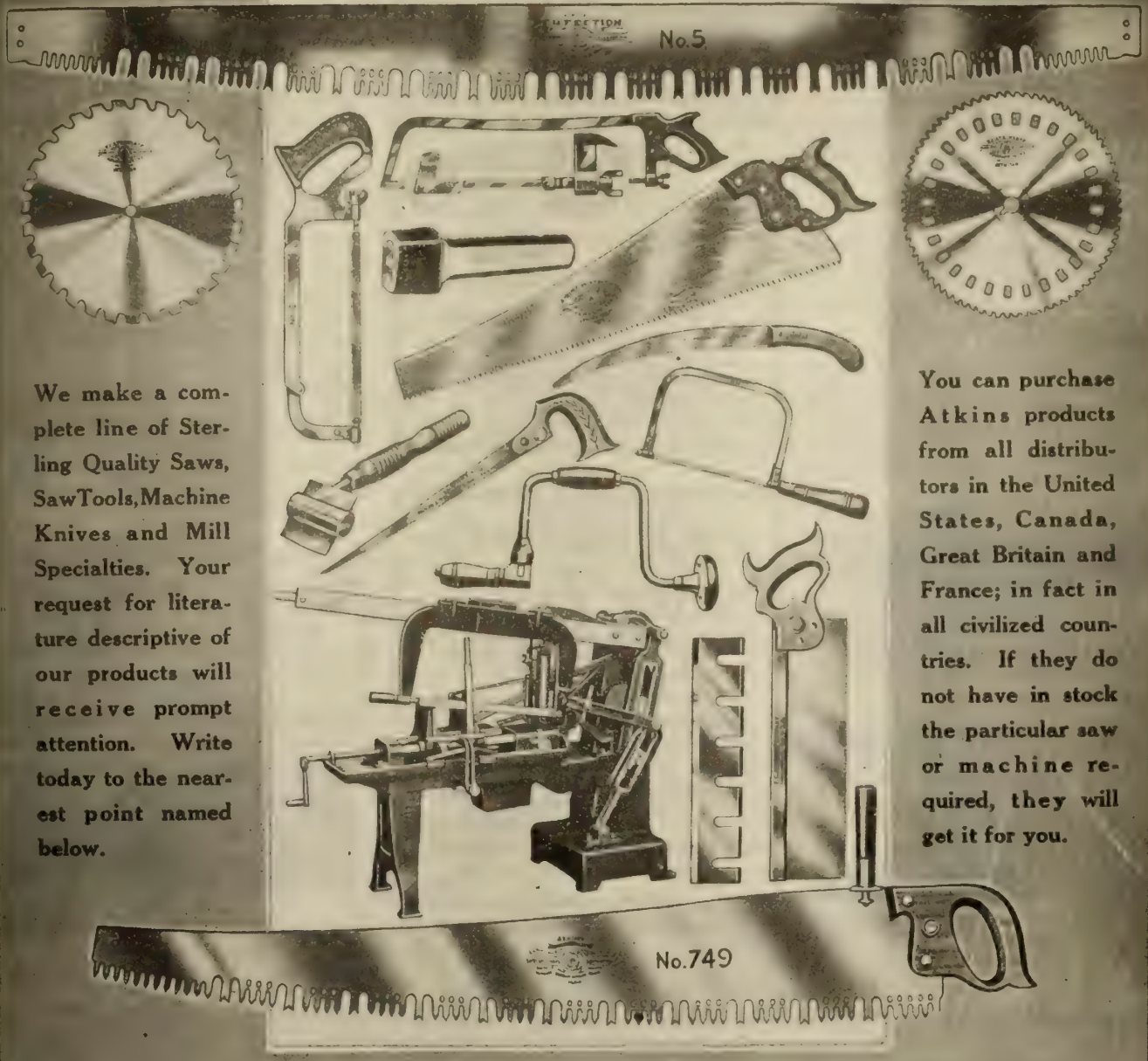
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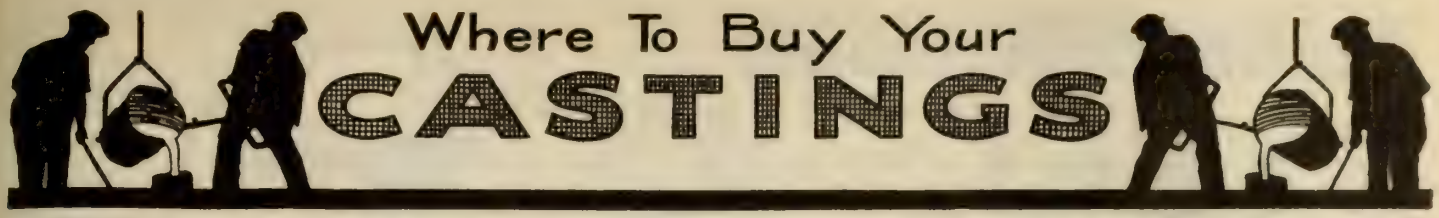
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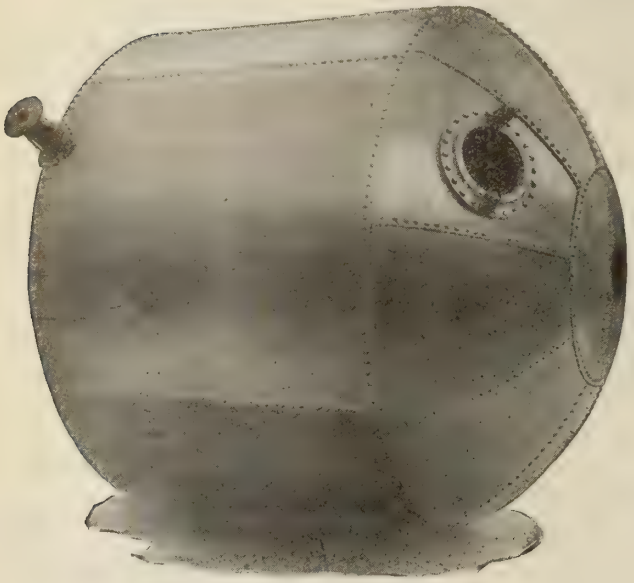
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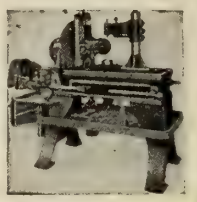
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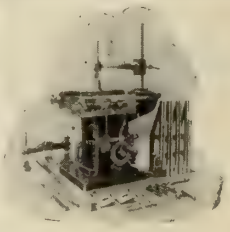
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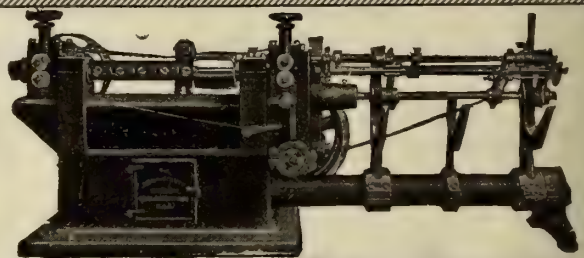


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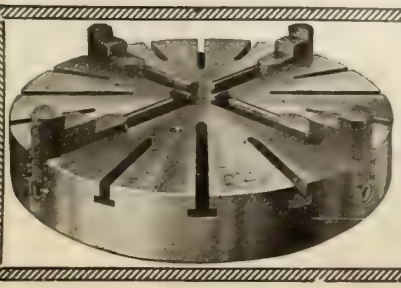
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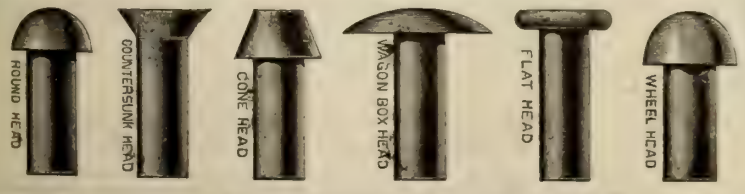


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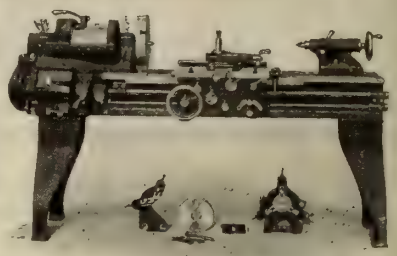
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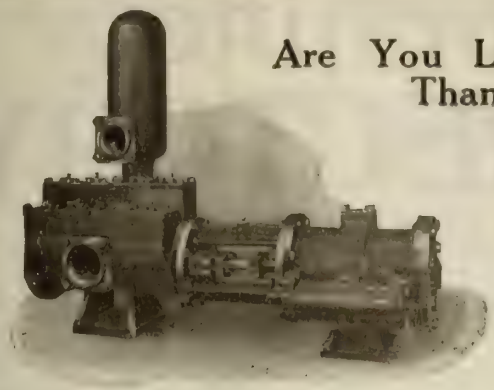
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Chicago Watchman's Clock Co., Chicago, Ill.

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Gisholt Machine Co., Madison, Wis.

Clocks, Watchmen's
Chicago Watchman's Clock Co., Chicago, Ill.

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Petrie, Ltd., H. W., Toronto, Ont.
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Atkins & Co., Inc., E. C., Indianapolis, I.
Oakley Chemical Co., New York, N.Y.

Compressors, Air and Gas
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Petrie, Ltd., H. W., Toronto, Ont.

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Petrie, Ltd., H. W., Toronto, Ont.

Fans, Electric
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Fans, Exhaust
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

Fans, Ventilating
Can. Blower & Forge Co., Ltd., Kitchener
Petrie, Ltd., H. W., Toronto, Ont.

Fibre
Diamond State Fibre Co. of Can. Ltd., Toronto, Ont.

Files and Rasps
Nicholson File Co., Port Hope, Ont.
Simonds Canada Saw Co., Montreal, Que

Filler, Iron (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

Fire Escapes
Reelofson Elevator Co., Galt, Ont.

BUYERS' DIRECTORY

Fittings, Pipe
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph Ont.
Fittings, Limited, Oshawa, Ont.

Flexible Shafts
Strand & Co., N. A., Chicago, Ill.

Fluxes, Welding
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Forging Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Forgings, Drop
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd Toronto, Ont.

Forgings, Hammer
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

Forgings and Stampings, Drop.
General Forgings & Stamping, Ltd., Merritton, Ont.

Foundry Equipment
McDougall Co., Ltd., E., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Foundry Supplies
Rice Lewis & Son, Ltd., Toronto, Ont.

Frogs, Spring or Rigid
Can. Steel Foundries, Montreal, Que.

Furnaces, Electric
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces, Heat Treating Coal
Rockwell Co., W. S., New York City.

Furnaces, Heat Treating Oil and Gas
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Rockwell Co., W. S., New York City.

Furnaces, Lapwelded.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Furnaces, Tempering and Annealing
Bellevue Industrial Furnace Co., Detroit, Mich.
Brown & Sharpe Mfg. Co., Providence, R.I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Furnaces and Ovens, Electric
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York, N.Y.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Gages, Measuring (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

Gages, Recording
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Special Measuring (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Gages, Thread
Brown & Sharpe Mfg. Co., Providence, R.I.
Starrett Co., L. S., Athol, Mass.

Galvanizing
Fittings, Limited, Oshawa, Ont.

Gas, Coal Compressed
L'Air Liquide Society, Toronto, Ont.

Gas, Compressed
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Gaskets
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N.J.

Gauges Vacuum and Pressure
Taylor Instrument Co., Toronto, Ont.

Gear Blanks
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

Gear Counters
Hart Mfg. Co., R. A., Battle Creek, Mich.

Gear-Cutting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machines
Brown & Sharpe Mfg. Co., Providence, R.I.

Gears, Cast
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Cut
Brown & Sharpe Mfg. Co., Providence, R.I.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto Ontario.
Hepburn Ltd., John T., Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., E., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

Gears, Dressed
Kennedy & Sons, Wm., Owen Sound, Ont.

Gears, Forged
Canada Foundries & Forgings Co., Welland, Ont.

Gears, Herringbone
Hamilton Gear & Machine Co., Toronto, Ont.

Gears, Rawhide (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

Gear, Silent Chain
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Car
Hans Renold of Canada, Ltd., Montreal, Quebec.

Gears, Worm
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.

Generators, Acetylene
L'Air Liquide Society, Toronto, Ont.

Gloves, Protective
Industrial Glove Co., Toronto, Ont.

Goggles, Safety
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Grab Buckets
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

Grease Cups, Pressed Steel and Brass
Can. Winkley Co., Ltd, Windsor, Ont.

Greases, Lubricating
Canadian SKF Co., Toronto, Ont.

Grinding Machines
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co., of Canada, Ltd., Hamilton, Ontario.

Grinding Machines, Abrasive Belt
Norton Co. of Can., Ltd., Hamilton, Ont

Grinding Machines, Automatic
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Bench
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., E., Galt, Ont.
Norton Co. of Can., Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

Grinding Machines, Center
U.S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Cutter and Reamer
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton,

Grinding Machines, Die
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.

Grinding Machines, Drill
Bellevue Industrial Furnace Co. Detroit, Mich.
Bertram & Son Co., Ltd., The John Dundas, Ont.

Grinding Machines, Electric
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Floor and Tool
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Grinding Machines, Internal.
Garlock Machinery, Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Portable
Strand & Co., N. A., Chicago, Ill.

Grinding Machines, Snagging
Blount Co., J. G., Everett, Mass.
Norton Co. of Can., Ltd., Hamilton, Ont.

Grinding Machines, Surface
Brown & Sharpe Mfg. Co., Providence, R.I.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machines, Thread
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Grinding Machinery, Tool Post
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence, R.I.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

Grinding Wheels
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

Gun-Barrel Machinery
Steinle Turret Machine Co., Madison, Wis.

Hack Saws, Power
Atkins & Co., Inc., E. C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Hammers, Chipping
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

Hammers, Drop
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

Hammers, Electric
Brown, Boggs & Co., Ltd., Hamilton, Ont.

Hammers, Pneumatic
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hangers, Shafting
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto

Hobbing Machines
Shore Instrument Co., Jamaica, N.Y.

Hardening, Case-Hardening and Tempering
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

Hammers, Power
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Hobs
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Hoists, Electric
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Hoists, Hand
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

Hoists, Pneumatic
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

Holders-On, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

Hydraulic Machinery
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

Hydrogen
National Electro Products, Ltd., Toronto, Ont.

Hydrogenating Plants.
National Electro Products Ltd., Toronto, Ont.

Igniters, Gas Engine
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, Ohio.

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence, R.I.

Insulation
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont.

Jacks, Hydraulic
Norton, A. O., Boston, Mass.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Japanning and Varnishing Ovens
Brantford Oven & Rack Co., Brantford, Ont

Jigs and Fixtures (See Tool Work)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

Keyseating Machines
Morton Mfg. Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Keys, Machine
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Knives, Machine

Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Que.

Lamp Holders

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathe Attachments

Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

Lathe Tools

Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

Lathes, Automatic and Semi-Automatic

Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Bench

Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Lathes, Boring

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)

Acme Machine Tool Co., Cincinnati, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Engine

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Ill.

Lathes, Extension and Gap

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.

Lathes, Heavy Duty Projectile Boring

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Horizontal Turret

Blount Co., J. G., Everett, Mass.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

Lathes, Relieving

Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

Lathe, Universal Hand

Brown & Sharpe Mfg. Co., Providence, R.I.

Lathe, Speed and Hand

Blount Co., J. G., Everett, Mass.

Lathes, Spinning

Pryibil Machine Co., P., New York City.

Lathes, Threading

Hendey Machine Co., Torrington, Conn

Lathes, Vertical Turret

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

Lathes, Wood Turning

Blount Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Lead Pipe

Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Lighting and Generating Sets.

Beardmore & Co., Ltd., Wm., Montreal, Que.

Linoleum Mill Machinery

Bertrams Ltd., Edinburgh, Scotland.

Liquid Air Plants

L'Air Liquide Society, Toronto, Ont.

Lockers, Clothes

Dennis Wire & Iron Works, London, Ont.

Lubricants

Oakley Chemical Co., New York, N.Y.

Lubricating Systems

Bowser, S. F., & Co., Ltd., Toronto, Can.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Truing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Manganese Steel

Can. Steel Foundries, Montreal, Que

Mandrels, Expanding

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Mandrels, Solid

Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Measuring Machines

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont

Mechanics' Fine Tools

Lufkin Rule Co., Windsor, Ont.

Metals, Alloy

Canada Metal Co., Ltd., Toronto, Ont.
Can. Steel Foundries, Montreal, Que
Fisher Motor Co., Ltd., Orillia, Ont.

Metal Workers

Parker Co., Charles, Meriden, Conn.

Micrometer Calipers

Brown & Sharpe Mfg. Co., Providence, R.I.
Rice Lewis & Son, Ltd., Toronto, Ont.

Milling Attachments

Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines

Brown & Sharpe Mfg. Co., Providence, R.I.
Burke Machine Tool Co., Conneaut, Ohio.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Milling Machines, Automatic

Brown & Sharpe Mfg. Co., Providence,
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Bench

Burke Machine Tool Co., Conneaut, Ohio

Milling Machines, Hand

Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Horizontal and Planer Type.

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto, Ont.

Milling Machines, Plain

Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Thread

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Milling Machines, Universal

Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

Milling Machines, Vertical

Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, Ohio.
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto Ont.

Motors, Electric

Can. Fairbanks-Morse Co., Ltd., Montreal
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

Nails and Staples

Canada Metal Co., Ltd., Toronto, Ont.

Nipples

Canada Metal Co., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Nitrogen

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Nut Tappers (See Bolt and Nut Machinery)

Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
National Acme Co., Cleveland, Ohio.

Nuts, Finished and Semi-finished

Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Nuts (up to 4 in.)

Steel Co. of Canada, Ltd., Hamilton, Ont.

Nuts, S.A.E., Plain and Castellated

Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Oil Filtering and Storage Systems

Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Storage Engineers

Bowser, S. F., & Co., Ltd., Toronto, Can.

Oil Hole Covers

Can. Winkley Co., Ltd., Windsor, Ont.

Oils, Soluble

Brantford Oven & Rack Co., Brantford, Ont.

Oxygen

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

Oxy-Acetylene Apparatus

Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can. Fairbanks-Morse Co., Ltd., Montreal.
Atlas Press Co., Kalamazoo, Mich.

Paper Mill Conveyors

Bertrams Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

Patterns, Wood and Metal

Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa, Ont.

Phosphor Tin

Canada Metal Co., Ltd., Toronto, Ont.

Photographic Duplicating Machines

Photostat Corp., Providence, R.I.

Pipe Bending Machines

Can. Fairbanks-Morse Co., Ltd., Montreal
Underwood Corp., H. B., Philadelphia Pa
Williams Machinery Co., A. R. Toronto

Pipe Cutting and Threading Machines

Can. Fairbanks-Morse Co., Ltd., Montreal
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Pipe

Canada Metal Co., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Pipe Fittings

Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

Pipe and Nipple Threading Machines

Landis Machine Co., Inc., Waynesboro, Pa

Pipe Fitters' Tools

Rice Lewis & Son, Ltd., Toronto, Ont.

Pipe Threading Die Heads

Landis Machine Co., Inc., Waynesboro, Pa

Piston-Ring Machines

National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

Planing Machines

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto,

Planing Machines, Rotary

Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plate Rolls

Bertram & Son Co., Ltd., The John, Dundas, Ont.

Plates, Boiler and Shell.

Beardmore & Co., Ltd., Wm., Montreal, Que.

Pneumatic Tools

Cleveland Pneumatic Tool Co., Toronto, Ont.

Polishing and Buffing Machines

J. R. Baxter & Co., Ltd., Montreal, Que.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Pryibil Machine Co., New York, N.Y.

Pressed Steel Parts

American Pulley Co., Philadelphia, Pa
Fisher Motor Co., Ltd., Orillia, Ont.

Presses, Arbor

Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

Presses, Drop and Forging

Brown, Boggs & Co., Ltd., Hamilton, Ont
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal

Presses, Foot and Hand

Brown, Boggs & Co., Ltd., Hamilton, Ont

Presses, Hydraulic

Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont
Williams Machinery Co., A. R., Toronto, Ont.

Presses, Power

Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Presses, Screw

Brown, Boggs & Co., Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont.

Profiling Machines

Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Protractors

Brown & Sharpe Mfg. Co., Providence, R.I
Lufkin Rule Co., Windsor, Ont.

Propellers

Kennedy & Sons, Wm., Owen Sound, Ont.

Pulleys, Cork Insert

American Pulley Co., Philadelphia, Pa.

Pulleys, Metal and Fibre

American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co. of Can., Ltd Toronto, Ont.
Dominion Engineering Works, Limited Montreal, Que.

BUYERS' DIRECTORY

Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

Pulp and Paper Mill Equipment
Dominion Engineering Works, Ltd., Montreal, Que.

Pumps, Centrifugal.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Pumps, Hydraulic
Can. Fairbanks-Morse Co., Ltd., Montreal
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Lubricant and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

Pumps, Power
Bowser, S. F., & Co., Ltd., Toronto, Can.
Can. Blower & Forge Co., Ltd., Kitchener.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Hepburn Ltd., John T., Toronto, Ont.

Pumps, Semi-Rotary Wing.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Punches, Center
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

Punches, Hand
Brown, Boggs & Co., Ltd., Hamilton, Ont
Can. Blower & Forge Co., Ltd., Kitchener
Jardine & Co., A. B., Hespeler, Ont.

Punches, Power
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Petrie, Ltd., H. W., Toronto, Ont.

Punching Machines, Horizontal
Bertrams Ltd., Edinburgh, Scotland.

Pyrometers, Electric
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

Racks, Cut
Hamilton Gear & Machine Co., Toronto, Ont.

Racks, Storage (See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ont.

Reamer Holders
Simonds Canada Saw Co., Montreal, Que

Reamers, Expanding
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Reamers, Solid
Butterfield & Co., Inc., Rock Island, Que.
Morse Twist Drill & Machine Co., New Bedford, Mass.

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Recorders, Temperature
Taylor Instrument Co., Rochester, N.Y.

Recorders, Time
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

Regulators, Temperature
Taylor Instrument Co., Toronto, Ont.

Rivets and Burrs
Parmenter & Bulloch Co., Gananoque, Ont.

Rivets and Burrs
Steel Co. of Canada, Ltd., Hamilton, Ont.

Rivets, Chain
Fittings, Limited, Oshawa, Ont.

Rivet-Making Machinery
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

Riveting Machines
Can. Fairbanks-Morse Co., Ltd., Montreal
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

Rudder Frames, Steel
Can. Steel Foundries, Montreal, Que.

Rubber Mill Machinery
Bertram Ltd., Edinburgh, Scotland.

Rules, Steel and Wood
Brown & Sharpe Mfg. Co., Providence, R.I
Lufkin Rule Co., Windsor, Ont.

Rust Preventatives
Oakley Chemical Co., New York, N.Y.

Sand Equipment
Can. Link-Belt Co., Toronto, Ont.

Sand Rammers, Pneumatic
Cleveland Pneumatic Tool Co., Toronto,

Saw Frames and Blades, Hack
Atkins & Co., Inc., E. C., Indianapolis, I
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Son, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que

Sawing Machines, Power Hack
Atkins & Co., Inc., E. C., Indianapolis, I.
Can. Fairbanks-Morse Co., Ltd., Montreal.

Saw Sharpening Machines
Atkins & Co., Inc., E. C., Indianapolis, I.

Saw Tables, Universal
Petrie, Ltd., H. W., Toronto, Ont.

Saws, Circular Metal
Atkins & Co., Inc., E. C., Indianapolis, I.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

Saws, Hand
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, Hot and Cold
Atkins & Co., Inc., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

Saws, High Speed Steel
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Metal Band
Atkins & Co., Inc., E. C., Indianapolis, I.

Saws, Metal Cutting
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

Saws, Milling
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Saws, Screw Slotting
Atkins & Co., Inc., E. C., Indianapolis, I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Que.

Saws, Wood
E. C. Atkins & Co., Indianapolis, Ind.

Scales
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

Screens
Dominion Engineering Works, Ltd., Montreal, Que.

Screw Drivers, Optical, Jewelry and Novelty
Strand & Co., N. A., Chicago, Ill.

Screw Machine Work
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

Screw Machinery, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

Screw Machines
Brown & Sharpe Mfg. Co., Providence, R.I

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R.I.
National Acme Co., Cleveland, Ohio.

Screw Machines, Plain or Hand
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Screw Machine Products
National Acme Co., Montreal, Que.

Screw Plates
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

Screws, Cap and Set
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

Screws, Safety Set
Galt Machine Screw Co., Galt, Ont.

Second-Hand Machinery
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

Sections, Ship and Boiler.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Separators, Moisture and Oil
Bowser, S. F., & Co., Ltd., Toronto, Can.

Separators, Oil and Waste
Bowser, S. F., & Co., Ltd., Toronto, Can.

Shafts, Flexible
Strand & Co., N. A., Chicago, Ill.

Shafting
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto,

Shapes, Cold-Drawn Special Steel
Union Drawn Steel Co., Hamilton, Ont.

Shaping Machines
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Shears, Hand
Can. Blower & Forge Co., Ltd., Kitchener.

Shears, Power
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

Shearing Machines, Angle, Iron Bar and Gate
Bertrams Ltd., Edinburgh, Scotland.

Sheet Lead
Canada Metal Co., Ltd., Toronto, Ont.

Sheet Metal Working Machinery
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

Sheets.
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Nickel, Monel and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.

Sheets, O.P.C.R. & B.A. and Blue Annealed.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Side Frames, Locomotive
Can. Steel Foundries, Montreal, Que.

Slotting Attachments
Brown & Sharpe Mfg. Co., Providence, R.I.
Kempsmith Mfg. Co., Milwaukee, Wis
National Acme Co., Cleveland, Ohio.
Kearney & Trecker Co., Milwaukee, Wis.

Slotting Machines
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Solders
Canada Metal Co., Ltd., Toronto, Ont.

Special Machinery and Tools
Brown Engineering Corp., Ltd., Toronto
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.

Spikes, Railway and Pressed
Steel Co. of Canada, Ltd., Hamilton, Ont.

Spinning Lathes
Pryibil Machine Co., P., New York City.

Springs, Milled
Barnes & Co., Wallace, Hamilton, Ont.

Springs, Small Spiral Helical, Compression, Extension, Torsion and Special
Barnes Company, Wallace, Hamilton,

Springs
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont

Springs, Flat Steel, Brush Holder, clock, Small Flat Springs.
Barnes Company, Wallace, Hamilton,

Sprockets and Chains
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

Squares
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

Stamping, Metal
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Parmenter & Bulloch Co., Gananoque, Ont.

Stamps, Steel
Diamond Saw & Stamping Works, Buffalo, N.Y.

Steel Concrete Reinforcement
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel Plate
British Empire Steel Co., Montreal, Que

Steel and Iron Bars
Steel Co. of Canada, Ltd., Hamilton, Ont

Steels, Tool
British Empire Steel Co., Montreal, Que

Steel, Cold-Rolled Strip
British Empire Steel Co., Montreal, Que.
Barnes Company, Wallace, Hamilton,

Steel Castings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Steel, Crucible, Spring
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Que.

Steel Forgings
Beardmore & Co., Ltd., Wm., Montreal, Que.

Sheets, Open Hearth Steel
Steel Co. of Canada, Ltd., Hamilton, Ont.

Steel, Shafting and Free Cutting Screw
Beardmore & Co., Ltd., Wm., Montreal, Que.
Union Drawn Steel Co., Hamilton, Ont

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Steel, Sheet
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

Steel, Stainless
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, Alloy, Open Hearth and Electric
United Alloy Steel Corp., Canton, Ohio.

Steels, Alloy and Carbon
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co of Can., Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

Steels, High-Speed
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
British Empire Steel Co., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

Steel, Magnet
Vanadium Alloys Steel, Latrobe, Pa.

Steel Tubing, Close Joint and Welded
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

Stern Frames, Cast Steel
Can. Steel Foundries, Montreal, Que

Straightening Machinery
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

Studs
Galt Machine Screw Co., Galt, Ont.

Stud Setters, Self-Opening
Geometric Tool Co., New Haven, Conn.

Swaging Machines
Atkins & Co., Inc., E. C., Indianapolis, I

Switches, Railway
Can. Steel Foundries, Montreal, Que.

Tachometers
Bristol Co., Waterbury, Conn.

Tanks and Pumps.
Bowser, S. F., & Co., Ltd., Toronto, Can.
Toronto Iron Works, Toronto, Ont.

Tap Holders
Brown & Sharpe Mfg. Co., Providence, R.I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

Taper Pins
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

Tapes, Measuring
Starrett Co., L. S., Athol, Mass.
Lufkin Rule Co., Windsor, Ont.

Tapping Machines and Attachments
Burke Machine Tool Co., Conneaut, Ohio
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

Taps and Dies
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Preston & Schwarts, Ltd., Galt, Ont.

Taps, Collapsing
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B. Hespeler, Ont.
National Acme Co., Cleveland, Ohio

Teeth, Dredge Basket
Kennedy & Sons, Wm., Owen Sound, Ont.

Thermometers
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

Thread-Cutting Tools
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwarts, Galt, Ont.

Thread Cutting Machines
Landis Machine Co., Inc., Waynesboro, Pa.

Threading Machines
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

Thread Lead Testing Machines
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

Thread-Rolling Machines
Bliss Co., E. W., Brooklyn, N.Y.

Tie Plates
Steel Co. of Canada, Ltd., Hamilton, Ont.

Time Recorders
International Business Machines Co., Ltd., Toronto, Ont.

Tongs
Hepburn Ltd., John T., Toronto, Ont.

Tool Cases
Rice Lewis & Son, Ltd., Toronto, Ont.

Tool Holders
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

Tool Posts, Lathe
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

Tools, Small (See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Preston & Schwarts, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

Tool Work
Brown Engineering Corp., Ltd., Toronto

Torches, Blow
National Electro Products, Ltd., Toronto Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.

Trackwork, Railway
Can. Steel Foundries, Montreal, Que.

Trackwork, Manganese Steel
Can. Steel Foundries, Montreal, Que.

Transmission Machinery
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound, Ont
Petrie, Ltd., H. W., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal Que.

Treated Bits
Vanadium Alloys Steel, Latrobe, Pa.

Trolleys and Tramways
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont
Wright Mfg. Co., Lisbon, Ohio.

Trolley Wheels,
Langley & Austin, Galt, Ont.

Trowels, Plastering
E. C. Atkins & Co., Indianapolis, Ind.

Trucks
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

Tubing, Seamless Steel, Brass and Copper and Fibre
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

Turret Heads
Bertram & Son Co., Ltd., The John, Dundas, Ont.

Turret Machines (See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, Ohio
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wis

Turrets, Tool Post
Gisholt Machine Co., Madison, Wis.

Tyres.
Beardmore & Co., Ltd., Wm., Mon

Unions, Pipe
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

Valves
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Ltd Montreal Q
Dominion Engineering Works, Limited, Montreal, Que.

Vises, Drilling Machine
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Kempsmith Mfg. Co., Milwaukee, Wis.

Vises, Pipe
Charles Parker Co., Meriden, Conn.

Vises, Planer and Shaper
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Hendey Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R. Galt, Ont.

Vises, Wood Workers'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ont.

Voltmeters
Bristol Co., Waterbury, Conn.

Wagon Loaders
Can. Link-Belt Co., Toronto, Ont.

Washers, Lock, Split and Spring
Barnes Company, Wallace, Hamilton
Canada Metal Co., Toronto, Ont.

Welding Apparatus, Oxy-Acetylene
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products Co., Ltd.

Welding Apparatus.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L' Air Liquide Society, Toronto, Ont
National Electro Products Co., Ltd.

Welding Machines, Oxy-Acetylene
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.

Welding, Electric
McLaren Belting Co., J. C., Montreal Que.
Steel Co. of Canada, Ltd., Hamilton, Ont

Welding Rod, Tobin, Manganese Bronze and Aluminum
Canada Metal Co., Ltd., Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.

Welding Supplies
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd.

Wheels, Industrial
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Headgate
Kennedy & Sons, Wm., Owen Sound, Ont

Winches, Stoplog
Kennedy & Sons, Wm., Owen Sound, Ont

Wire
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, On
Greening Wire Co., B., Hamilton, Ont
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Wire, Black Tempered, Music Phosphor Bronze and Premier
Barnes Company, Wallace, Hamilton.

Wire, Copper and Brass, Fine and Heavy
Steel Co. of Canada, Ltd., Hamilton, Ont

Wire Lead
Canada Metal Co., Ltd., Toronto, Ont.

Wire Straightening and Cutting Machinery
Brown, Boggs & Co., Ltd., Hamilton, Ont
Shuster Co., F. B., New Haven, Conn.

Wire, Welding
Canada Metal Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products, Ltd., Toronto, Ont.

Wires, Special
Canada Metal Co., Toronto, Ont.
Dennis Wire & Iron Works, London, Ont
Greening Wire Co., B., Hamilton, Ont.

Woodworking Machinery
Can. Fairbanks-Morse Co., Ltd., Montreal
Williams Machinery Co., A. R., Toronto Ont.

Wrenches, Drop Forged
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

Wrenches, Machinists'
Armstrong Bros. Tool Co., Chicago, Ill

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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COAL AND COKE

Mines and Coke Ovens
WASHINGTON, PA.
MEADOWLANDS, PA.
CANONSBURG, PA.
CONNELLSVILLE, PA.

BRITISH-AMERICAN FUEL & METALS LIMITED
McKINNON BUILDING TEL. MAIN 7815 TORONTO

For Difficult Drives,

such as cone drives in Paper Mills, in places exposed to cold and wet, or hot and dry conditions, this superior, efficient belting invariably makes good. We cite the instance of difficult drives because it is in the extreme tests that

"P.M.S" Belting

has especially excelled. "P.M.S" Belting will not slip or stretch, and withstands conditions of heat and dryness, or cold and wet. Made from the toughest of Sea Island Cotton, and rubber-friction-surfaced "P.M.S" offers a tremendously strong belting. It is made in convenient lengths and widths to suit any drives.

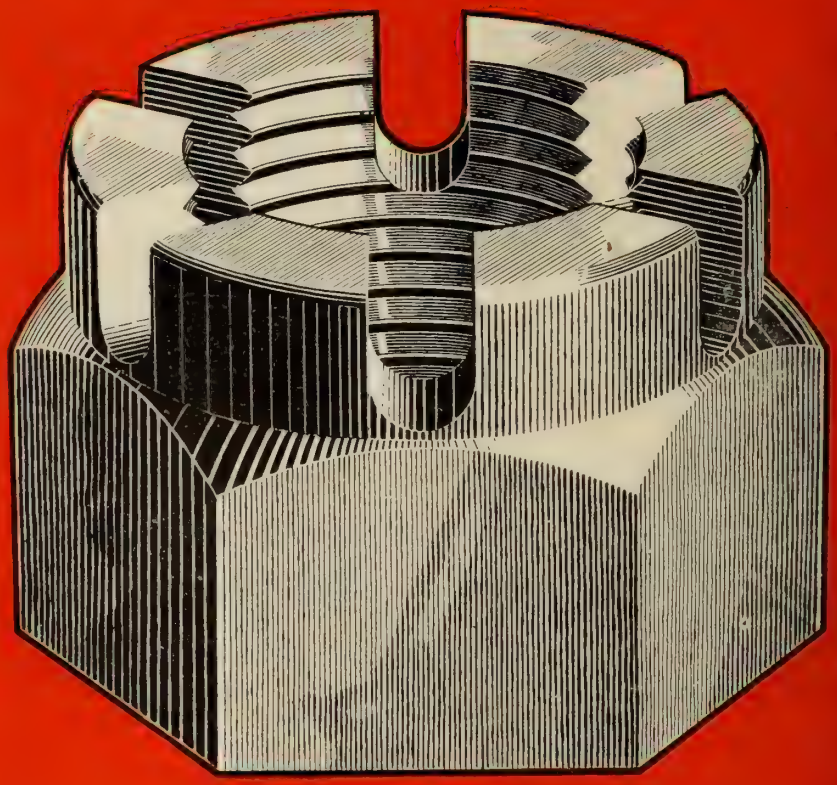
Gutta Percha and Rubber Limited

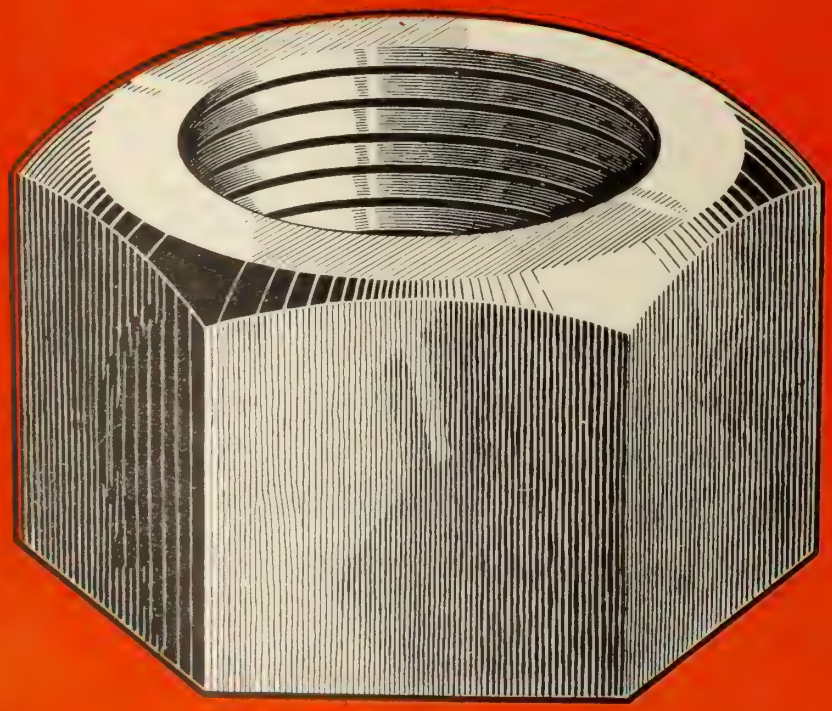
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Screw Machine Product up to 2¼" diameter—to specifications.

Special Product Hardened and Ground to specifications.

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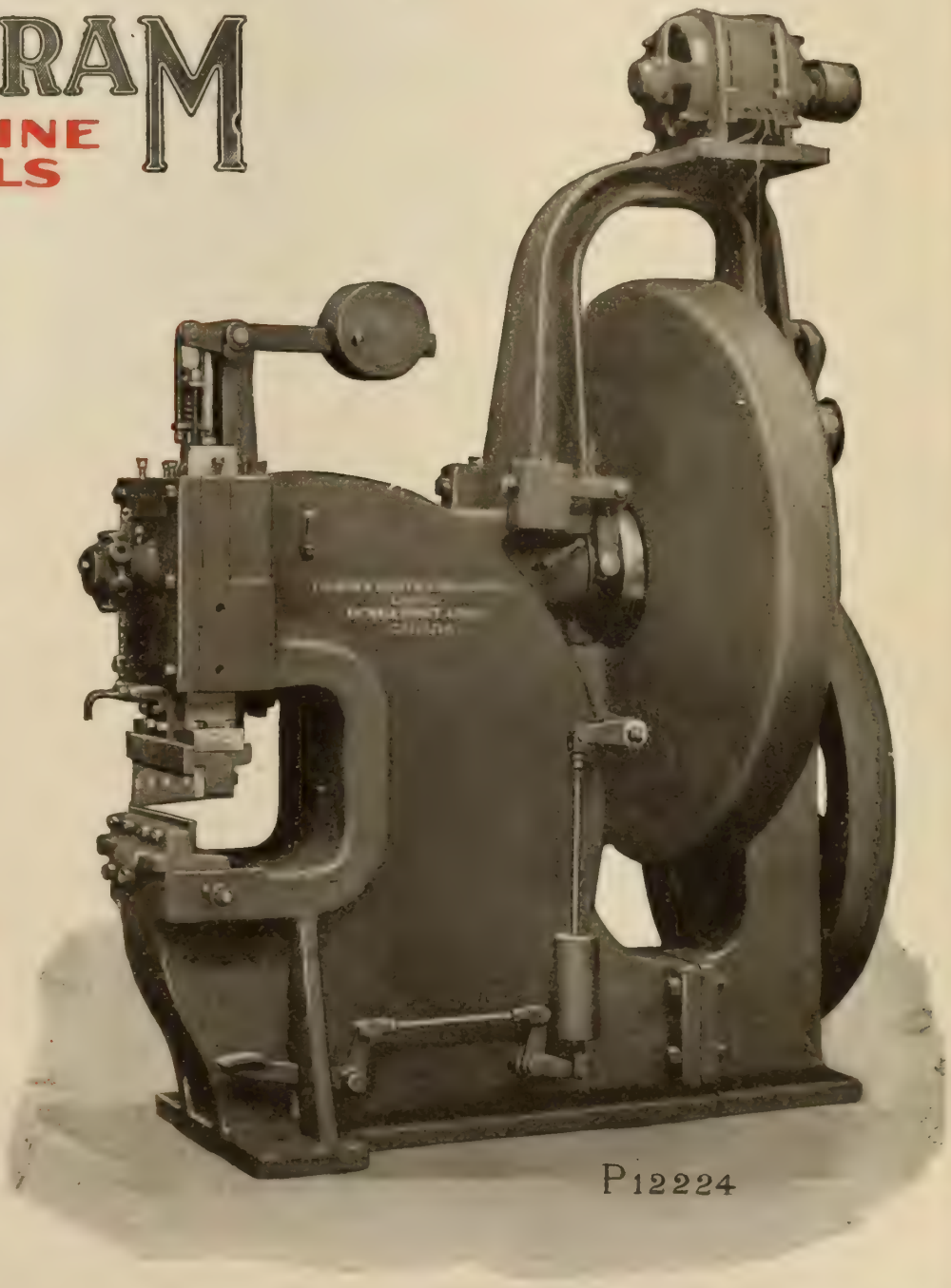
CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVII. No. 21 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | May 25, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

BERTRAM
MACHINE TOOLS

Illustration shows our No. 4 Single Punch and Shear, 12″ Throat, Motor Drive through belt, fitted with plate shearing attachments.



Capacity

To punch 1″ hole through 1″ Plate
To shear 1″ Plates
To " 6″ x 1″ Flat Bars
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Write for full particulars re any machine or machines in which you are interested.

The John Bertram & Sons Co., Limited
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TRADE P.M.S MARK
TORONTO, CANADA

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Try it! Test it! Compare it!

We court investigation. "P.M.S" Belting is recommended, and sold strictly on its merits—of course; it's well-made of exceptional materials. The toughest of Sea Island Cotton, rubber-friction-surfaced to make it non-slip and assure the maximum transmission of power, is the basis of "P.M.S" excellence. But, to convince yourself, just try it! Test it! Compare it with others! Give it the severest trial you like, so long as it's a fair one. Then, you'll appreciate "P.M.S", as we know it—practically perfect belting.

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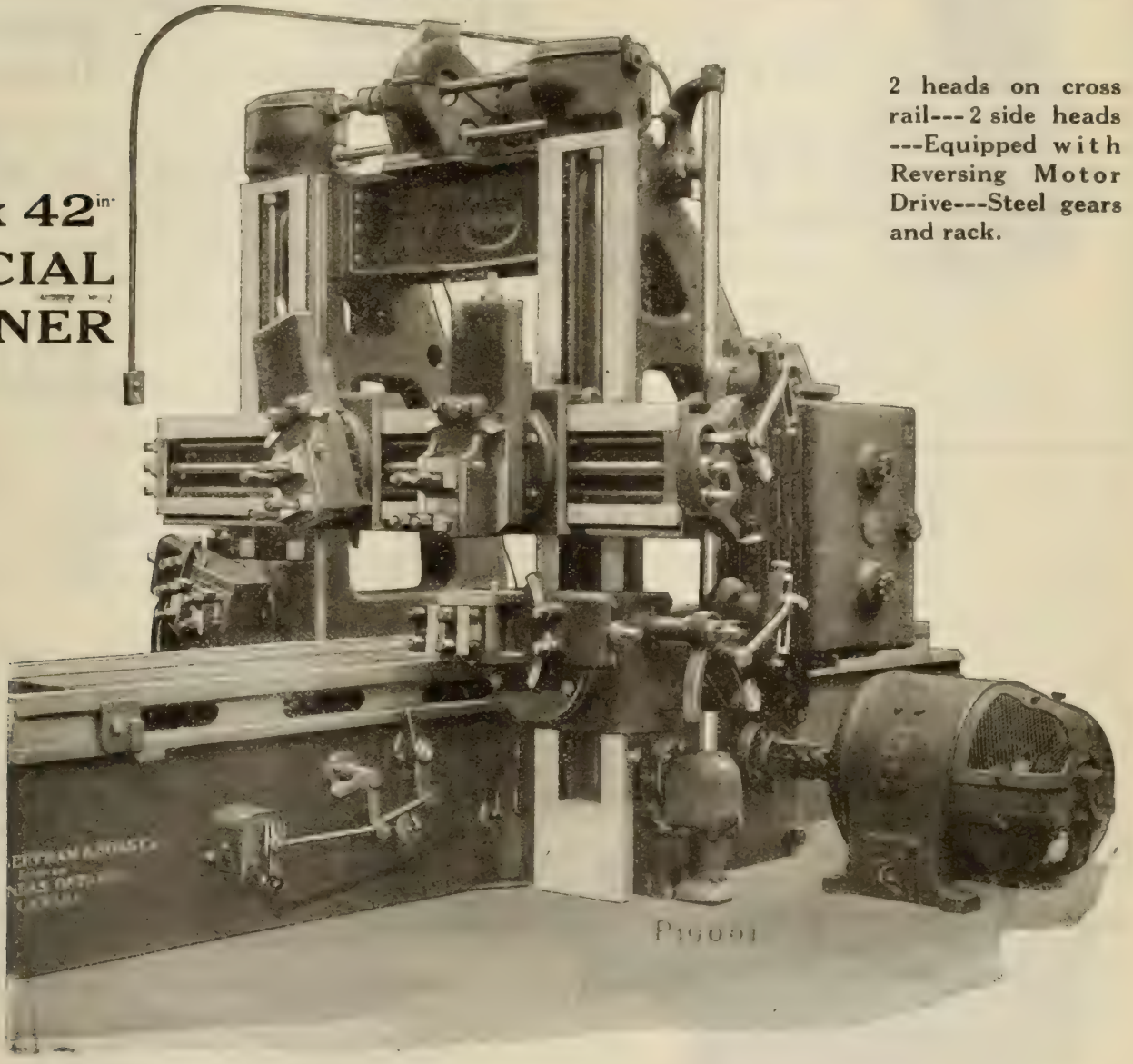
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The BERTRAM Page

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42in. x 42in. SPECIAL PLANER

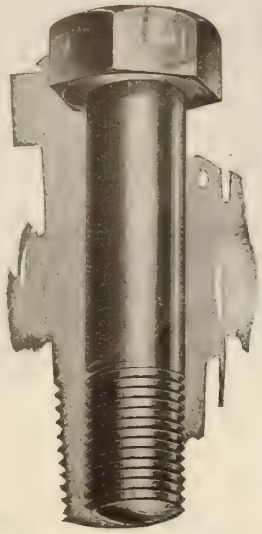
2 heads on cross rail---2 side heads ---Equipped with Reversing Motor Drive---Steel gears and rack.



The John Bertram & Sons Co., Limited

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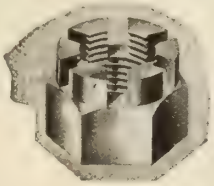
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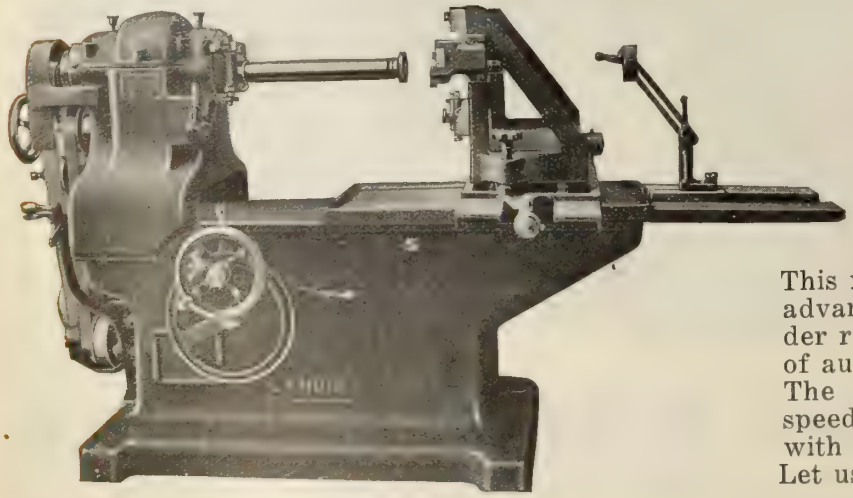
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LANDIS

No. 5 Cylinder Grinding Machine

This machine possesses a number of distinct advantages that make it unexcelled for cylinder regrinding. Its range covers every type of auto cylinder bloc.
The Landis Centering Fixture permits of speedy and accurate location of cylinder bores with spindle and thus reduces set-up time.
Let us tell you why the Landis is the choice.

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Power, Speed and Service

—BUILT INTO—

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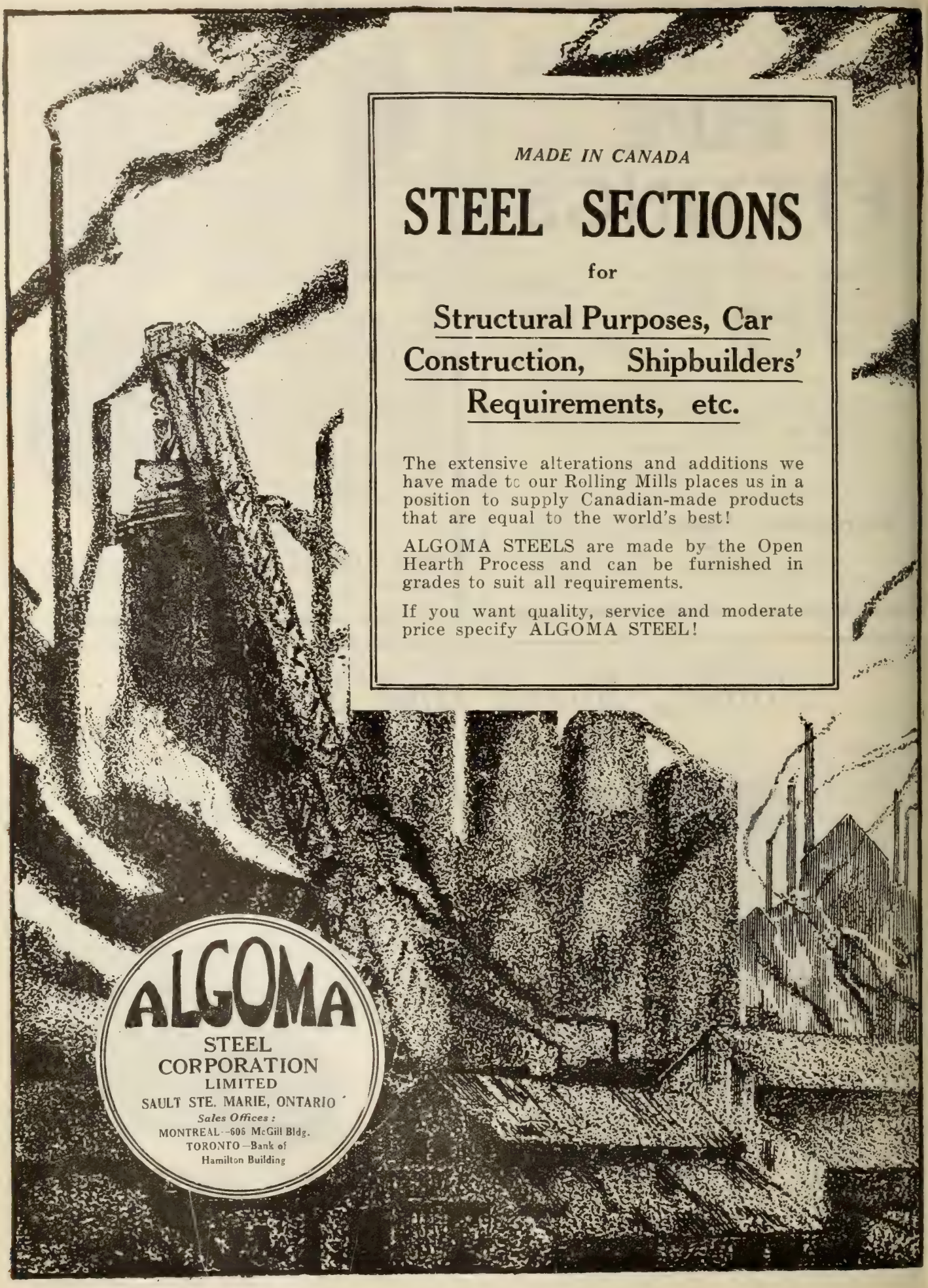
The name "Gibraltar" represents strength, and this applies to this Belt, both to the duck and to the rubber friction between the plies.

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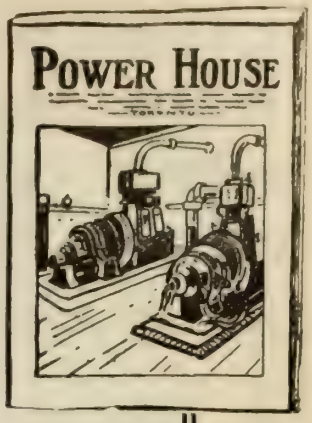
"Gibraltar" Belting will give unexpected service, no matter how difficult the drive.



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A file that has lost its keenness wastes a workman's effort and time, and so costs more than a new file.

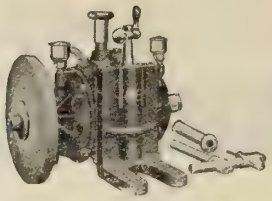
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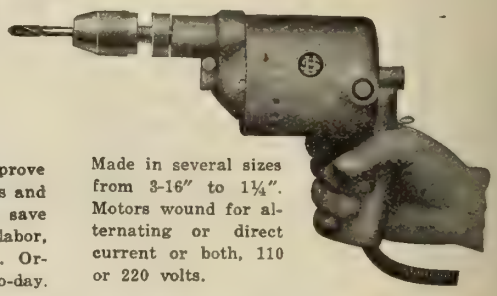
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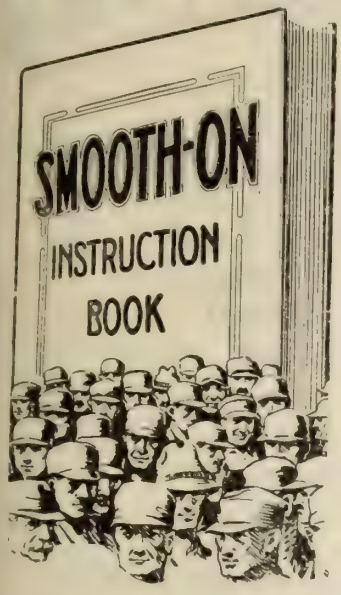
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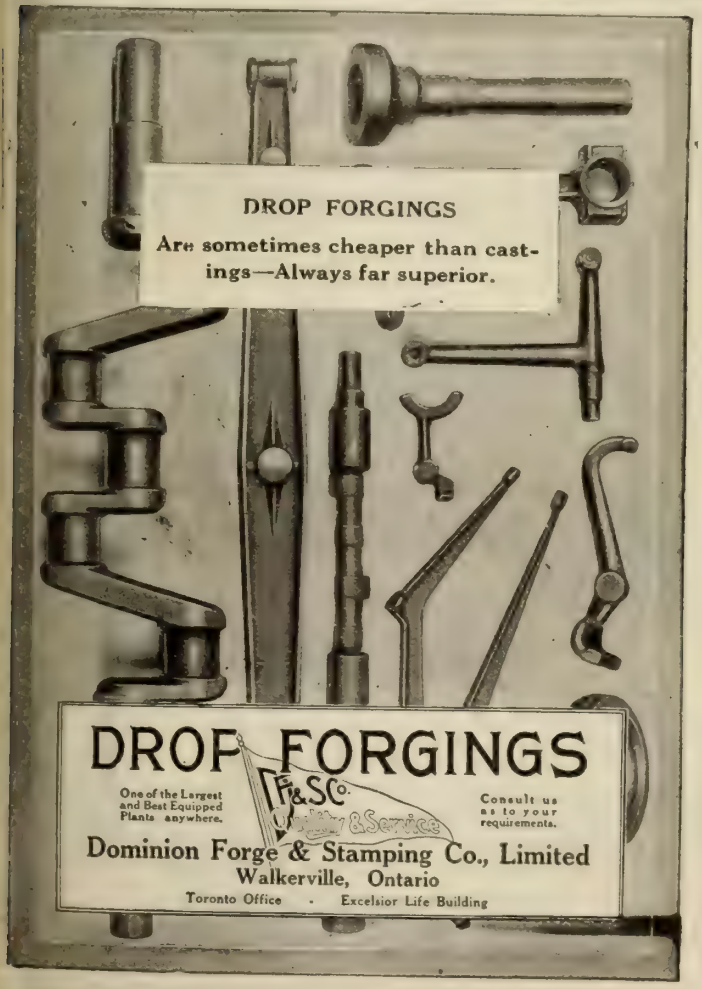
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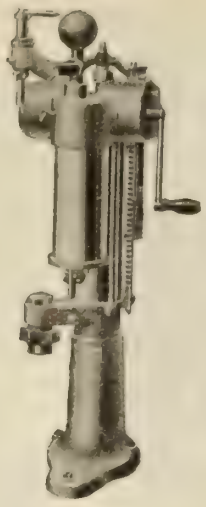
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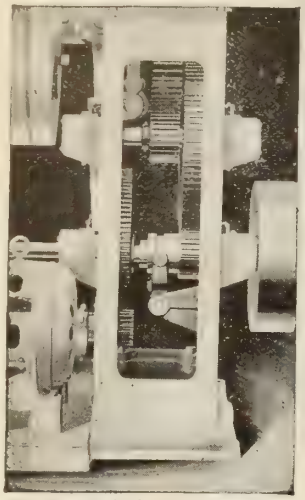
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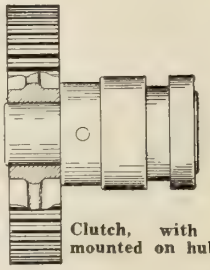


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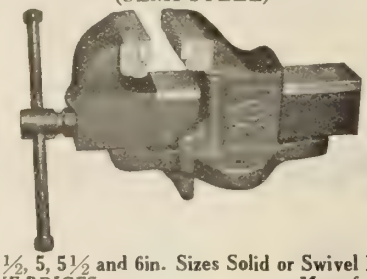
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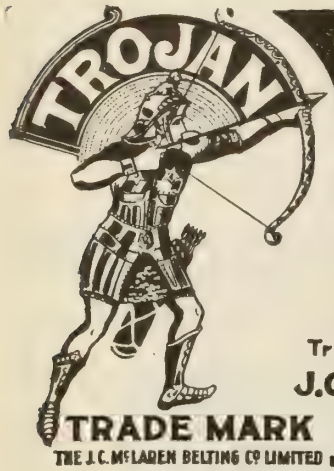
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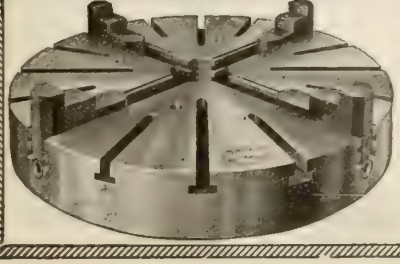
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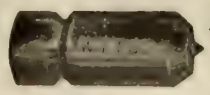
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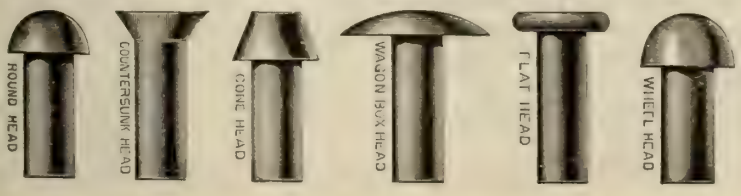


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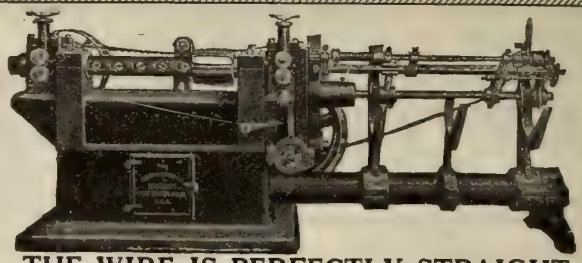
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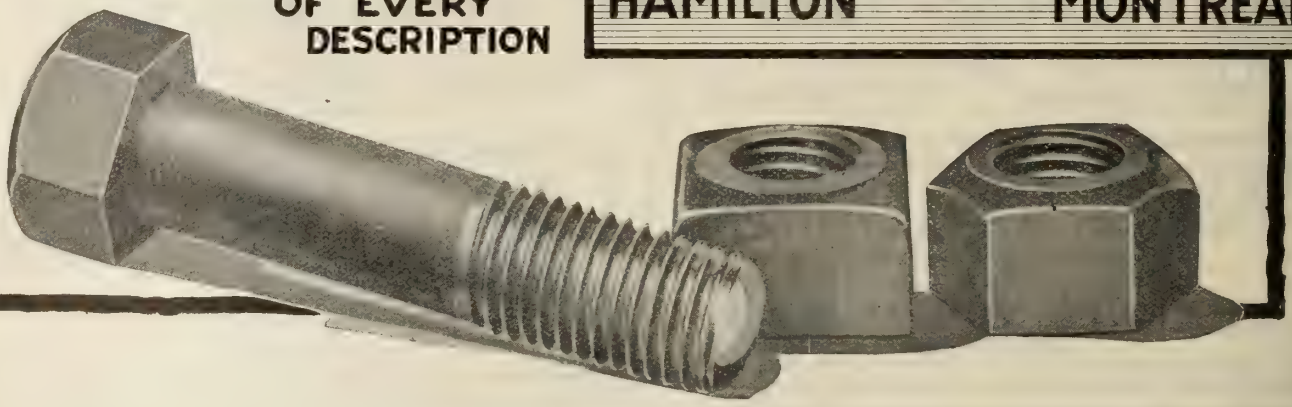
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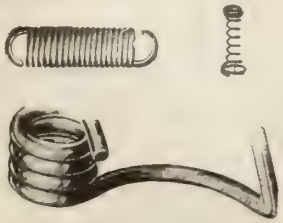
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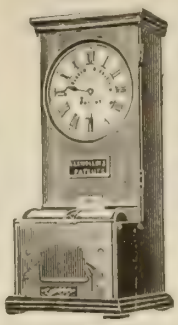
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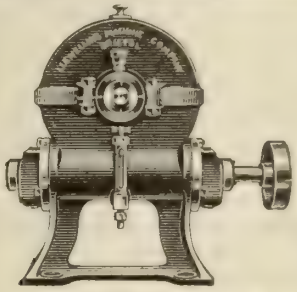


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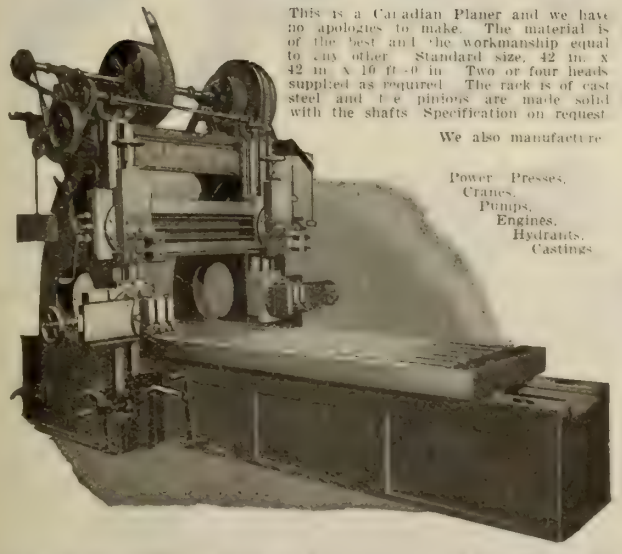
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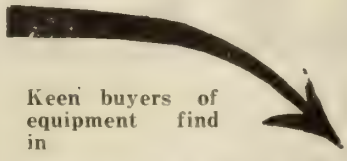
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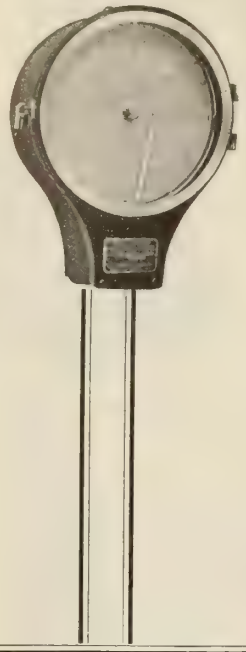
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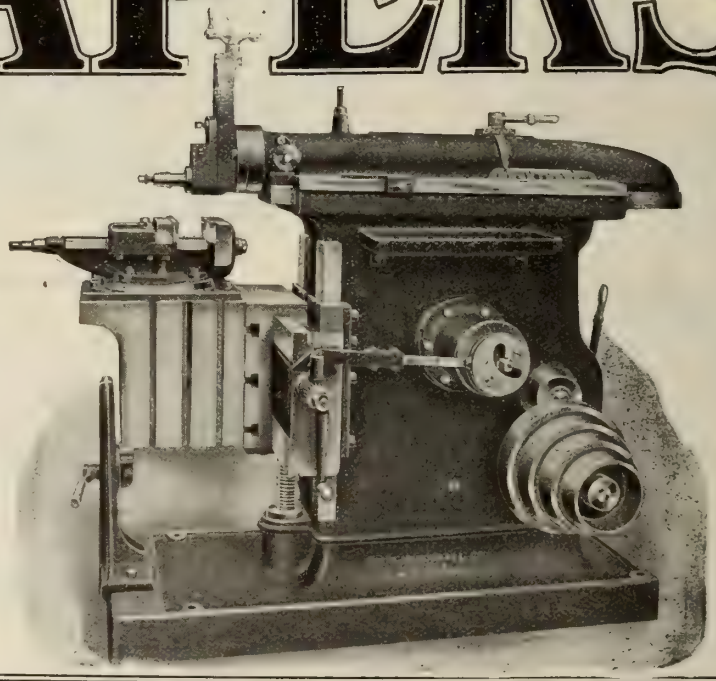
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CANADIAN MACHINERY
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VOL. XXVII. No. 21. MAY 25, 1922.

Saving Money By Means of the Turret Lathe

Production Increased by Efficient Chucks and Work-Holding Fixtures—Indexing Devices With Ample Wearing Surface Most Suitable—Machining Hydraulic Shock Absorber—Operations on Bronze Valve

By H. ALTON

ONE of the most interesting machines in the ever widening range of machine tools, is the turret lathe. All the interesting features of an engine lathe are present and in addition, there is a broader field of application. that is limited only by the ingenuity of the tool designer and engineer. There is always a certain amount of time consumed in setting up a job, chucking it, and in otherwise handling it, in and out of a machine. If these chuckings and handlings can be reduced. there is obviously a large saving in time. The ratio of time consumed in chucking and handling, to time taken in performing a single operation, varies according to the design of the work-holding fixtures, the nature of the machining, and the shape of the piece. It is not unusual to run across a job where it requires as much time to chuck the piece of work, as it takes to accomplish the machining operation. Another argument in favor of the fewer number of chuckings, is that of accuracy. It is impossible to set a piece of work a second time and obtain results that are absolutely concentric with the portion machined in the first setting. A limit of a few thousandths of an inch, or more, must be permitted.

Information and cuts 1 to 4 by courtesy of Millholland Machine Co., of Indianapolis. Data and cuts 5 to 10 through courtesy of Jones & Lamson Co., of Springfield, Vt.

For these reasons it will be seen that it is most desirable, from a point of view of economy, and also of accuracy, to reduce the number of chuckings. To accomplish this on a lathe, there was developed the turret, which carried several tools and was able therefore to perform with one setting, multiple and complex operations. For a number of years turret lathes have been improved and an infinite number of fixtures have been applied to them.

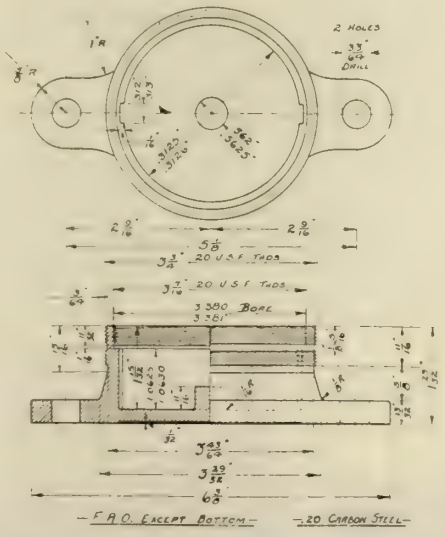


Fig. 1.—Hydraulic shock absorber machined on a turret lathe.

Chucks and Work-holding Fixtures

One of the important matters to consider in connection with the turret lathe is the work-holding fixture, or chuck. If the work is circular and of a symmetrical concentric design, a good universal three-jaw type of chuck can be used to advantage. It is more than likely that special jaws will be required, with faces machined to locate successive pieces of work in a definite position relative to the turret and other component parts of the machine and the tooling. The nature of the machining operation has to be considered and provision made to grasp the work in such a manner that it will not be dislodged, if for any reason an excessive pressure of the tool is placed upon the work. Then again the chucking problem has to be considered from another angle. A piece should be held so that the greatest possible number of machining sub-operations can be done without re-chucking.

In some lines of work a type of collet or draw-in chuck is found to give good results. In this type of chuck special provision has to be made to ensure that the pieces of work of slightly varying diameters are gripped in the same relative position with regard to the turret tools, cross slide, etc. In a

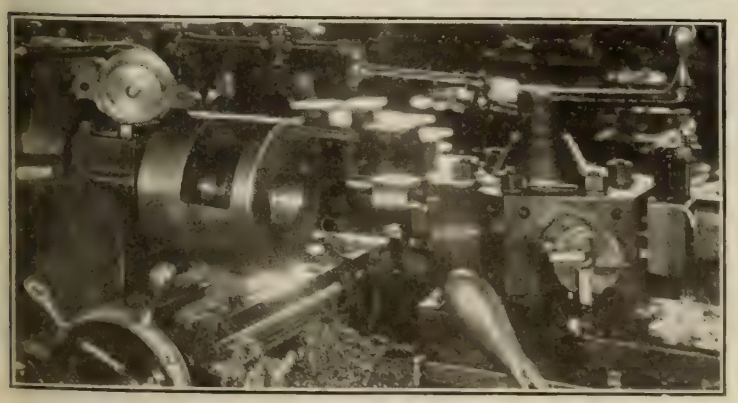


Fig. 2.—Turret lathe tooled to machine hydraulic shock absorber shown in Fig. 1.

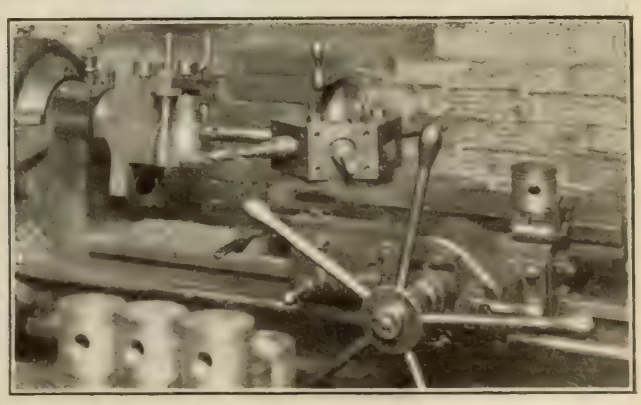


Fig. 4.—Cross boring gas engine pistons on a turret lathe.

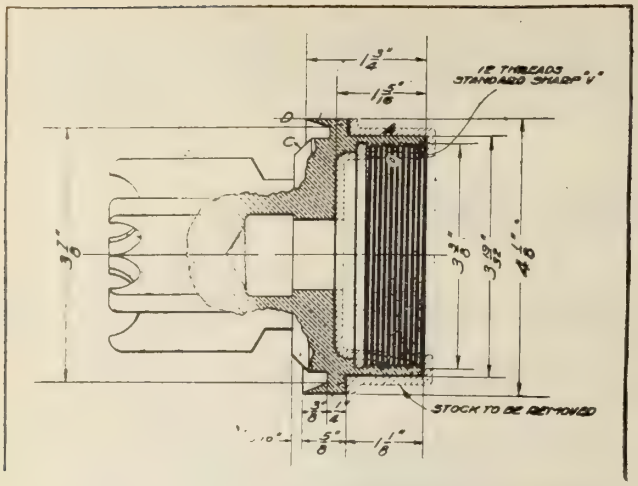


Fig. 5.—Outline of bronze valve showing metal to be removed in first operation.

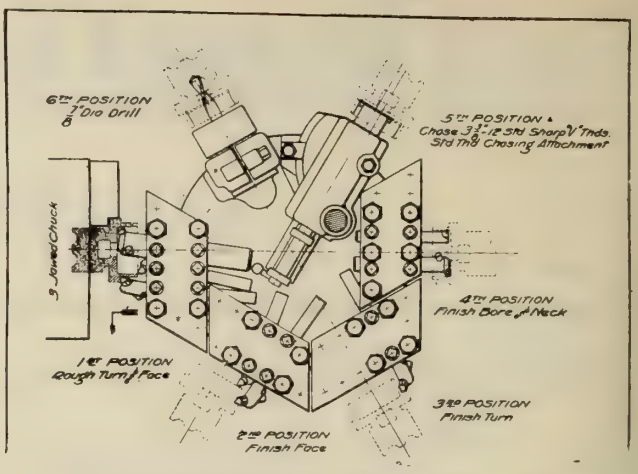


Fig. 7.—Tooling layout for first operation on bronze valve.

great many instances longitudinal cuts are governed by stops which have a fixed position on the lathe bed. Thus if the piece of work were chucked a few thousandths of an inch farther in or out than the previous piece, the longitudinal dimensions of the latter would be in error to just that extent. Instead of designing the chuck to overcome this difficulty some engineers operate their stops by making contact with the work. This is not a good practice as the revolving work causes undue wear on the stop and renders it necessary to adjust it continually. For finish operations this practice is useless. It may be permitted in roughing operations only, but even then it is not desirable.

The methods of applying chucks to turret lathes do not present the same difficulties as are encountered in work-holding fixtures. Often an irregularly shaped piece comes to a turret lath that has had some previous operations performed on it, and it has to be located according to the machined surfaces, and grasped in such a manner that there will be no interference with further operations it is desired to perform. The design of these work-holding fixtures is a very extensive subject, and would provide material for many articles. The general principle followed is, to have a definite finished part, or unfinished portion of the work, register against a certain finished part of the fixture, in such a way as to locate it relative to the tooling. The fixture is further designed to drive the work in a positive manner. A single strap, or hinged portion of the fixture is usually the only moving part. This hinged piece when clamped serves to hold the work in the fixture, and up against the locating points. It is unusual for this part of the fixture to do much driving. A wing nut with washers, is commonly provided to quickly clamp the strap or hinged cover in place. A fixture may function splendidly in every way, but it might not lend itself to rapid chucking and hence not be an economical one to use, in cases where the machining time is relatively short. In order to speed up the actual chucking operation, air operated chucks are frequently used. This method of operating a chuck does away with all wrenches, and a piece of work is released from the chuck and another one chucked in the space of a very few seconds without stopping the lathe. On operations where a short time only is consumed, air chucks speed up production to an astonishing degree.

Turret Construction

In general use to-day there are many fundamental designs of turrets, each of which has an army of satisfied users. A few of the commoner designs are, the round turret, the hexagon turret, the flat turret, the hollow hexagon, the tilted turret, etc. They are all good designs of proven merit. The choice of the design to be used would largely depend upon the class of work in hand. What is really more important than the design of the turret itself is the ability of the indexing device to stand up under long service. Even if the chuck, the turret, and the tools, are all of first class design, accurate work cannot be done unless the indexing device functions properly.

The indexing device usually consists of a steel ring which is dowelled, and well fastened with screws, to the body of the turret. For each station there is a registration hole, or slot, in the ring. This hole or slot is tapered. Into this

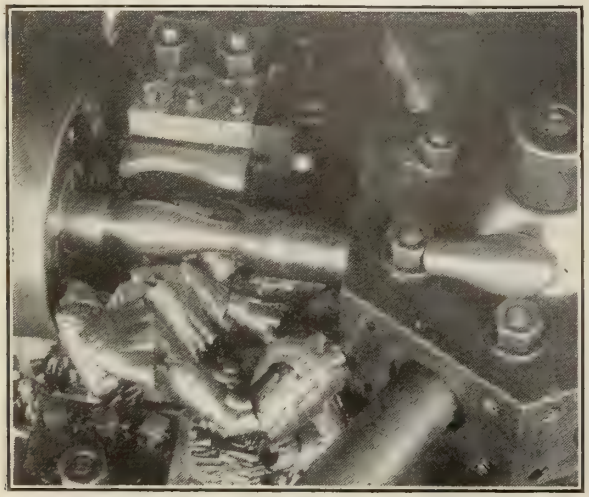


Fig. 3.—Turret lathe tooled for turning machine handles

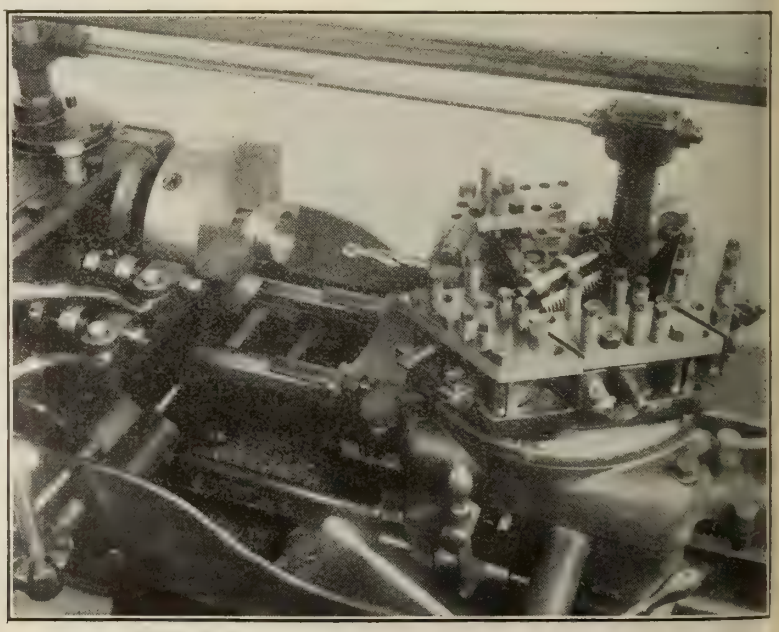


Fig. 6.—Bronze valve being machined in a turret lathe.

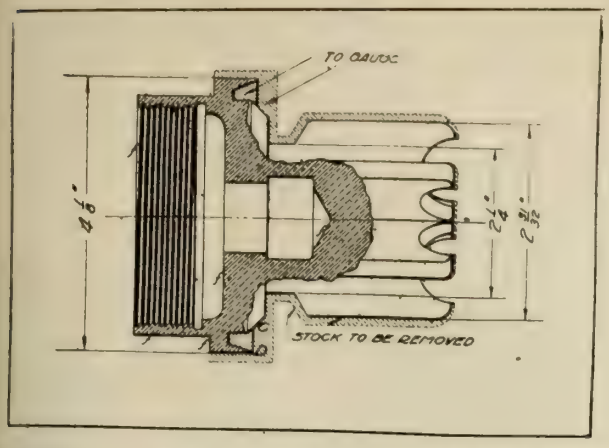


Fig. 8.—Bronze valve showing metal to be removed in second operation.

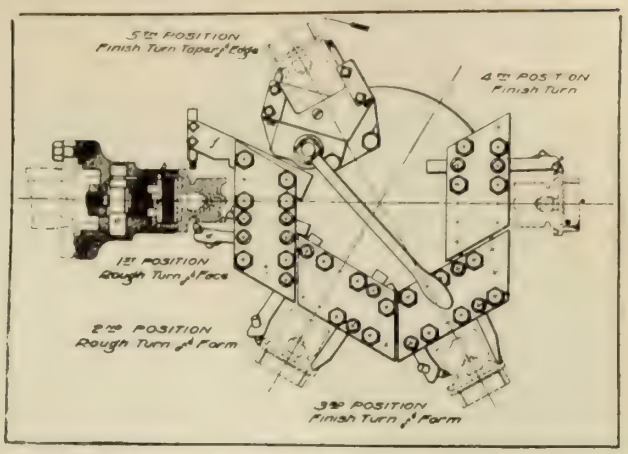


Fig. 9.—Work-holding fixture and tooling layout for second operation

opening a tapered pin, machined to fit the hole or the slot, is inserted and is usually held in place by a stiff spring. The index ring and pin are nearly always hardened and ground. There are many excellent indexing devices, but the best types are those that have ample wearing surfaces, are simple, and are ruggedly designed throughout. The locking device holds the turret rigidly in place after it is indexed, thus removing undue strains from the indexing parts.

Round turrets are somewhat limited as to the variety of tools that can be mounted on them. In fact any tool that cannot be mounted on a bar is not economically attached to a round turret. It is not usual to mount more than four bars in a round turret, which type is usually found on the smaller sizes of machines generally used on brass work for the production of small screws, rivets, and similar articles. The hexagon turret is one of the commonest types and is one of the most useful. It provides six turret faces, all of which are flat and lend themselves to the mounting of a wide variety of tools. The flat, hollow-hexagon, and tilted turrets are all adapted for special uses. Their respective manufacturers have shown many ways in which their machines can perform special operations to advantage.

General Design of Turret Lathes

Turrets are mounted on a form of lathe carriage. They are usually equipped with a large number of longitudinal feeds. It is only occasionally that a turret is provided with transverse motion. The difficulty of placing the turret again in a central position, in line with the axis of the spindle, is great, if transverse motion is provided, but this difficulty has been successfully overcome by some manufacturers.

Facing operations in a turret lathe on which the turret has no transverse feeds, are commonly taken care of in one of two ways. The first is to provide a small slide on the face of the turret. The other method is to use, when one is provided, the independent tool slide mounted on a small carriage, located between the main turret carriage and the head-stock. This tool slide is usually equipped with hand and power transverse feed. The general characteristics of the turret lathe head-stock are often the same as those of the average engine lathe.

As turret lathes are almost exclusively employed on quantity production jobs, are called upon to operate at high speeds, and almost continually, most parts of the machines are of very rugged design. The bearing of the turret carriages on the shears is long, the spindle is large and usually has an extra large hole throughout its length. There are many turret lathes on the market to-day that have many automatic features and possess many individual points of design. Such lathes often possess an all-geared head with a single constant-speed pulley drive. Gear boxes are provided that give a wider range of feeds. Automatic stops are provided, also automatic mechanisms that reverse the feed and index the turret. A lathe with all these features becomes practically an automatic, of the single spindle type. But the full automatic lathe is quite another type of machine and belongs to another subdivision of the general classification of lathes.

Some makers of turret lathes have marketed a two spindle machine, which carries two parallel spindles in the head, the axes being in a horizontal plane. The turret carries a double set of tools and two pieces are machined at once in the time it takes to complete the work on one piece on a single spindle machine.

Turret Lathes on Single Operation Jobs

Although the primary idea of using a turret lathe is to accomplish a complex operation, which is divided into several sub-operations, with one setting, it has been found very profitable to use the turret lathe on simple pieces where delicate or perishable tools are employed, Several sets of tools can be kept in the turret and when one set shows signs of needing regrinding or adjustments. the turret can be indexed to a new position and the machine can be kept going on continuous production. Although no tail stock is furnished as regular equipment on a turret lathe, many simple engine lathe jobs can be accomplished by placing a tail centre in the turret. It is not usual, however, to do such work, as it is not a difficult matter in a manufacturing shop to plan work for a turret lathe along the lines upon which it has been designed to function.

The operation which is about to be described is the machining of a reser-

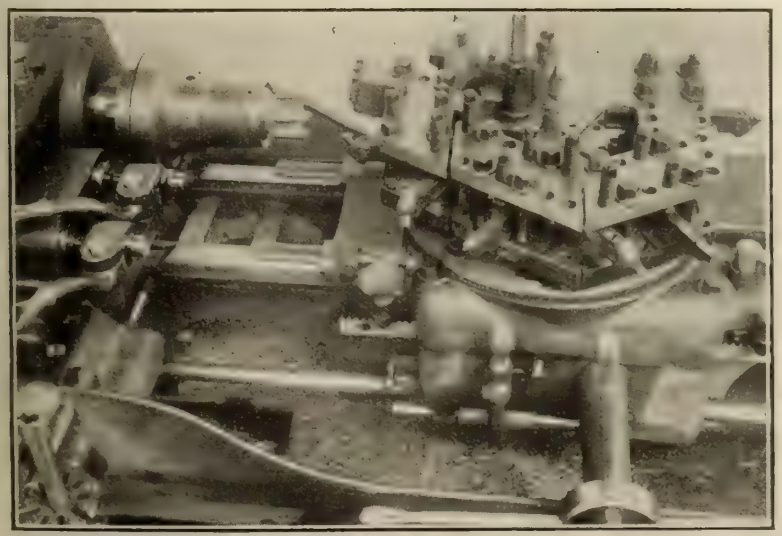


Fig. 10.—Flat turret lathe tooled for second operation on a bronze valve.

voir of an hydraulic shock absorber. This piece is shown in Fig. 1 and it will be noted that it is machined to very close limits, the tolerance being plus or minus .00025 inches. The operations performed are rough and finish boring, rough and finish face the bottom, and to turn the small pin in the centre. Fig. 2 shows the lathe tooled up to take care of this operation. The work is held in a special fixture. The machine is equipped with a hexagon turret and the machining is divided into four sub-operations. The first is to rough bore, with the tool in the boring bar shown extending from the turret face in line wth the fixture. That is to say, in Fig. 2 the turret is indexed to take care of the first sub-operation. The turret is then indexed, turning in a clockwise direction, and the bottom is faced as well as the pin rough turned. A special tool is used as is shown. It consists of four flat cutters inserted in a solid block holder, which accomplish the facing, and rough turn the pin. The tool resembles a hollow mill with inserted cutters. The next indexing of the turret finish faces the bottom and finish turns the pin by means of similar tools which are clearly shown in Fig. 2. The finish boring operation is taken care of by the boring bar and tool shown in the turret face in line with the rear end of the machine. The reservoir is made of .20 carbon steel and the lathe can produce nine pieces per hour.

Forming Machine Handles

Fig. 3 shows a turret lathe tooled up for the turning of machine handles. Bar stock is used and is fed out against a stop-bar in the turret. The piece is held in a collet chuck. It is first centred, then drilled, and reamed. These form three sub-operations, requiring in each case an indexing of the turret. Next a dead centre on the turret is brought forward to support the overhanging end of the work. Then the forming tool slide is moved up and a rough forming tool on the front, roughly shapes the handle. Next the finish forming tool on the rear of the forming cross slide finishes the forming. The handle is then cut off with a swing-over, cut-off tool attached to the side of the front forming tool. One of these handles is machined every four minutes.

Cross Boring Gas Engine Pistons

Fig. 4 features a lathe tooled to cross bore pistons. An accurate work holding fixture is attached to the spindle of the machine. In it the pistons are located in the exact position necessary for the machining. This is accomplished by the assistance of a locating bar in the turret. After the piston is located the clamp is tightened down. Then the following sub-operations occur, each accompanied by an index of the turret to bring the proper tools into position; drilling, rough boring, finish boring, and reaming. A production of fifty-five pistons per hour is maintained. These three examples of turret lathe practice have all been made on the simpler form of turret lathe that in many respects resembles the engine lathe.

Machining Bronze Valve on Flat Turret Lathe

The flat turret lathe upon which the machining operations about to be described were performed is not equipped with a cutting off slide. The turret itself, is provided with transverse feed, which can be operated by hand or power. The lathe has an all-geared head, and is equipped with a wide range of lever controlled speeds and feeds. There are many automatic stops and the turret can be indexed by power, if it is desired to do so.

The machine will work at very high speeds, holds the work to close limits, and lends itself to the use of standard tools. The job about to be described is completed with nearly all standard tools, as will be noted later.

First Operation

The part to be machined is a wing valve of tough bronze which requires fine workmanship to insure proper action when in use. The valve is shown in Fig. 5. The metal to be removed with the first chucking is shown "dotted in." Surfaces A, B, and C, must be true with each other, yet it has been found to be most economical to divide the machining into two operations. To obtain accuracy in the second operation an interesting work-holding fixture has been developed. The inside thread must be true with the surface A, and so act as to not expand or distort the thin wall. This requirement prohibits the use of a tap. Previous to what we herein term the first operation the large diameter has been rough turned and a shoulder faced. The casting is then held for the first operation in a three jawed chuck the threaded end out, as shown in Fig. 6. Fig. 7 shows the tooling layout. In the first turret position the boring and turning are done, and the bottom of the hole is faced as well as the small external shoulder. The turret is fed longitudinally into the work and then the crossfeed is engaged and the turret is fed outward as indicated by the direction of the arrow. An automatic stop determines the depth to which the boring and turning tools feed. Then the power transverse feed is automatically engaged. This combination of longitudinal and transverse feeds, permitted by the design of the turret head, allows the same tools to turn and bore, then face out, reducing the number of tools used and the tool settings required.

The second position of the turret carries the tools for finish facing. The third turret position finish turns the surface A. The fourth turret position is where the bore is finished and the necking done. In the fifth turret position the thread is chased. This is a 3⅜ inch—12 standard "V" thread. The cashing tool shown is standard equipment for this type of lathe. It is claimed to be the most satisfactory method yet developed for combining engine lathe accuracy with turret lathe speed in threading. It is entirely automatic in its action, except for the feeding in of the tool a little deeper for each cut. It cannot overrun, may be withdrawn for gauging without losing its position, and returns on the back stroke at high speed. The sixth turret position carries a ⅞ inch drill which is fed into the work for a short distance only. The entire operation is accomplished in 2¾ minutes.

Second Operation

Fig. 8 shows the surfaces to be machined in the second operation. The surfaces marked "F" in this cut are finished in the first operation. The metal shown in the shaded section is that which is to be removed in the second setting. The seat C must bear a definite relation with the edge D. To hold the valve for the machining operation, it is screwed on to a threaded plug (a) shown in Fig. 9 which gives a tooling layout of the operation. The valve is centred in the hardened sleeve (b) and is firmly seated against the face of (b), which assures that the second operation will be true with the first. In the first position of the turret, the tool (d) is fed in, to turn the wings. Then the cross feed is thrown in and the tool (f) squares down the flange and the third tool faces square the ends of the wings. Fig. 10 shows the set-up and the turret in the first position. In the second turret position the large diameter of the valve is rough turned and the groove between the corner (D) and the surface (C) rough formed. In the third turret position the wings are finish turned and the groove finish formed. In the fourth turret position the large diameter is finish turned. In the fifth position the tools fitted in an angular slide which feeds in the direction of the arrow, finishing the seat and trimming the feather edge to the definite relation required; the time for this operation is four minutes per piece. The work-holding fixture is designed to grip on the thread and finished surfaces as described. Chuck jaws would distort such a fine shell, even if they were true enough to give the accuracy required. The eccentric (C) in the work-holding fixture is turned to release the work if tightened on the thread by the intermittent cutting on the wings.

Standard Tooling

All the work in the first operation done on a standard machine and only standard tooling equipment is used. The tooling in the second operation is almost entirely standard, the exception being the holder (f) in the first turret position, and the cross-slide in position five. The latter is a standard slide but it is mounted on a special angle base and provided with a special tool holder. This example is particularly interesting from the fact that standard tooling enters so largely into the work, and shows the possibilities of economically doing special work on a turret lathe.

The mounting of a grinding wheel should be rigid, and the wheel so supported that it revolves true.

Eliminating Cold Trim Press Accidents

Danger of Working on Unguarded Presses—Repeating of Press Ram Not Always the Cause of Trouble—Unsatisfactory Experiments With Mechanical Tripping Devices—Electrical Guard Which Has Solved the Problem

By G. A. KUECHENMEISTER, Personnel Manager, Dom. Forge & Stamping Co.

THE story of punch press accidents in our cold trim department is typical of any punch press department. There was a time, not so long ago, when our operators were working at unguarded presses. Some months we had no " accidents" at all and we felt highly elated. Then the following month we had a series of injuries—fingers amputated and hands mangled. It was considered "tough luck" and that was exactly what it was—all luck. And that is exactly what any operator must trust to when operating unguarded presses. If he is lucky he will get away with it, but usually, he doesn't for very long.

A properly guarded press not only reduces accidents, it eliminates them. We have had no fingers amputated, crushed or mutilated, no hands mangled during the past year (business of rapping on wood) and we cannot see any reason why we should.

Our records of punch press accidents show that in every case the man had his finger or hand somewhere in the vicinity of the punch at the time the punch descended; not necessarily directly under the punch but close enough so that when the punch entered the die his finger or hand was injured. Then, too, we have records where a man was working along nicely, the press working fine and his hands, eye and foot (on the treadle) functioning like an automatic machine. Then it happened. Something went wrong and he made a grab for the die just as the punch came down. With the usual result. And always we were told the same story—the press repeated.

In several cases that was found to be true, at least the press did repeat when it was tried after the accident. However in most cases the press was found to be in good working condition and did not "repeat" until the next man got hurt. The real trouble seems to have been that we gave the men the same chance that the "shell game" artists give the fellow who thinks he can follow the movement of the little pea.

Schemes Tried Out

All the time that this "spotted" accident record was being made we tried to find some way of reducing the injuries. We bought window cord and pullies and tried to harness the men's arms to the presses so that when the press operated the arms would be pulled backward out of danger. That did not meet with the hearty approval of the men so we dropped it. We installed a mechanical two-handed tripping device on approval.

The foreman was all in favor of it but after it was installed he always found a good reason for not putting work into that press that could not be done without using the foot treadle. The experiment was a failure and the guard was quietly "lost." Had we thrown the treadle onto the scrap pile, where it should have been put, the device would have been used.

A series of injuries that were caused for no other reason than that the operator had nothing for his hands to do after he put the forging on the die and which resulted in the meat being scraped off the finger tips led us to experiment with another two-handed tripping device. We reasoned that a man could not use both hands to trip the press and have them near the die at the same time. The experience we had with a mechanical guard that required adjustment with almost every change of dies decided us in favor of the electrical device that we now use.



Fig. 2.—Same press shown in Fig. 1. Note position of operator's hands when tripping press. Eyes protected by goggles.

Protection Guaranteed

The guard, or tripping device, consists of a 220 volt solenoid direct connected to the clutch pin. Two push buttons placed on the frame of the press are connected in series and must be pressed at the same time to energize the magnet. A cut out switch on the top of the press which is hooked onto the ram breaks the current flowing through the solenoid as soon as the ram descends and makes it impossible for the solenoid to again become energized until both buttons are released and again pressed.

That feature makes it impossible for the operator to plug the buttons and keep the press going continuously and prevents "repeating." The location of the solenoid and push buttons is such that it never interferes with changing dies, removal of bolster plate, crank, shaft, pulley or fly wheel and only in case of a complete over-hauling of the press is it necessary to remove any part of the tripping mechanism.

The change from the foot treadle to the push button control of course brought out objections of various kinds. The first difficulty encountered was with the clutches. It was found on some presses the solenoids would not pull the

(Continued on page 29)

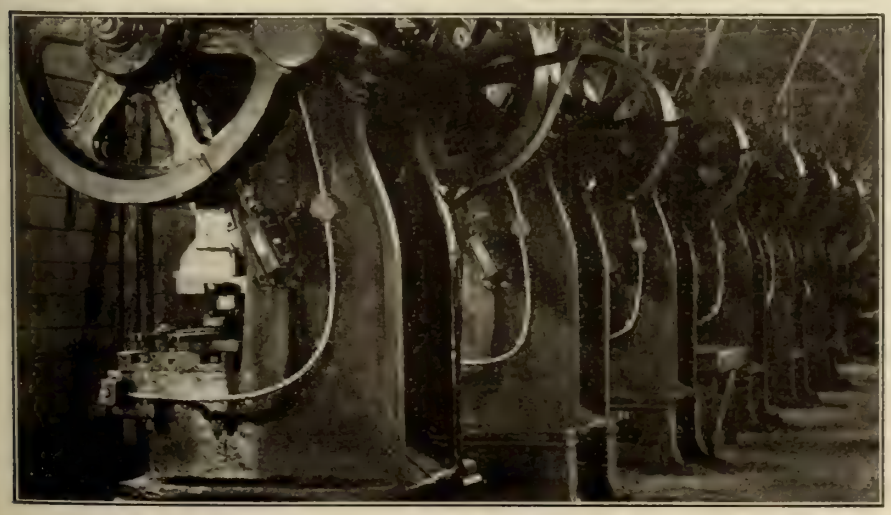


Fig. 1.—Battery of cold trim presses equipped with two-handed electric tripping device.

Readers Display Interest in Previous Articles

Inspection of Special Shaped Castings—The Noon Hour Problem—Non-Slipping Wrench—Counterbalancing Overhanging Work While Machining—Offset Drilling Device

By DONALD A. HAMPSON

SUPPLEMENTING the very complete article on inspections systems for the average shop, there might be told the method we adopted on some castings of rather special shape. Roughly, these castings were a 2 inch cube, solid, with several short arms projecting at different angles from the cube. After boss holes had been drilled in the arms, a number of holes were drilled in the center cube, using a box jig which located the piece from the boss holes. As the center holes cut up the cube pretty well, the latter could not be cored.

Surface inspection seemed to be the only way to determine how good a casting was until the piece was nearly done and then rejection followed if the cube was not clean in the center holes. The castings were turned out on a moulding machine and the foundry was running on a standard mixture, so the variables were concentrated in that center cube with its sponginess or lack of it, We found that the surest check was to weigh the castings as they came into the shop; an ounce under weight was suspicious, though surface inspection often showed this loss as careless grinding, but two ounces under foretold a spongy center every time.

Noon Hour Problem

How true to life is that one superintendent's experience with the noon hour problem! Give a bunch of men and boys a little time and they are sure to stir up mischief or conceive labor agitations. And then the ball playing—the exertion and excitement, heated bodies, waiting 'till the last bell rings and rushing in with one fellow way behind who has to chase the last fly over the fence, then the discussions and drinking for an hour or two. I played ball that way myself, giving it up finally because I noticed that I was more tired from the strenuous exercise crowded into a few minutes than from standing all day in front of two lathes.

The reading room solution is good—the very best. If you can get men to read anything other than yellow journals you are making progress and helping them to better themselves. If you can get them to read something along their line of work, you are doing even more. Books, periodicals, trade papers, house organs—what appeals to one does not appeal to another but all of those named will help the individual to help himself. I recall going into a foundry one noon and there seeing a lad comfortably stretched on his back in the curve of a wheelbarrow which was tilted against a heap of sand—said lad was reading his correspondence school papers; he had the right idea, that of resting his muscles while exercising his mind. Find a person who has exchanged the cigarette habit for the study habit and you find one whom it will be impossible to keep from advancing.

In one plant that I know of they have solved the noon hour problem pretty well by making that "hour" thirty minutes. That extra time is taken off on Saturdays. There is not much time for fomenting around or for violent games in a thirty minute period. As a part of this plan workmen and apprentices are recruited as far as possible from those residing within a thousand feet of the plant; these men go home at noon—out of sixty, at least half reside nearby and the inducement of a warm meal is more than they can resist. Besides, they get into a different atmosphere for a short time and they return to their work with new vigor. For the men who remain, there are the shop papers which the company takes and which the men are invited to read.

This plan of a short noon period and of localizing the help has worked out splendidly. One might say that more time was required to eat and digest food but these men seem to thrive on it; as a lad, the writer used to be in a factory where there were a hundred men doing the hardest kind of physical work amid heat and dust—there were no regulations then and the men would go right back to work as soon as they had eaten, which seemed to do them no harm for they were the healthiest and most rugged of any industrial gang in town.

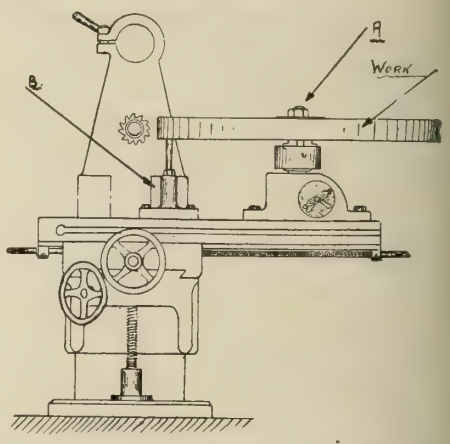
Tap Saving Wrench

"A tap-saving wrench" is most convenient to have around. Sometimes they are made on the principle of the friction tapping device so common for drill press use but much smaller and with only one slip surface. The great trouble with all such tools lies in their use by careless men; such men will employ them on taps larger than intended for and will then have to tighten up the slip member to drive the tap—next man that comes along doesn't know that the tool has been used ignorantly and left so and he depends on the setting to save breaking taps of a smaller size, which it will not do when tightened up so much.

If a friction, or slip, tap wrench can be made so that its adjustment is inside or is sealed—then it is all right. But otherwise the tool gives a false sense of security and disaster results. The best safety is a careful man. Careful machinists use a 4 inch or 6 inch tap wrench on No. 3 taps without mishap but they do it because their attention is concentrated on their work—not looking around the shop or talking to Bill—and because they cultivate the sense of feeling. Using but one hand on the tap wrench is the first move in the cultivation of a sense of touch. On small work, it is a good plan to hold the work in the left hand and the wrench in the right.

Overhang of Work

The writer had a large gear to cut on a small miller not long ago and he used substantially the same method as your correspondent. In addition, there was rigged up a counterbalance as shown by Fig. 1. The center bolt was tapped and a small eye bolt screwed in. In this eye, a rope was tied and carried up over two sheave wheels (of wood) set in slotted ends of a piece of timber laid across the countershaft planking. Weights about one hundred pounds heavier than the gear plank were attached—the excess being to compensate for the center head and the overhanging table.



The weight was counterbalanced by passing cable through overhead pulley and attaching to eye-bolt at A.

Thus arranged it was easy to raise and lower the knee as if there had been no 400 lb. casting on the table and the latter had not been run out to the limit. A swivel was not needed for the rope as the blank was indexed because the rope itself merely twisted that much.

The application of individual motors to machine tools has played no small part in the rapid development of certain classes, chiefly planing machines, milling machines, high-speed drills, high-speed grinders, etc., but in the view of the author the most modern application is that of the planing machine. By means of variable-speed motors it has been possible to increase the number of operations which can be undertaken at one setting, thus effecting a saving in time and power and gaining the advantage of the greater precision which attaches to the machining at one setting.

Different Methods of Forming Gear Teeth Profiles

Grinding Process Seldom Used Except for Worms—Producing Thin Gears in Punch Press—Classification According to Tooth Shape—Involute System in General Practice

By CHESTER B. HAMILTON, Jr., B.A.Sc., M.E.

THERE are two classes of ground tooth gears. Neither are used to any extent, though a few years ago it seemed as though the demand for quiet automobile rear axles would compel the use of ground bevels. The invention, however, of the Gleason curve tooth bevel gear generator—misnamed spiral bevel—solved this problem completely and economically.

The form tool method is applied to gear tooth grinding in a machine which uses an emery wheel with face formed to coincide with the tooth space, for cleaning and smoothing ordinary rough molded cast iron spur gears. As the tooth form is different with each number of teeth, a number of wheels are required to cover the range from small pinion to large gear, just as with the ordinary rotary gear cutter. The peculiarity of this process is that the form of the wheel, once established, is persistent, because the curve of the rough casting differs from the finished gear only in accidental irregularities which would not occur twice in the same place. The wheel therefore, though subject to constant wear, maintains its shape.

The generating process as applied to grinding tooth profiles takes the gear after hardening and seeks to correct the distortions resulting from the heat treatment by repeating the generating process by which the tooth was originally produced. This time, however, a very slight amount of metal is removed by an emery wheel which is given a motion relative to the work that its cutting face generates the working face of the gear tooth. The moulding generating process is used, the describing generating process hardly being applicable.

Grinding Worms

It was mentioned at the top of this section that few gears were ground. The number is in fact negligible, but this is not true of worms. Grinding is by all means the modern method of finishing worms. The modern high efficiency worms of the automotive type with large helix angles and pressure angles can be ground quite readily with the side of a flat wheel, or with the angular surface of a conical wheel. They have even been designed of such form that they can be ground with the cylindrical face of plain straight face wheels. The real difficulty in all of this class of work is not so much the grinding of the worm as the devising of means which will ensure the tooth form agreeing with that developed by the hob which finishes the worm wheel. It will be seen that the surface of the worm tooth is a warped surface which contains only one series of straight line elements. The same is true of the form of the hob—neglecting gashing and relieving. These elements of hob and worm must agree if the drive is to be efficient and durable. But the elements of the worm were created by conjugate action with the straight line elements of the face of the emery wheel which ground it. Hence the necessity for the mathematical accuracy in the face and position of the grinding wheel, the case being further complicated by the fact that the face of the wheel changes as it wears and is re-dressed.

Stamping Gear Blanks

Gears of very narrow face may be formed by stamping from sheet metal, usually brass. They are suitable only for very light duty, such as transmitting motion with practically no power, and are applicable to cheap clocks and gas, water or electric meters, speedometers, etc. Improvements in very small gear cutting machines have reduced the desirability of the stamping process. It still has advantages where the diameter of the hole is so small as not to admit a machine arbor stiff enough to allow a large bank of blanks to be cut off at once, and also where quality is a slight consideration.

The method of making pinions which corresponds to the stamping of gears, is by drawing brass rod through a die. In this case there is no punch, and the process is purely that of reduction to the desired cross section by cold drawing. This is applicable to spur gears only, of course. Very small pinions can be drawn in the form of wire, of any length and to very accurate dimensions. This process is not subject to the disadvantages as to quality that lie against the punch and die stamping. There is a true story of an instrument maker, who, some years ago, needed three brass pinions ¼ inch face by three-sixteenths diameter. He made one by cutting from the solid rod, but it took a long time, and considerable skill. In disgust he gave it up and wrote to a specialist in small gears. In reply he received a quotation on pinion wire at a few cents per foot, and a sample two inches long enclosed in the letter.

Form of the Tooth

Under the classification of gears according to form of tooth the first thing to be considered is the kind of curve. The earliest gears had teeth of circular cross section. They were simply round pegs. This form still persists to a slight extent in the lantern pinions of some clocks, and the similar roller pinions used on certain farm tractors to mesh with specially shaped internal gears on the final drive to the rear wheels.

The cycloidal tooth is of more recent date, but not used of late, and may be considered obsolete, having been superseded by the involute. The cycloidal curve is based upon the pitch circle and is traced by a point in a smaller "describing" circle while it is being rolled tangent to the pitch circle. There are two curves possible, one when the describing circle is rolled tangent to the inside and one to the outside of the pitch circle. The tooth curve uses only a small part of the whole, above and below the pitch circle, for the addendum and dedendum curves respectively. The cycloidal gear will only transmit uniform angular velocity when the centre distance is exactly fixed to bring the pitch lines of gear and pinion precisely together. This is one of a number of serious disadvantages. Wilfred Lewis, a leading authority on gear, says, "The cycloidal system cannot compete with the involute because its cutters are formed with greater difficulty and less accuracy, and a further expense is entailed by the necessity for more accurate centre distances. Cut gears are not only more expensive in this system, but also when patterns are made, the double curved faces require far more time and care. It is hardly necessary to argue any further against the cycloidal gear teeth, which have been declining in popularity for years, and the question now to be considered is the angle of obliquity most desirable for interchangeable involute teeth."

Involute Curve

The involute curve is developed from a base circle, smaller than the pitch circle. It is the curve traced by a describing point definitely located in a tangent which may be unwrapped from the base circle. Thus it is seen that the involute tooth curve can exist only outside the base circle. That part of the tooth within this circle will be made up of radial flanks or some empirical modification. The pitch circles of a pair of gears are the circles which might be imagined to replace the gears and roll together as a pair of smooth wheels without slipping. Their diameters are therefore proportional to the tooth ratio, and they are tangent to each other where they cross the line of centres. This is called the pitch point.

The pressure angle is the angle made with the line of centres by the common tangent of the tooth curves of two teeth

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when their tangent point crosses the line of centres. It is, therefore, the angle which the tangent to the tooth curve at the pitch circle makes with the radius at the same point. Considering the way the involute was drawn in the first place, by unwrapping a tangent from the base circle, it is evident that if the describing point, after drawing the curve may be returned to the pitch point, then the tangent to the base circle is the normal to the involute curve at the pitch point. Proceeding similarly for the other gear of the pair, and remembering that the pitch point is common to the two involutes, being their point of tangency, we see that the two tangents to the two base circles are one and the same straight line. This line is the "line of action," and the angle between it and the line of centres is the complement of the pressure angle.

Further consideration leads to the conclusion that the contact point between two involute teeth always lies in this line of action, beginning when they first mesh at the point where the line cuts the outside or addendum circle of the driven gear, continuing through the pitch point, and ending where it cuts the addendum of the driving gear. This portion of the tangent is called the line of action. The angle which it subtends at the centre of either gear is the arc of contact for that gear. The first portion of the arc of contact up to the pitch point is the arc of approach. The part from the pitch point till the teeth cease to mesh is called the arc of recession. We have been considering motion and pressure in one direction only, but as the teeth are symmetrical and motion reversible, or even just considering the back contact, it is evident there is a complete duplicate diagram which is the mirror of the first, referred to the same line of centres.

Range of Involute System

The involute system of gear tooth curves possesses very desirable flexibility in a number of its features. While the pitch circles remain tangent to each other where they cross the line of centres at the pitch point, being governed by the ratio of the two gears, the base circles may be almost anything we choose, depending on the pressure angle of the teeth. The addendum and dedendum circles may be varied considerably in distance apart depending on the depth of tooth desired, and in position relative to the pitch circle, depending on the proportions of addendum and dedendum desired in the teeth of gear and pinion. When formed cutters are used to produce the teeth all this must be decided before the cutters are made and cannot be changed thereafter. When the teeth are made by the templet or the generation processes, either with a hob or Fellows' shaper cutter, the flexibility of gear design is still greater. Then the pressure angle is fixed by the selection of the templet or the tool, but the gear blank may be turned over or under standard sizs, and when the teeth are generated they will be found to have an increased addendum and decreased dedendum, or vice versa. They will mesh and roll correctly, if the variation has not been carried to extremes.

Arc of Contact

By a selection of whole depth the length of the arc of contact is controlled. By choice of addendum and dedendum, through the turned diameter of the blank, the relative lengths of the arc of approach and arc of recession are controlled. The tooth action in regard to slippage and wear, impact and noise, varies in these parts. Tooth strength is also controlled. All pure generated involutes are undercut in the flanks, below the pitch circle of pinions and gears of less than a certain number of teeth, which varies with the pressure angle. Small pressure angles and small numbers of teeth have the most under cutting. By reducing the dedendum of the pinion of a given pair and increasing the addendum by the same amount, and taking the reverse procedure with the mating gear, a combination is produced which is very much stronger.

A feature of the involute tooth form which not only gives flexibility itself, but is fundamental to much of the preceding matter, is the fact that involute gears will operate correctly and transmit angular velocity when run at increased centre distances, but of course with increased back lash. Also two gears, both made with long addendums and short dedendums, from over size blanks on the system described to reduce under cutting, will run together. The reason is that, in effect, new enlarged pitch circles are established, of the same ratio, but the base circle remains the same, therefore the pressure angle is increased and the tooth is merely generated out of a portion higher up in the involute curve.

Different Methods

The "long and short addendum" method is not adapted to an interchangeable system of gears, but to specially designed combinations. There are a number of other ways in common use of eliminating the under cutting and weakening at the root of the pinion tooth, and the corresponding interference at the tip of the tooth, The Brown & Sharpe system of interchangeable involute gears has a corrected tooth form which eliminates all the interference and most of the under cutting for all combinations of numbers of teeth from twelve up to the rack.

This is accomplished by making an empirical modification in the formed cutter used, which thins the tips of the gear teeth and thickens the root, especially on pinions and gears of low numbers of teeth. The curve at and near the pitch line remains the pure involute. This system is very satisfactory for use with formed cutters, but, being empirical and the correction varying with the number of teeth, it is not adapted to the generating process.

The pressure angle in common use for many years has been 14-1/2 degrees. This was selected in the days of cast gears and hand-made mortice teeth, because of the ease with which it could be laid out accurately by patternmaker or millwright, without a protractor, for its sine is almost exactly one to four (.25038). Wilfred Lewis, about the year 1875, introduced the 20 degree pressure angle tooth in the William Seller Company's plant, when they were changing from cycloidal to involute. He says, "I did not at that time have quite the courage of my convictions that the obliquity should be 22-1/2 degrees, or one fourth of a right angle."

Besides having a thicker root and therefore stronger tooth, the 22-1/2 degree involute for a given depth can be made with a fewer number of teeth without interference or undercutting than can the 20 degree, just as the 20 degree involute is superior to the uncorrected 14-1/2 degree tooth. However, if the height of the tooth is reduced by using a smaller addendum and dedendum, the same result is accomplished, viz.—less interference and under cutting at low numbers of teeth, and lower numbers possible without these troubles. The Stub Tooth, as it is called, has the great added advantage of using only the best part of the involute curve, that close to the pitch line, and thereby greatly reducing the rubbing action and increasing both the mechanical efficiency and the durability. The Stub tooth is stronger than the full depth tooth of the same or less pressure angle, because the distance beyond the root at which the load is carried, i. e. if the cantilever arm is less, and the resisting cross section at the root equal or greater.

The Brown & Sharpe standard 14-1/2 degree tooth has an addendum of 1/P, where P is the diametrical pitch, a dedendum of 1.157 P, which includes a clearance of 0.157/P, or 0.05 x P' where P' is the circular pitch. This is the general system in common use throughout that part of the world using English inch measurements. Grant's system, as used in the Bilgram bevel gear generator, is the same as the Brown & Sharpe, except the angle is 15 degrees and the curve of course, is uncorrected, being a generated involute.

(To be continued)

In our issue of April 27, there appeared an item on page 42, regarding the test of a pipe threading machine at the Brantford plant of the Williams Tool Corporation. Mention should have been made of the fact that the machine was equipped with a 20in. Landis die head fitted with chasers 6¼ in. wide for the cutting of the 5¾ in. thread on 13in. O. D. pipe.

If we spent as much time planning to enjoy our work as we do planning to enjoy our holidays, the latter would take care of themselves.

Mechanical Technology of Forge Shop Practice

Interest Shown by Manufacturers in Technical Training of Youth —Art of Welding and Working Iron—Model Forge Shop Layout —General Practice Exemplified

AS AN example of the interest shown by some manufac urers in the technical training of young men, the accompanying article has been prepared. In a recent catalogue issued by the Buffalo Forge Co., entitled "Mechanical Technology," the bulk of the space has been devoted to instruction in the art of forging in its many branches. The different processes in the production of iron and the manufacture and working of steel have been dealt with in a manner that will not only appeal to the young man but to many others of advanced age who may be indirectly associated with industrial life. In commencing, the instruction covers in a brief way the development of the different classes of iron and steel. Extracts of the pages are given.

Iron is the most important of the metallic elements, silvery white in color when pure, very tenacious, malleable and ductile. Iron was first produced in America in 1622 near the James River, Virginia. It is used in the industrial arts in four forms—cast-iron, malleable iron, wrought iron and steel, each form having its own marked physical properties fitting it for a special purpose. Cast-iron is an alloy. It is often called pig-iron because of the fact that it is molded in litle bars or pigs as it runs from the furnace. The process of making this iron is that of smelting or melting the ore in a blast furnace in connection with various fluxes, particularly limestone. These furnaces are from 50 to 60 feet high and are called "blast" furnaces because the blast is forced into them. This species of iron is extremely brittle and melts at a relatively low temperaure; is crystalline in construction and can only be used for such articles as may be made or cast in molds. It contains a large percentage of carbon and usually silicon, phosphorus and sulphur. The amount of carbon varies from 1.5% to 4.5%. Malleable iron is cast-iron which has been toughened during the process of baking in an oven for six or eight days. This decarbonizes the cast-iron.

Wrought iron is the extreme of the series. It is an alloy of iron and comes the nearest to being pure, having an extremely small percentage of carbon, practically none. It is very malleable, fusing at a very high temperature; becomes pasty during a considerable range of heat; will keep in a malleable condition above a red heat, which is much below the fusing point and thus can be bent and formed into different shapes with the hammer. Iron work produced in this way is called Wrought Iron. Wrought iron manipulated when hot is said to be forged. Two pieces brought to a fusing point may be united into one piece by hammering. Pieces so united are said to be welded. It will not become hard and brittle like cast-iron as it is of a fibrous construction; it shows a high tensile strength at a fracture. This iron is divided into classes —common or refined iron and Norway iron. Wrought iron has been largely displaced for most purposes by the increased production of steel. The iron used in making the exercises in this course should be Norway iron as better results are attained than by using common iron.

The general process of making wrought iron at the present day is known as "puddling." This process was invented about the year 1780 by Henry Cort and improved about fifty years later by Joseph Hall. The method employed is one of melting cast-iron in a chamber or on the hearth of a reverberatory furnace, the flame passing over the molten metal. The requisite time for this operation is about thirty minutes. When the metal becomes melted, an oxidizing metal is added. All phosphorus, sulphur, carbon and other impurities may be eliminated by stirring. During the melting a slag forms and adjusts itself to the iron around each fibre, showing a fibrous rather than a crystalline structure. There are many varieties of various capacities; the capacity of the most common size ordinarily being from 500 lbs. to 1,500 lbs.

Art of Welding

Some metals, when heated, become gradually softer as the temperature increases, until a heat is attained at which the metal is in such a condition that if two separate pieces are brought into contact by slight pressure, they will adhere and form a single piece. Every metal is not affected in this manner. Cast-iron, for instance, does not become gradually softer as the heat is increased, but remains firm until a certain temperature is reached and then softens suddenly and goes to pieces. Any metal which softens gradually when heated, may be welded, while metals which act as cast-iron, connot be welded. The condition at which pieces of metal are ready to adhere, is known as the welding heat. The two pieces of metal properly shaped are brought to this welding heat, placed



Fig. 5.—Apprentices on forge work.

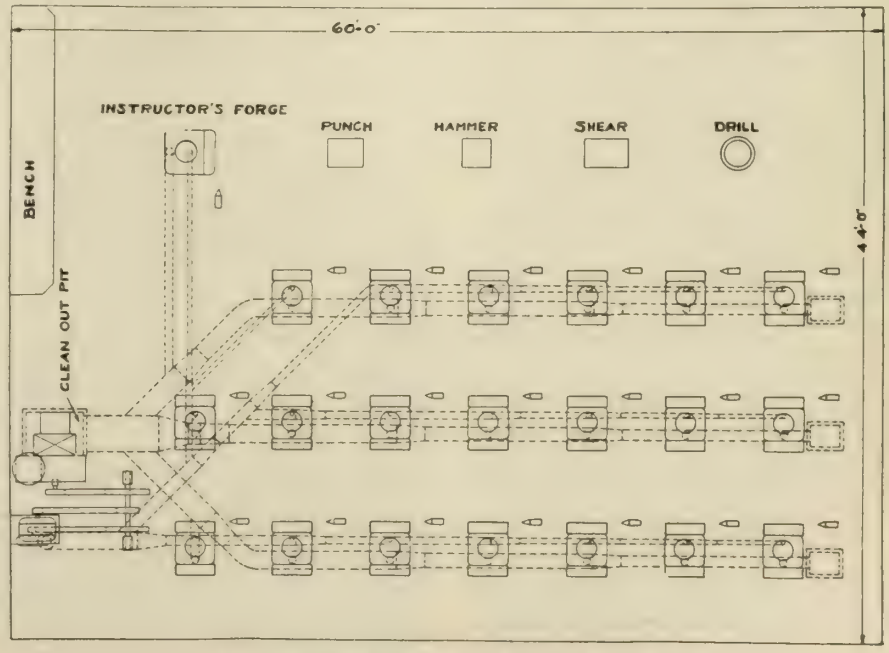
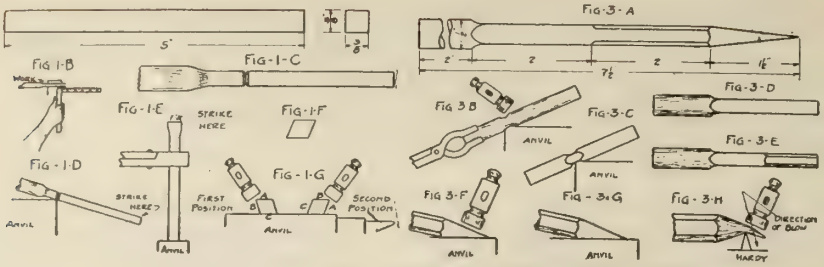


Fig. 6—General layout of forge instruction department



Figs. 1 and 3.—Some examples of modern forge practice

Exercise No. 1.

Stock—Norway iron, ½" x ½", convenient length.

One end of the stock is to be drawn until a length of 5" or more is ⅜" x ⅜". 5" of the drawn portion is then to be cut off on the hardy end, the cut end squared. The finished piece, Fig. 1 A, must be smooth, true to size, square in section and straight.

Beginning near the end of the stock, strike every other blow on a given face, and the alternate blows on one of the adjoining faces. Occasionally turn the work so that the two faces previously on the anvil may be brought under the hammer. To mark the work where it is to be cut hold the square to the edge of the hardy across which slide the stock as indicated by the arrow, Fig. 1 B, until its end is opposite the 5" mark on the square. Put down square, take up hammer, and strike a light blow. After this cut on all four sides, Fig. 1 C. Break the piece off by bringing the cut over the edge of the anvil, Fig. 1 D, and deliver a blow on the end of the piece. To square the cut end, first upset, Fig. 1 E, and then draw down to size. If it is discovered that the stock is becoming diamond shaped, Fig. 1F, instead of square in section, hammer on the high sides, Fig. 1 G.

Exercise No. 3.

Stock—Norway iron, ½" diameter, 6" long.

A round section is to be drawn to a square; a square to an octagon; and an octagon to a round point. The finished piece must agree with the drawing, Fig. 3 A in form and dimensions.

Square one end of stock (see Fig. 3 D), make center punch mark 2" from squared end. After heating with squared end of stock in tongs, bring centre punch mark over edge of anvil and strike one blow, Fig. 3 B. Turn the stock through an angle of 90° and strike a second blow, Fig. 3 C. Draw the stock to a square section as shown by Fig. 3 D. Lay off center punch mark 4" from squared end, and proceeding as before, produce the form, Fig. 3 E. Lay off center punch mark 6" from squared end and draw the point first to a square, Fig. 3 F, and then to a round. Fig. 3 G If there is excess of stock cut it off on the hardy, Fig. 3 H. Do not let the shoulders, Fig. 3 E, cover the punch marks. Better form them a little in front of the mark and draw them back to it. When rounding the point turn the stocks; turn the stock first in one direction then in the opposite, otherwise the point will be twisted off. The point will split if drawn at too low a heat.

together and thoroughly hammered, or forced together by pressure in such a way as to bring the two pieces into contact at all parts of the weld. The weight of the blow must be governed by the size of the bar, as the blow must be sufficient to affect the metal from the surface to the center. With this precaution a good weld may be produced. It is necessary to make some of the most difficult welds at one heat, as it is often impossible to re-heat. In all welding, the greatest care must be observed to heat the piece properly. A piece of wrought iron, when brought to a welding heat, is almost white, and little explosive sparks appear upon the surface. These little sparks are small particles of iron which become separated from the bar and burn.

It is very essential to have and maintain a good fire during the process of welding. Good coal and material are among the essentials. The good fire is indispensable in order to attain the best results in welding. Tuyere iron must be well covered with coke and the fire must be absolutely free from all clinkers and well banked with green coal, burning up quickly to allow all gas to escape. Keep plenty of coke on top of the iron. Do not continually poke the fire.

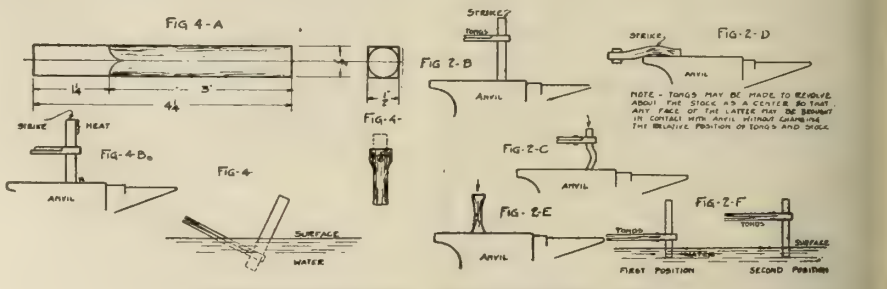
Oxidization of Iron

If a piece of iron is heated in contact with air, it will absorb oxygen from the air and form a scale, upon the surface which is known as oxide of iron. The hotter the iron, the more rapidly this scale will form. The scale does not adhere firmly to the iron and cannot be welded. Two methods are used to guard against oxidation. In the first it is accomplished by having a thick bed of fire for the air to pass through before coming in contact with the iron and by maintaining a moderate blast. The second method is by coating the surface of the iron with a substance called flux, which lowers the melting point of the scale and makes welding easier. This flux is formed by a fusible mixture which offers protection to the iron. The most common flux for iron, is clean sharp sand and borax; the latter is used for fine work and steel. To weld steel is quite a different proposition, for the welding temperature of steel is, on account of its greater fusibility, considerably less than that of iron. There are so many different kinds of steel that the same rule will not apply to all of them. Cast tool steel is the most difficult to weld.

Scarf or Lap Weld

This weld is the one usually adopted by smiths and is the best when it is practicable. For most welding, the ends of the pieces must be so shaped that when welded together, they will form a smooth joint. This shaping the ends is called "scarfing" and the shaped end is called a "scarf." The scarfs should be so shaped that when placed together they will touch in the center leaving the sides open. In this way the scale is forced out between the pieces. If the pieces should join on the sides and leave the center hollow the scale would be imprisoned, making a bad weld.

To Be Continued



Figs. 2 and 4.—Other examples of forge work.

Exercise No. 2.

Stock—Norway iron, ½" x ½", 5" long.

Stock is to be upset to 3" in length. The finished piece, Fig. 2 A, must be sound, must be square and uniform in section. True to size, straight, and smooth.

The stock having been brought to a white heat, blows are to be delivered as shown by Fig. 2 B. One result of such blows is illustrated by Fig. 2 C. The stock may be straightened without changing the tongs, Fig. 2 D, or the tongs may be changed to one end. A second result of blows, Fig. 2 B, is shown by Fig. 2 E. This may be overcome and the piece upset evenly, by slightly cooling the ends, Fig. 2 F. Do not work the stock after it has cooled to a bright red heat. Strike true or the stock is likely to fly from the tongs, endangering your own safety and the safety of others. Do not attempt to straighten unless the stock is hot. In straightening be sure that the work beds well on the anvil before striking it, otherwise it is likely to fly. Do not take so much time in cooling that, Fig. 2 F, the body of the stock will become cool.

Exercise No. 4

Stock—Norway iron, ½" diameter, 5" long.

A piece of ½" round stock is to be upset until a portion of its length is large enough to form a ½" square. The finished piece must agree with the drawing, Fig. 4 A.

Make a center punch mark 2" from one end and heat from end to punch mark. Apply the tongs to the side of the stock before taking the latter from the fire. If the portion heated is too long, cool to punch mark, Fig. 4 C. In any case cool the extremity of the heated end slightly, to avoid the effect illustrated by Fig. 2 F. Strike as shown by Fig. 4 B. Continue to upset until the enlarged portion is about ⅝" in diameter, Fig. 4, then draw to a square. If when down to size, the corners are not sharp, upset again. By drawing they will become sharp. The square portion completed, finish the opposite end, A, Fig. 4 B. If it is necessary to cool the stock to the punch mark, Fig. 4 C, give it a very slight up end motion, so that the change from hot to cold may not be too abrupt. Otherwise the stock is likely to crack on the line of the surface of the water.

Overcoming Cause of Skin Infection Trouble

Research Work in Connection With Skin Diseases of Industrial Workers—Penetration of Oils Carry Bacteria Beneath Surface—Sanitary Conditions Should be Encouraged

THROUGHOUT the metal-cutting industries there exists a serious problem which has baffled industrial executives and metal-cutting operatives for years. Wherever certain liquids of oil or soap content are in use as aids in metal-cutting and metal-working, this problem—the scourge of boils and sores from skin infection—is encountered.

While there have been occasional attempts to overcome the infection, these efforts have met with little success. Nor has there been available any considerable or extensive reliable information on the causes or exact nature of the infection.

Recognizing these conditions, and realizing the extreme importance to the metal-cutting industries of a thorough, practical investigation into the problem, the research staff of the E. F. Houghton and Co., undertook this difficult task, and the information to follow is the result of their investigation.

Since the nature of such research is necessarily largely scientific, much of the terminology and detailed data is not readily understandable, even to the practical, intelligent lay mind. The purpose of this Foreword, is to endeavor to outline clearly, in plain, non-technical language the aims, methods, results and practical conclusions of the investigation.

The following material was prepared primarily for the practical information of executives in the metal-cutting industries, in the hope of aiding them in recognizing and aggressively overcoming the causes of these skin infection troubles. The investigation was undertaken also for the purpose of banishing widespread misunderstanding, which has long been apparent, as to the erroneous belief that cutting liquids are primarily responsible for the various forms of infection among metal-cutting operatives.

The pathological side of the subject involved required the aid of some of the leading bacteriologists of the world. Inasmuch as important portions of this research were carried on by these scientists, the compilation of the data involved must necessarily include considerable scientific phraseology. The language of the scientist, however, has a tendency to confuse the lay mind accustomed to directness and the use of simple terms of expression. Obviously, it is impossible to present a treatise on a subject of such a scientific nature entirely in non-scientific phraseology. We have minimized this feature in preparing this treatise by keeping always to the fore our purpose of aiding the industries in a practical way.

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I want it to be distinctly understood that we have not come to our conclusions solely through what might be called "theoretical knowledge," or "laboratory experimentation." When theory has differed with practical results, we have discarded the theory. Boils and other skin infections and irritations of those engaged in metal-cutting has been prevalent in varying intensity ever since modern methods of cutting metal with the aid of oleaginous, or saponaceous, liquids, or "refrigernats," have been practised. The blame has naturally fallen most heavily on the cutting liquid, the consensus of opinion being that the cutting liquid breeds bacteria which it conveys to the skin of the human being engaged in using it as a cutting medium. This opinion, however, is not supported by the facts.

Unprejudiced Investigation

Our staff has long known this belief to be erroneous, or only partly true, at the most. The cause of skin infection or irritation among metal workers had never, however, up to the beginning of the late war (to the best of our knowledge and belief,) been intelligently or comprehensively investigated by any organized body of unprejudiced investigators other than our own staff. There have been investigations by individuals it is true, but the results of these investigations seemed but to increase the doubt as to the cause, or increase the erroneous belief as to the culpability of the cutting liquid.

The research made by our staff previous to the war had been largely for our own manufacturing purposes and its results had never been given wide publicity. It had been sufficient, nevertheless, to attract the attention of the Government and to lead to a Government request for a full and exhaustive investigation. With the speeding up of the metal industry at the declaration of war had come particularly virulent and widespread outbreaks of skin infection among metal workers. This was a pronounced handicap to the nation's need and the Government's munitions program.

The tremendous demand on the metal cutters could not allow of this outbreak going unchecked, if it could be checked. So our staff was requested by the Government officials to make an independent investigation of the subject. The theory which the investigation took as its premise was that the demands upon the metal workers had so increased their hours of labor as to shorten their hours of cleanliness and that infection followed uncleanliness through the operation of a natural law.

The task was to determine the character of the infection—whether bacteriological or otherwise—and trace it to its source. The generally accepted theory was that the bacteria were bred in the decomposition of fatty acid oils. It was, therefore, the conclusion that pure animal oils were the most prolific sources of complaint. For a time this theory seemed to be sustained, and there is today more complaint from the use of No. 1 Lard Oil than from any other oil.

Nevertheless, we soon established the fact that the infection epidemics were breaking out in places where pure animal oils were not in use, that in many plants where No. 1 Lard Oil was in use there was slight trouble experienced from the infection, and that the epidemics were occurring more or less irrespective of the variety of oil used. Our investigation was organized under the direction of Mr. Louis E. Murphy, vice-president of the company, who is in active management of the oil department of our concern, and our chief chemist, George W. Pressell.

Laboratory and Field Research

Bacteriologists of world fame were employed and placed in collaborative effort with each other, as well as with our research staff. A number of other scientists and bacteriologists of lesser note and students were employed to aid and supplement the work of the chief investigators. Field investigators were also engaged and an extensive program of intensified investigation laid out. We also conducted correspondence, including many thousands of personal letters, to obtain the co-operation, advice and experience of the men in the various industries concerned.

The office man's opinions were of course eliminated, and those of the practical man, were he proprietor, superintendent, foreman or workman, secured. This effort laid special stress on getting the views of men afflicted, those of their attending physicians, plant surgeons, etc., etc., and descriptions of the methods employed to effect prevention and cure. The correspondence also approached every oil manufacturer of any prominence in the English speaking countries, soliciting his co-operation on the solution of this very important problem.

The investigation was the most exhaustive and minute ever conducted by our staff and nearly a year was consumed in pursuing it and collating the manifold sections of the investigation. When it was finally completed, and the Government had been informed of its result, we came to the conclusion that we owed it to the industries that we contribute the results arrived at, for the benefit of the metal-working industries

in general. This treatise is the outcome.

The results and conclusions can be briefly summarized as follows:

The infection is bacterial. The bacteria, or germ, is not present in the oil, no matter of what variety or character the oil may be, but exists on the human body.

The germ has no power to create a boil or sore until it has secured ingress to the skin; or until the skin is broken or some means arise by which the bacteria can attack the flesh. All cutting oils have skin penetrative powers. This property of penetration is due to the high thermal conductivity of such oils; i.e., their ability to convey heat from the point of generation to the atmosphere. The oils can therefore penetrate the skin, and they do actually penetrate through the pores.

They penetrate the skin of hairy persons much more readily than the skin of those who are devoid of hair, because hairy skins are more vulnerable through the superabundance of capillary pores.

The oil, in penetrating the skin through the pores, carries with it the bacteria which exist naturally on the surface of every living body. The bacteria also secure entrance to the skin through minute punctures made by metal chips which are carried in solution by the oil to the human body. Many of these chips are so minute as not to be discernible to the naked eye.

These epidemics of boils are more prevalent in hot weather, or under heated woring atmospheres, than in cool weather and under cooler working atmospheres. The sores are not always precisely similar and the bacteria are not always the same. Sore-producing bacteria have been found in oil, but only in oil which has been used at least once, and not in the fresh oil as it is received from the manufacturer.

Unsanitary Conditions Serious Factor

Conditions as to sanitation are highly important, and the investigation proved conclusively the value of proper sanitary measures. The breeding of such bacteria has been traced to unsanitary conditions existing in the establishment where the oil is used. It has been found that workmen often expectorate into the oil as it passes through the machine, spit into the oil tanks, throw garbage or other filth and refuse into the oil, and otherwise contaminate it while it is in use.

Some oils encourage this bacteria breeding, when contaminated, to a greater extent than others. The worst offenders are the oils commonly known as "parafine oils." It must not be inferred that we mean parafine base oil, or oils made from parafine base crude. The distillates from parafine base crude are among the oils least culpable in this respect. These parafine oils, which are the most favorable culture media, are the ones produced in the process of pressing parafine wax. The actual difference between these bacteria-carrying parafines and the other parafines is that the former are oils pressed from residuum matter while the others come over the still in the distillation.

The most practical preventive of these epidemics of sores is cleanliness on the part of the operatives. The operatives should be instructed to wash up with pure soap; to avoid the very common practice of smearing the body with oil before washing, and to wash as frequently as possible. They should wash every four or five hours on the average and at noon as well, and before supper when they work overtime, as well as when they quit work. They should be taught to change their clothing at least twice a week and wear clean overalls and working clothes. The overalls should be washed at the regular periods set by the time it takes a pair to become soiled. Soiled underclothing, linen and outside clothing help to deposit germs on the skin. When the clothing gets saturated with oil that is permeated with minute metal chips, the rubbing of the clothing allows the metal to abrade the skin, thus affording a place of ingress for bacteria.

The skin of the metal-working operative is no more bacteria-infested than that of any other human being or worker. The metal operative is, however, more exposed to conditions which give the bacteria opportunity to get under the skin and do harm.

Disinfectants and Germicides Ineffective

Extensive study of the possible effectiveness of disinfectants and germicides shows little practical result from their use.

The benefit to be derived by incorporating in the oil socalled "disinfectants" or "germicides" is negligible. It is a fact, however, that Carbolized Cosmoline, applied to the skin after washing, acts as a preventative of the bacterial infection in question. The carbolic acid content of this preparation, being of a germicidal nature, kills the germs, while the Cosmoline, being of the petroleum family, spreads an oleaginous film which protects the pores from impregnation. Carbolized Cosmoline is, nevertheless, not infallible as a preventative and will most likely fail unless hygenic, sanitary and cleanly precautions are taken. The oil must be protected against contamination of any kind. This includes the best and most modern methods of minimizing the amount of metal chips which are carried off in the oil.

Epidemics of sores are likely to occur in any plant where metal-cutting is done with the aid of oil. Previous immunity from such epidemics is no guarantee for the future. It happened on several occasions during our first inquiry that we were informed at a plant that no such thing as sores had ever been known there. Then, after a short time, we received from the same concern an inquiry as to how we were getting along with our investigation. They added that they were experiencing an outbreak of sores on their employees "for the first time."

Oil plant workers, except those engaged in parafine pressing plants, are not very susceptible to the infections in question. The Houghton employees, for instance, rarely experience sores and, when they do, the trouble can never be ascribed to the oil with which they came in contact, or to the bacterial infection above outlined and described in the following treatise. Neither has any other oil works that we know of ever had an epidemic of such bacterial infection or irritation due to oils, the parafine oil pressing plants excepted. We found the epidemic to be quite common in the pressing plants of parafine wax manufacturers.

The immunity of the Houghton plant may in some degree be due to the dermatological phenomenon that these sores never occur upon the skin of a negro. The skins of dark, swarthy people, such as those from southern climes or those whose immediate ancestors come from southern climes, seem to be similarly immune. This may be for the reason that the hides of all tropic-bred animals —including the human animal—are tougher and more difficult to penetrate than the hides of animals raised in cooler climates.

The main reason for the absolute immunity of the Houghton workmen from such sores and irritation, we believe, is that the nature of their work compels frequent washing and attention to sanitary habits. They are continually impressed with the fact that the products they turn out must be absolutely clean and sanitary. They know that the prevention of infection or contamination of the oil is a primary principle of oil manufacturing.

In conclusion, we unhesitatingly say that the elimination of these sores is essentially a matter of the proper education of the workmen. The education is most satisfactorily given by means of posters placed in prominent places throughout the shops and in the washrooms. These posters will lose their value, however, if not replaced from time to time, kept clean and in an attention-attracting condition. Workingmen become so accustomed to their environment that they gradually come to pass an important notice by, without deriving any impression. They are very likely to forget even a fire notice which they see right before their eyes daily.

If there is an internal publication distributed among the employees, it should feature the prevention of sores from time to time, just as much as it undoubtedly does the prevention of fire and accidents. Cleanliness should be preached at all times. A polyglot working force, with workmen of many nationalities, offers its own problem as to the dissemination of this infection-prevention information.

The final word is this, that no matter what may be the source of the cutting oil you obtain, it does not, if it comes to you fresh from the manufacturer, contain bacteria which will create these boils. Oils that decompose readily, such as animal oils, will supply nourishment to such bacteria. Parafine oils will give the bacteria the greatest aid in getting under the skin and into the flesh, but even they do not, if fresh, contain the bacteria when received.

ELIMINATING COLD TRIM PRESS ACCIDENTS

(Continued from page 21)

the clutch bearings and remedied. Some of the men found it difficult to get out of the habit of using the foot to trip the press but after a few days with the new device, that was overcome and in a short time all objections were forgotten and everybody was satisfied.

It had been freely prophesied that production would suffer. The foreman, of course, was the first man to make the prediction that he could not get out enough work and that he would be blamed for the slowing up. He was told, and shown with paper and pencil, that even though his production was decreased fifteen per cent. the saving in the cost of lost fingers and hands would take care of the loss due to fewer forgings being trimmed per day. The foreman was willing to use the new guards when he was assured he would in no way be held responsible. We did not look for a permanent decrease in production and results proved we were right.

The first few days of course showed a decided decrease in production but as soon as the men became accustomed to the new way of tripping the press and devised new methods of handling the forgings it soon came back to normal. In some cases there is a permanent decrease in the number of pieces put through the press but the job is free fom the old time danger which more than makes up for the loss. In many other cases production has increased. A general average up of all jobs shows that production has not suffered and the elimination of injuries removes a charge against the department that formerly increased the operation expense considerably.

If the proof of the pudding is the appearance of the dish after the meal then the record of a department with twenty presses operating for twelve months, showing only two injuries—one due to a wrench slipping and the other to a blow from a hand hammer— should be considered sufficient proof that guarded punch presses and careful supervision by the man in charge does eliminate "accidents" and that such things need not be "part of the day's work."

Avoid an accumulation of material around the machine. A clear floor provides freedom of movement and prevents many accidents. If it is necessary to have parts about the machine, see that they are properly and firmly piled.

It has been estimated that there were, July 1 last, 12,588,949 motor vehicles in the world, of which 10,505,660 were in the United States. No other country reaches 500,000, Great Britain being second with 497,582, Canada third with 463,448, France fourth with 236,146 and Germany fifth with 91.384. All of Europe is credited with 1,110.990, or rather less than New York and Pennsylvania combined.

Introducing



TRACEY MANES

TO BE foreman of the tool room at the Massey-Harris Co., Toronto, you must be able to deliver the goods, and that is why Mr. Manes is where he is to-day. He has had a varied experience since he was born in Orno, Ontario, back in 1868, and although he was only able to secure a general public school training, he has made the most of his time and opportunities since that time.

After leaving school he devoted about four years of his life to farm work, and cutting timber in the bush. He would summer on the farm and winter in the bush, but soon the engineering bug got him, and he came to Toronto 33 years ago to start as apprentice in the tool room of the same firm he is with today.

He served his time, but left the Massey-Harris Co. in 1896 to go to the Canadian Fairbanks Co., Toronto, working in their tool room. From here he moved to the Canada Foundry, Toronto, but moved again and landed at the Elliott Paper Mfg. Co., Toronto, as general foreman of factory, supervision of machinery, repairs, etc.

During all these moves he was lapping up all the information possible, and in 1910, he went back to his old love, the Massey-Harris Co., as a lathe hand. The old familiar Irish saying held true, for in 1911 he was made assistant foreman of the tool room. On May 28, 1914, he blossomed out as a full-fledged foreman having held the position ever since.

Mr. Manes has wonderful patience with the rising gerenation, and helps the boys learning their trade all he possibly can. This has made him a favorite with the boys up at the Toronto Technical School, because for the past five seasons, he has been showing them in the evenings how to become capable toolmakers.

Mr. Manes belongs to the Masonic order, and is also a member of the Oddfellows, but best of all he is a dyed-in-the-wool baseball fan, who roots for the home team on all occasions. "Young men to-day have an excellent chance to advance if they will only stick to it," says Mr. Manes, and we agree with him, for it is the same "Sticktoitiveness" that has placed him where he is to-day.

IMPORTANT VOLUMES

The first volume of a most important work, "A Dictionary of Applied Physics," edited under the supervision of Sir Richard Glazebrooke, K. C. B., F. R. S., will be ready for Canadian distribution about June 1st by the Macmillan Co. of Canada, Toronto. This work will be published in five volumes. Succeeding volumes will appear at intervals of from two to three months. It is arranged as follows:

Vol. I. Mechanics, Engineering and Heat.

Vol. II. Electricity.

Vol. III Meteorology, Metrology, and Measuring Apparatus.

Vol. IV. Optics, Sound, and Radiology.

Vol. V. Metallurgy and Aeronautics.

This is the first attempt which has been made to bring within the compass of a single work the latest results of research, and the most approved methods in all branches of the subject. It should prove invaluable to all manufacturers who are vitally concerned with the question of physics as applied to industry, which has grown enormously in the past few years. The experience of the war has enforced more strongly the lessons thus taught, and the importance of Applied Science is now universally admitted.

To find the diameter of a pump cylinder to move a given quantity of water per minute, divide the number of gallons by 4, then extract the square root, and the product will be the diameter in inches of a pump cylinder required to do the work at a piston travel of 100 ft. per min.

Recent Developments in Mechanical World

Cleaner Workshop Methods

AN INGENIOUS method of purification is now carried out in many industrial establishments for the removal of dust and refuse. If the stuff is combustible a double purpose is served by consigning the material to the fuel quarters. The main features of the installation are a special exhauster and separator, which work in conjunction and are connected by means of trunking, their respective duties being to draw the refuse from the various machines and then deposit it in some convenient place for handling.

* * * *

Developments in Die Casting

A SURVEY of modern die casting, which consists of forcing liquid metal under dies, reveals a great advance in the use of aluminium alloys. Dies obviate a great deal of machinery work. Parts which otherwise would be made separately and then assembled can often be combined and cast into one die casting. The castings have almost a perfect finish, free from porosity and other defects so common in sand and malleable castings. The dies themselves are fairly costly, says Practical Engineer, as they take long to build, and involve very skilful workmanship; yet where castings are used in lots of 10,000 upwards they will turn out cheaper than sand castings. In dies for parts made of white metal alloys, a high-grade machine steel is used, whilst for aluminium parts a steel with 0.40 per cent. to 0.50 per cent. carbon is used, and generally the steel is not heat treated. In weight, generally, die castings should not exceed: For zinc-tin alloys, 10 lb.; lead alloys, 15 lb.; aluminium alloys, 3 lb. The future of the industry lies in the proper development of a grade of steel permitting the die to offer greater resistance to wear and pressure.

* * * *

Lubricating Air Compressors

ONE OF THE secrets of successful compressor operation is its lubrication, and it cannot be over-emphasised that the least possible quantity of oil must be used. Any excess will carbonise because of the temperatures to which it is exposed. This carbonaceous matter is sticky in the early stage of its formation, which gives it a tendency to adhere to the piston rings, valves, receivers, and may be carried even to the fuel valve parts. In its later stages the carbon forms a hard solid that interferes with the operation of the compressor. Unfortunately there is no oil which will not deposit some carbon, but there is a surprising difference in the quantity of carbon deposited by different oils. Consequently not only must oil be selected with care, but particular attention must be paid to prevent the use of more oil than is necessary. This is one of the principal reasons for arranging the stages of most air compressors with the intermediate stage at the bottom, says a writer in Lubrication. In this construction there is always a pressure opposing the tendency of oil to work up into the air space from the lowest cylinder wall where it is thrown by the crank pin. In fact, at least one manufacturer has found it necessary to cut down the quantity of crank case oil so much in order to keep it from getting carbon and only a little vapour. Several cases of air compression explosions which have been investigated carefully suggested that the cause was excessive carbon deposits in the piping, which had greatly restricted the area of the passages. The real cause of these explosions is still to be explained satisfactorily, but it is to be noticed that practically all occurred in piping remote from the compressor, and hence at places not subjected to the highest temperatures.

Hardening High Speed Steel

FOR HIGH-SPEED steel the salt bath hardening method is held to produce a cleaner tool than muffle furnace hardening, but there are disadvantages, such as quenching temperature is too low, soft scale is ofttimes produced, also blistering and pitting, and the pots used are very shortlived. Pack hardening with charcoal gives a tool free from scale, but here again are disadvantages. The quenching temperature is too low, and the tools are carburised. The cutting edges of the tools, due either to higher carbon content of the surface, or the tools coming into contact with each other also at times melt. Other methods of packing have been tried, but without success, says a writer in Practical Engineer. Neither has any success been achieved with a lead bath hardening. There is difficulty in controlling the time of immersion, and at a temperature of 2,200 deg. Fah. volatilisation inevitably ensues. If hardening is done by heating in semi-muffle furnaces, pyrometers should be used. A great advantage of this method is the high temperature attainable, resulting in a great degree of red-hardness, and almost complete solution of the carbides. A set-off, however, is the scaling of the tools, to lessen which a thorough pre-heating and the proper mixture of fuel and air in firing is essential. Successful hardening is obtained by employing two pre-heating furnaces, one at about 1,000 deg. Fah., and the second at 1,700-1 800 deg. Fah. There is no scaling in the former, and in the latter pre-heater, the steel oxidises, requiring less time to bring to heat, and thus reducing scaling to a minimum.

* * * *

Research Work on Cast Iron

DEFECTS associated with unsoundness, porosity and shrinkage continue to trouble the metal working industry. Examples of such difficulties in heavy and light castings and in malleable work have been submitted and help sought in the remedy of same. The variable practice in cupola operations, in the preparation of facing and core sands for definite types of castings has again been illustrated in several of the problems submitted. The synthetic preparation of sands and linings for high-temperature work is under consideration by the British Cast Iron Research Association and trials suggested based on recent refractory research results. In the domain of the light castings foundry problems connected with mixtures, and treatment for light castings subject to shock have been investigated and advice given. Certain abnormal structures in heavy and light grey iron and malleable castings have been submitted for investigation and advice tendered. Problems associated with the chemical analysis and testing of cast iron have been dealt with. In many of the above cases data of a specially useful character has been obtained such as is of service to the researches on moulding sands, cupola linings, shrinkage and draws and the pig iron grading problems. The influence of design has been of signal importance in some of the troubles experienced, and the full particulars supplied in several of the most intricate problems under investigation have materially helped the director in his conclusions. Work is proceeding on the main problems of research and data of practical assistance in the carrying out of these somewhat lengthy researches continues to arrive from members.

* * * *

With a total of 80,853,000 lb. copper U. S. exports in March showed a marked gain over recent months and registered the largest total for any month in nearly two years. Imports of both tin and zinc were larger. Tin imports for March at 15,783,000 lb., have been exceeded only once in the last two years, according to the Department of Commerce.

Automatic Seam Welding in Making of Tubes

Material Must be of Suitable Composition—Finger Arrangement Prevents All Twist or Curl When Strip Stock is Entering Rolls—Compressing the Metal After Weld is Made

By J. L. ANDERSON

THE CONCLUSION of the first part of this article, which appeared in the May 4 issue, described the various details of the swaging machine and it operations in the making of steel tubing.

The action of this machine is decidedly different from that in which the cage is stationary, resulting in a series of very powerful blows which is destructive to the rolls and hammers. The dies oscillate due to centrifugal force with the hammers and thereby produce a succession of squeezes varying between 3,000 and 5,000 per feet, depending on the size of the machine and the speed at which it operates. The over sized tubing as delivered from the tube welding machine is compressed with an accuracy equal to the accuracy of the dies, and with a finish which is very much smoother than is usually possible with the draw bench.

Obtaining Accuracy

The swaging speed on full length tubing will usually be in the neighborhood of 30 to 40 feet per minute. The swaging machine is used often times in conjunction with the draw bench in order to reduce the diameter of the tube sufficiently to pass through the dies so that the dog of the draw bench can grip it. The swaging machine when equipped with formed dies is used very extensively for swaging tubes which are to be tapered or changed in form. It is sometimes necessary to perform an operation of this kind by passing the tube through successive dies in order to produce the final form. If tubing is required to be brought to accurate dimension externally and internally, the operation must be performed on the draw bench, and for this purpose the draw bench is usually fitted with what is termed a back bench. This is an extension of the bench in order to provide support for a rod which is termed the triblet rod, and carries on its end a hardened steel plug which is the exact internal dimension of the tube. This dimension being considerably smaller than the tube allows for the tube to be passed over the plug, previously lubricating the plug and tube, and when entered in the die or dies is drawn down to finished dimension passing through the annular space between the triblet and the die, thereby being brought to proper dimension both internally and externally. Sometimes it is necessary to perform this in more than one operation, if the reduction required is excessive.

The drawing speed with properly lubricated dies is usually in the neighborhood of 40 lineal feet per minute, the machine always requiring two men for maximum production. When equipped with a roller die head the drawing of various shapes of tubing from round tubing is possible, squares and rectangles being most common.

Straightening Finished Tubes

Tubes coming from the swaging and drawing operations are never absolutely straight and must be straightened, which is usually accomplished in a straightening machine, or in some cases by hand straightening over a block in the usual manner. The straightening machine, however, makes possible very much larger production at less cost and produces uniformly straight tubing without danger of kinking or flattening. This machine is usually of the ten or twelve roll type, with two sets of rolls at right angles to each other, three rolls in each case being power driven, with the final roll in each set adjustable, as are the two idlers. This arrangement simplifies the straightening operation and makes possible the straightening of tubes at speeds of 100 to 200 feet per minute, depending on the size.

After the swaging and drawing operations the crop ends, if any, are removed from the tubes by the tube cutting machine which carries a swinging high speed saw, belted to a motor, the motor being mounted on the base of the swinging head carrying the saw. The saw used is a special saw for cutting soft steel at high speed, and is driven at from 3,000 to 4,000 R. P. M. The saw is actuated by a foot treadle operating through a compound lever which advances the saw, thereby severing the tube. All moving parts above the table are covered by removable guards, and provision is made to discharge the sparks and chips accompanying the cutting operation to the rear of the machine.

There is a demand for steel tubing bent in various ways, and a tube bending machine is usually a part of the equipment of every tube welding plant. Round, rectangular and other shaped tubes can be bent perfectly to any reasonable radius without deforming or wrinkling, the bending operation being in reality a drawing operation, a plug of proper type being used inside of the tubes and removing the finished bends.

The machines are always equipped with clutch pulleys for driving in both directions, and very often with power attachment for entering and withdrawing the plug, considerable power being required for withdrawing the plug after the bend has been completed, due to the gripping action of the walls of the tube upon the plug. All the operating levers of the machine are in a convenient position so that one man controls all the motions of the machine, while another is usually employed for feeding the tubes and removing the finished bends.

Production Time

A different set of tools is required for every change in dimension, or radius. These tools are readily mounted on the machine by the removal of four bolts, and the clamping action of the jaws accomplished in various ways to suit the particular requirements. The actual time consumed in making a bend of 90 degrees seldom exceeds eight seconds, the production of 100 to 120 bends per hour being possible. The machine as usually furnished will produce bends up to 180 deg.

The simplicity of the process of manufacturing welded tubing as described, eliminating the necessity for ponderous equipment of great cost and the numerous operations required to produce more than a million feet of tubing a year can produce tubing in its own plant for its own consumption in competition with market prices; this is particularly so if his requirement is more or less special.

The successful operation of an installation of this kind is assured by reason of the engineering assistance available for the solution of the many and varied problems which arise in production and fabrication, to say nothing of the education in the art of tube making, of the personnel responsible for the success of the undertaking, as well as the education of the employee in the operation and possibilities of the various machines.

Conclusion of a paper read before the Schenectady, N. Y., section of the American Welding Society, February 8, by the author, who is welding engineer of the Air Reduction Co.

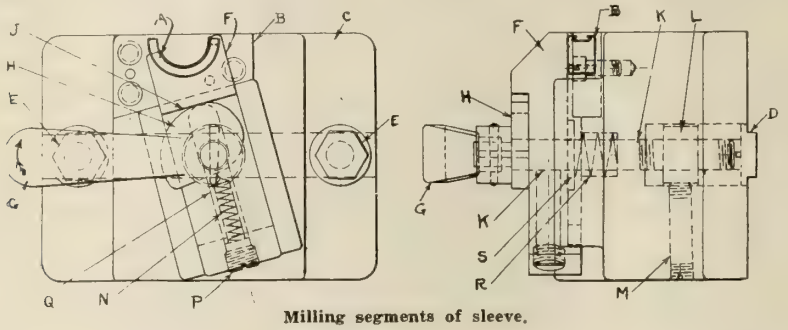
The Boaman & Smith Co. of Providence, R. I., have recently published a series of new catalogues covering their various lines of equipment. H. 1 deals exclusively with a wide range of milling machines suitably adapted to many lines of work. H. 2. describes in detail the different styles of boring machine made by this firm. H. 3. shows a line of machinery especially designed for work in connection with the manufacture of automobiles. H. 4. is a descriptive booklet illustrating machines particularly adapted for machining of pumps and valves.

Practical Ideas for Shop Executives

MILLING SEGMENT OF A SLEEVE

By F. Scriber

What proves to be a very quick operating fixture for milling the dovetail slot in the segment of sleeve A is illustrated in the accompanying sketch. The sleeve is here set on its edge and is indicated as A, in the fixture is a plate B shaped to receive this sleeve, this plate is attached by means of screws and dowels to the cast iron base of the fixture C which has a tongue D made as



Milling segments of sleeve.

part of it and two bolts E for holding and locating it on the milling machine. After the work is put in position it is clamped therein by means of a lever G, this clamp is unusual in its operation as a cam H is employed to advance it to the clamping position. In operating this clamp which is guided in a milled slot in the casting, the lever G is pushed in the direction of the arrow which causes the raised surface on the ram H, acting in contact with shoulder J of the clamp F, to advance the clamp to the position shown over the work.

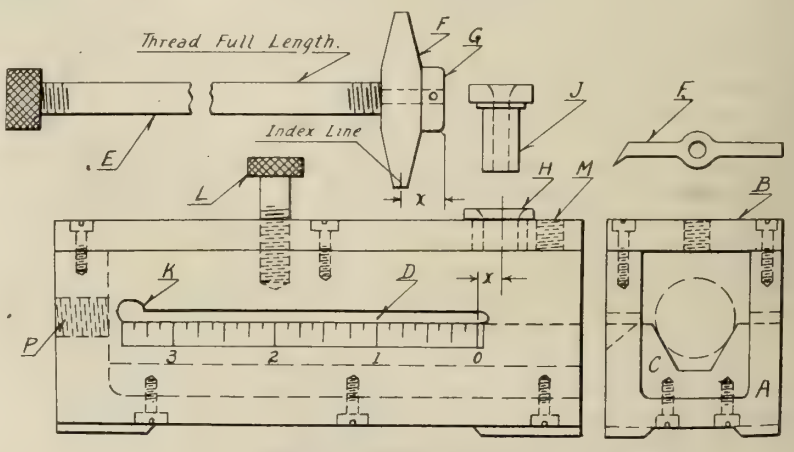
The dowell on the cam then permits the clamp to rest while the lever causes the clamp to tighten on the work by simply tightening the cam side against the clamp by means of the screw K which is operating in the nut L into which it is thus screwed. This nut is locked in position so it will not turn by a screw M after it is adjusted radially so the screw will clamp tight with the lever in the position shown. Upon releasing this lever G a spring N backed up by a screw P held in a spring plunger Q, which comes in contact with the unthreaded portion of the screw K, causes the clamp to be forced back clear of the work while the spring R, in contact with the washer S, raises the clamp up from the work as the screw is loosened, thus it will be seen that the operation of this fixture briefly stated is as follows:

The operator puts the work in position, following which he turns the lever G which through the medium of the cam advances the clamp while at the same time tightening the clamp on the work, after which the milling machine cutter is caused to mill the tee slot in the work, the cutter in this instance being of the end mill type, held in a horizontal milling machine. Following this; releasing the clamp is accomplished by turning lever G backward which action allows the clamp to rise from the work and slide back clear of the work by means of the two springs shown, thus the work may be readily removed by hand. It will be apparent that this fixture is very speedy in its operation, and in this instance this quick action is obtained at slight additional expense in the construction of the fixture.

UNIVERSAL DRILL JIG

By Robert Mawson

The drilling of small holes in pins is often a detail that will require a number of different jigs unless care is taken in the design of these tools. A jig that has a wide range for work of this character is shown in the accompanying sketch. The base A is made of cast iron box construction, open at top and one end. A machine steel plate B is secured to the top by means of screws and dowels. Bolted firmly to the inside base is a V-block made of steel or cast iron.



Design of universal drill jig.

Through both side walls are slots D machined and at the same central height at the hole P. The front edge of one slot is bevelled and graduated for setting gage piece to desired length. The screw E is made to fit hole P and of ample length for capacity of jig.

The steel pointer F is made a sliding fit on end by E and secured in position by collar G, which is pinned on. The piece F is a snug sliding fit in the side slots. With the pointer at zero the end of gauge G is central with drill bushing. Suitable slip bushings J may be made to fit the fixed bush H. A knurled headed screw L is provided to hold pin while drilling. For drilling holes close to end of work a screw hole M is used.

ASSEMBLING STAND FOR MACHINE SHOPS

By Robert Mawson

Anyone with experience in machine shops on assembling operations will know that much time is lost in this department with shortness of parts when the work is under way. It is often found that some of the smaller elements have not been called out of the stores, the result is time is wasted by the workman either going for them or sending a helper for the missing material. Another loss of time is caused by the want of system in keeping the parts along side the job, usually a box or table being utilized for this purpose. The result is that the man has to look over many parts and pick out the one needed at the time.

We recently introduced the stand illustrated for this purpose and it has solved the problem proving satisfactory to the men also, which is often a great factor in the shop. Give the men something they want and like and it is used successfully, but give them the opposite and a score of faults are quickly found why it should not be used.

The stand is placed at the rear of the assembling table and at a convenient height for the workman. It is made with

a number of openings and also hooks which are screwed into the framework of the stand. The manner in which this device is used is briefly as follows: each of our different assemblies and sub-assemblies are routed through the shop by means of bills of material. These have recorded on them the name of each part, drawing number of each part, stock parts such as bolts, screws, etc., and the number required of each for one assembly. Further, the bill of material is made out in rotation of assembly, the words being listed on the sheet in sequence they are needed for assembling operation.

When the order goes into the shop for a number of any machines to be made and assembled, the bill of material also goes with it and the foreman sends one of his men to the stock room to draw out the various parts. These are given him on an order signed by the foreman and are conveyed to the assembling department. The man then takes out the bill of material and ararnges them on the assembling stand, starting at the upper left hand corner and where bolts, screws, and the like are neeeded they are placed in the pocket after the part in which they are attached. The large pieces are placed on the various hooks as may be seen from the cut. The reason why the small parts are placed after the part in which they are attached is so that the workman first places the casting into position and then reaching for the holding medium fastens it as required.

It is easy to see the advantage of this method as the workman has only to follow along the stand in sequence and the various elements are at hand when he wants them and also where he needs them and further he is always sure of having just the proper amount and is saved the worry of sending for missing parts as was the case with the older one employed. The cut shows the convenient



Assembly stand for machine shops.

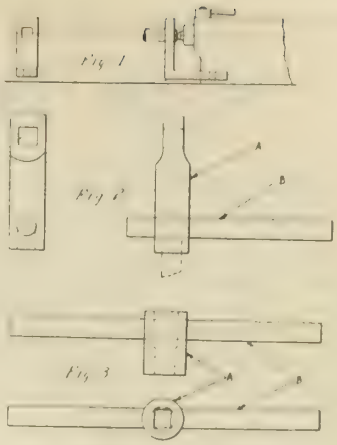
height of the table and also the handy position of the assembling stand. It need only be added that the size of the stand would have to be changed for some work and also the size of openings for the small units as we have done in our factory, but the illustration conveys very clearly the idea of the device and could be used to advantage in almost all shops doing assembling operations.

MACHINE TAP WRENCHES

By Harry Moore

Tapping operations, when performed in the machine, call for a big variety of holders and wrenches, the design of which is determined by the particular requirements of the job. It is sometimes difficult to discriminate between a wrench and a holder and two or three of the ideas shown may not be correctly described as either one or the other, since they do not actually hold the tap in the machine, nor do they wrench it around, the movement taking place in the machine, the wrench merely acting as a stop to prevent the tap from being rotated. It will readily be understood why these have been included under the above heading, however, when it is pointed out that they are put forward solely because they are believed to be a better means than the ordinary tap or monkey wrench generally utilized in this kind of work; and these latter still retain their names no matter what they are used for. In the few examples given, only those have been selected that could be made easily in any general shop large or small.

If the first example Fig. 1, a wrench for use on an engine in connection with these machines is well known. As the tap advances into the work, the end of the wrench resting on the carriage oftentimes playfully wipes everything—wrenches, calipers, etc, that may be lying there—onto the floor. Sometimes to add to the confusion, the operator finds the wrench squeezing up against the cross-slide, whereupon there is a frantic grab for the carriage wheel to release



Various types of machine tap wrenches.

tap—through the operator's divided attention—has walked off the center threatening to smash the whole business. This is not a fanciful picture by any means, and more could be said, but this will suffice to show the advantage it, and by the time this is effected the of a special wrench for lathe work that will bear against the side of the tail stock and so be clearly out of the way of everything. This wrench is just a piece of stock bent at right angles, both ends having squared holes, two or three if desired, to take the different sizes of taps. Make the wrench long enough to clear the tailstock clamping nut when backing out the taps.

Fig. 2, which is a development of this idea, is for use when tapping right up to a shoulder. It is very easy to strip a thread when a lathe is driven through the back gears, so that the careful operator sets his mark on the tap back a thread or so and finishes this distance by hand, twitching the wrench around as far as possible, and backing the lathe. The wrench in Fig. 2, is made in two pieces, A being round steel flattened out at the end, squared out for the tap and drilled for the handle B in two places, through the side and at the end, so that it can be quickly slipped out of one or the other. It is inserted in the hole at right angles when the lathe is running and in the hole at the end for finishing by hand, which latter can be done very quickly by reason of the wide swing this wrench has in comparison to the limited movement of a double-end tap wrench.

The wrench in Fig. 3 shows one way of solving the obstruction problem in a simple manner, in this case being the column of a drill press. In shops where several drill presses of different sizes are in use it is not customary to have wrenches to suit each machine, far from it, though of course this can be excused on the ground that hand tapping operations may not be a daily occurrence on drill presses. They are very frequent however for many reasons, chief of which is, it is easier to tap a piece of work already clamped down, than transport it somewhere else for the same purpose, especially when it is of such shape that clamping it is quite an operation in itself; still if it is necessary to lift the wrench off the tap square every half turn it is a question whether any actual time is saved at all.

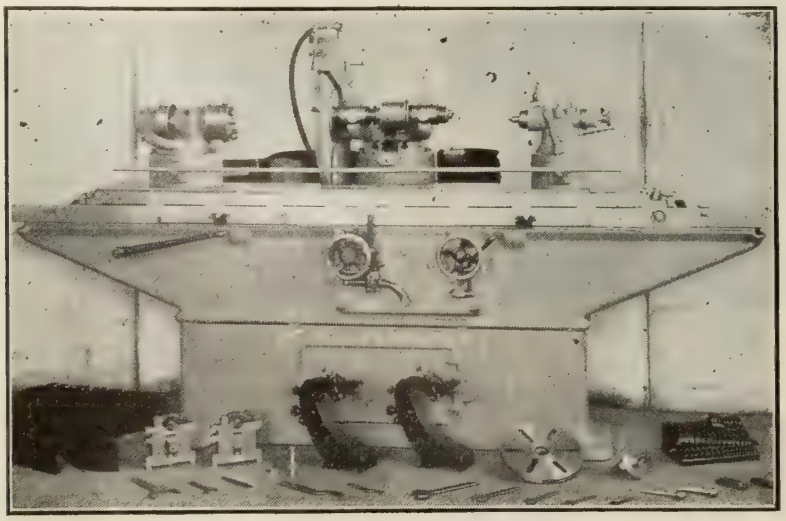
New Things in Shop Equipment

PORTABLE SAND DRILL

There has recently been placed on the market a portable drill stand for use with the "hole shooter" electric drill. With the drill vertical the combination serves as a bench drill in the usual sense. It can be swung into a horizontal position and the device can be used as an electric grinding machine, or for buffing or polishing. A large number of other applications can be made as the drill can be set to operate at any angle, by simply loosening the set screws, adjusting the drill body, and tightening the screws again. The base of the stand is of cast iron with a finished table 8 x 8 in. The upright is of 1¼ in. dia., cold rolled steel. The range of travel of the slide is 12in. and the range of travel of the rack is 3½in. The total weight of the stand is about 30 pounds. The design and construction of the stand has been so worked out that springs for controlling the travel of the rack have been eliminated. The apparatus is manufactured by the A. H. Peterson Manufacturing Co., of Milwaukee, Wis.

UNIVERSAL CRANK SHAFT GRINDING MACHINE

A machine that is designed especially for use in motor service shops has recently been placed on the market. It is capable of grinding crankshafts, pistons, wrist pins, valve seats, and stems, in addition to the regular straight and taper grinding usually done on a universal grinding machine. With an internal grinding attachment and chuck, it does internal and face grinding on such parts as individual cylinders, clutches and transmission gears. All ordinary parts of motors can be ground in the machine, excepting cylinders en bloc. By using a tooth rest, it will also grind line reamers, milling cutters, centres, boring bars and other tools. The automatic cross feed will move the wheel from 0.00025 to 0.004 inches at each reversal of the table. It is automatically disengaged when the work is ground to size. The travel is automatic and is controlled by easily adjusted dogs. The base of the machine rests on the floor at three points. This construction maintains the alignment of the table and prevents it being affected by any inaccuracies of the floor. The grinding wheel is 24 inches in diameter, 1 inch thick, and has 5 inch hole. It is protected by a heavy guard which helps to confine the spray and particles of abrasive. The machine is manufactured by the Brown and Sharpe Manufacturing Co. of Providence, R. I.



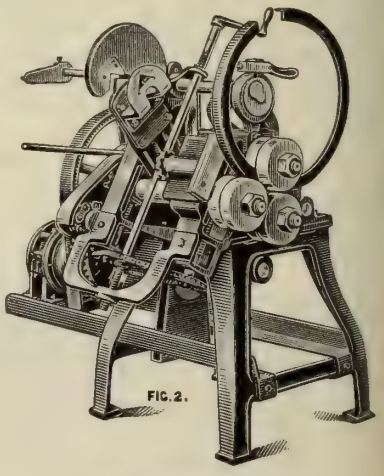
Universal and crankshaft grinding machine.

DOUBLE CRANK TOGGLE PRESS

Owing to the fact that steel stampings are rapidly replacing small steel castings in a multitude of instances the demand for power presses of large capacity has been steadily increasing. To meet this demand, the press about to be described, has been placed on the market. It was built for the purpose of drawing pressed-steel axle housings for automobile trucks. These housings are drawn in two sections from steel ⅜in. thick, which sections are welded together. The press is of the tie-rod construction twin-driven and triple-geared. All the gears are made of steel, have machine dressed teeth, and operate at a ratio of 85 to 1. A series of toggles transmit the power from the main driving gears to the cutside slide or blank holder, and a dwell of 120 deg. is obtained. Power is transmitted to the blank holder from both sides of the press in order to keep the construction simple, and at the same time avoid torsional strains. The crankshaft that drives the inner slide also has a driving gear on each end. Power is furnished for adjusting the inner slide or plunger by a 15 h. p. motor mounted on the front of the crown. The press is driven by a 100 h. p. motor through a hand-operated friction clutch of the double-grip type. Some of the principal dimensions are as follows:—Distance from bed to inner slide (stroke down and adjustment up) is 59 in.; distance from bed to outer slide (stroke down and adjustment up) is 56 in.; stroke of inner slide is 28in.; stroke of outer slide is 20in.; area of blank holder face is 5ft. x 8ft., 6in.; and area of plunger face is 3ft. x 7ft., 3in.; while the weight of this press is about 300 tons. The press is manufactured by the E. W. Bliss Co. of Brooklyn, N. Y.

ANGLE BENDING MACHINE

The machine here shown, which has been placed on the market recently, is designed for bending angle iron into circular shape. It is provided with shears



Angle bending machine.

for cutting the angles to any desired length and special rolls permit of forming the stock to a true circle without defacing the angles. Rolls for any purpose may be used when desired. The forming rolls are made in two parts with a steel plate between for insertion of the leg of the angle. Circles may be formed with the flange either outside or inside. The machine is equipped with friction clutch and may be adapted to belt or motor drive. Frame is of semi-steel and rolls are made of forged and hardened tool steel. Machine may be supplied either with or without the cutting attachment. Floor space required is 4 x 5 ft., and weight is approximately 1,800 lbs. It is manufactured by the Excelsior Tool and Machine Co., East St. Louis, Ill.

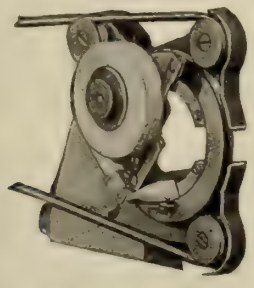
DUPLEX HAND MILLING MACHINE

The machine about to be described has been developed for rapidly slitting automobile piston rings of the step cut type, splitting babbitt-lined bearings for automobile crankshafts, milling slots and keyways and similar operations. The machine has a single-pulley drive from which power is applied by the medium of a friction clutch. On the driving pulley shaft is mounted a change pulley, from which power is applied to a pulley on the lower spindle by a belt. Spiral gears drive the upper and second spindle. These gears are hardened and run in oil. The number of teeth in these spiral gears differs by one for the more even distribution of wear. The spindles are made from high-carbon steel and run in bronze bearings.

The two spindle heads are adjustable and can be clamped in any position on the column without disturbing the gibs. The knee can be lowered or raised on the column, and as this member can be clamped in any position the locating of the work, with respect to the lower spindle, is done in this manner. In adjusting the set-up finally, the upper spindle head is adjusted relatively to the lower one. Then both heads are clamped to the column. Graduated dials are provided on all adjusting screws for securing accurate settings. The scale on the table can be moved toward or away from the column by means of a screw. The table is traversed past the spindles by operating a hand-feed lever. Electric drive can be applied if desired, by mounting a 1-½ h. p. motor on a bracket fastened to the base of the machine. The weight of the belt driven machine is about 900 pounds. The machine is manufactured by the Superior Machine and Engineering Co. of Detroit, Mich.

COIL TAPING MACHINE

The armature coil taping machine shown in the accompanying cut has been offered to the trade just recently. It is claimed to be a successful design, having a kickless self-feed attachment. It is easy to operate, the "pull" of the tape

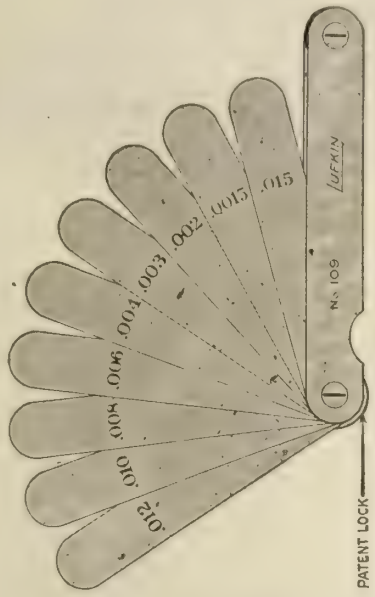


Coil taping machine.

being taken off the operator to such an extent that the coil can almost be allowed to lay in the operator's hand while taping and permits him to increase or decrease tape at will while running. The device may be operated at approximately 500 r. p. m. Machine is durable and well constructed. It is being placed on the market by the P. E. Chapman Electrical Works, St. Louis, Mo.

THICKNESS GAUGE WITH LOCK

A very useful thickness gauge with a lock has recently been placed on the market. The lock provides a means by which the blades may be held in any position. It consists merely of a knurled head nut that clamps the leaves tightly together when it is turned a fraction of a revolution. The gauge is adapted for use of automobile mechanics and repair men. When making adjustments of tap-



Thickness gauge with lock.

pets on motors the proper leaf can be used at the full length of the tool, namely 5½in. The gauge is made in several styles. The No. 6 size carries six leaves having thickness of two, three, four, eight, ten and fifteen one-thousandths. The No. 9 has nine leaves from one and one half to fifteen one-thousandths. All the leaves are well protected when the gauge is closed. All the leaves are one half inch wide and three inches long. The removal and insertion of the leaves is easily accomplished. If two leaves are separated from the others and locked in position they may be used as the two limits that are permissible in the fit. The leaves are accurately ground to size which is marked on each. The gauge is manufactured by the Lufkin Rule Co., of Saginaw, Mich.

TUBE BENDING MACHINE

There has recently been developed and placed on the market a machine that bends No. 22 gauge 7/16in. diameter tubing to the shape of a tennis racket. To accomplish the complete bending, two separate operations are necessary. A lot of tubes are run through the first bending and then the machine is set up for the second operation. The preliminary shape is obtained by bending the tube around a form on the table by means of two arms, or cranks, keyed to two vertical oscillating shafts. The cranks are driven through worm gearing and a crank motion underneath the table. The mechanism is controlled by means of a clutch. There are rollers on the ends of the cranks which engage the tube and bend it around a large form. The normal cycle of steps in this operation is to bend and release the part and then stop the machine. The part is then removed and replaced with another straight tube. In the second operation the frame is closed by the rollers on the swinging arms, as the cranks are operated, one leg of the frame passing under the clip at the left of the table, the other riding over the top. It is necessary to bend the frame through a greater angle of curvature than is actually desired on the finished part, in order to overcome the spring and allow the tubing to set. The machine normally operates at an average rate of 600 bends per hour, with the speed of the driving shaft at 300 r. p. m. On normal production the machine is stopped after each bend but when an operator has become accustomed to handling the work and maximum production is desired, the clutch latch may be thrown out and the machine operated continuously. Under these latter conditions the capacity of the machine is increased to about 1000 bends per hour. The machine may be equipped to take care of a wide range of work which is somewhat similar in nature. The equipment is manufactured by the Davis-Bournonville Co. of Jersey City, N. J.

NEW EQUIPMENT

The Modern Machine Tool Co. of Jackson, Michigan, has taken over the stock and tools of the Sprague-Hayes Mfg. Co. and will make and sell the Quickgrip table vise formerly manufactured by the Hayes Co.

MEDIUM DUTY POWER HACK SAW

The light weight medium duty metal cutting saw shown in the accompanying cut has recently been placed on the market. It has all the features of other machines of the same make, and is especially adapted for fast and accurate cutting.



Power Hack Saw.

It is equipped with automatic lifting device that relieves the blade on the return stroke. Gravity feed is used in cutting. Saw is automatically stopped at finish of cut. Provision is made for quick and easy adjustment for wear. These machines are made by the Racine Tool and Machine Co., of Racine, Wis., and will be known to the trade as the "Racine" Junior.

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New Engineering Bill

THERE IS A movement on foot to pass a bill in the Ontario Parliament which will make possible the incorporating of the professional engineers of the province. The present wording of this bill has some objectionable coercive features which should be remedied before its passing.

When presented to members of the legislature the other day, the general sentiment was in accord with the principle, viz., to give the engineering profession a recognized status, but luckily for the good of the province, objection was raised to the drastic clauses in the bill. After considerable discussion it was decided to let the matter stand until the committee consulted the engineers interested.

According to the present wording, any engineer not registered or licensed under the proposed association, and following out his profession, could be fined $100, $200 and $500, for the first, second, third and subsequent offences. In other words he must join up, pay a license fee, or drop out of the profession. Of course, these words are not bluntly presented, but that is what it amounts to. Here are how the clauses under discussion are worded.

The fines apply to a non-registered or non-licensed man who (a) practises as a professional engineer; (b) usurps the functions of a professional engineer; (c) uses verbally or otherwise the title of professional engineer, or of any words, name or designation that will lead to the belief that he is a professional engineer; (d) advertises himself as a professional engineer, and (e) acts in such a manner as to lead to the belief that he is authorized to fill the office of or to act as a professional engineer.

These are carefully worded statements, and yet, if allowed to go into force would work hardship on many men who have carried on in a small way for many years. Many of these are competent practical men who might not want to become members of the association or take out licenses, and therefore should not be coerced into such a step.

No one will question for a moment the need of organizing the engineering profession, for this should have been done years ago, but to start off in such a dictatory manner is not the way to get results. Granted that many men are practising as professional engineers who should be censured for so doing, still these are in the minority, and are soon found out.

The argument was raised that these clauses would safeguard the public, eliminating the fakers. All well and good, but before long we would have a worse condition on our hands, viz., a close corporation who could charge almost any fee it cared to. **By all means let us have an association**, but one governed by reasonable rules.

To define the term professional engineer, will prove in itself a problem, for there are the civil, electrical, mechanical, chemical, electric and mining fields. It will be some time yet before all these debatable points will be cleared up. In the meantime let the committee move cautiously, refusing to rush such a measure through until worded in such a way that it is fair and reasonable, not dictatory.

Have You a Convention Committee?

"HOW CAN we further reduce our expenses?" This question is being asked in every manufacturing plant in Canada, in fact all over the world. At the present time competition is keen, profits are small, and in many instances, firms are losing money instead of making it. The usual pruning of dead wood and flagrant extravagance has long since taken place. Now the task is to discover new channels for saving, and naturally these are not so easy to find, being underneath the surface.

The old idea of having the executive heads meet periodically to discuss ways and means of stopping leaks in efficiency is very good, but it does not go far enough. At the beginning everyone is full of enthusiasm and suggestions, but gradually these ideas taper off until the meetings fizzle out through lack of new suggestions.

The fault lies in the fact that the employees out in the shop have not been thoroughly sold on the necessity for saving. Cutting their wages is not the best way to save the situation. It shows a saving on the pay roll, but causes dissatisfaction, and quite often lowers production, the workman taking the stand that less money means less work. Before cutting wages, why not ask the men to form a "conservation committee." Tell them frankly the absolute need of such a body, and suggest to them that they pick only the best men available. Let them realize that this is the last stand before wage reduction. That you do not wish to reduce wages, but if something is not done at once, salaries will have to be cut. Appoint a similar committee in the office, then let them both work together.

This idea will prove successful, in fact has always done so where given a fair trial. One large company in the States says they saved $10,000 a year by adopting a policy such as we have outlined. Every industry will have its own peculiar problems, so that no hard and fast rule can be laid down. The main thing is to appoint the committees very carefully, realizing that this move means either profit, or continued loss.

Some of the sources of leak, which should be watched carefully are, personal telephone calls, needless waste of material both in shop and office, if production cards being used can be improved, and if more help is being carried than is necessary. The latter problem is always a difficult one to overcome, but with responsible and conscientious committees, they soon see that to make the jobs of all secure, including their own, they must view the problem from an unbiased standpoint. Many other suggestions could be made, but the idea is what counts. The sooner you start something along these lines the sooner your present losses will cease. The morale of the workers will also improve automatically, so you have everything to gain and nothing to lose.

Canada's greatest need today is creative and practical thinking by the individual. The agricultural and industrial world is composed of individuals.

Automobile Production Shows Decided Success

Iron and Steel Continue Firm—Steel Ingot Production Increases —Slight Advance in Price of Bars, Shapes and Plates in United States—Pig Iron Tapers Off—Small Tools and Supplies Active

BRITISH PIG IRON MAKES APPEARANCE

CANADIAN markets show practically no change over last week. Demand is keeping up, iron and steel being strongest of all. Prices are firm, and plates are moving at a good rate. These are being sold chiefly for tank work. Canadian representatives of American mills report good business in Canada at the present time.

Pig iron, is firm, but the quantity moving is not as large as a month ago. British pig iron has made its appearance on the Canadian market, and is selling more or less in Eastern territories. Toronto is beginning to investigate this new source of supply, and according to information received the price is about seventy five cents to a dollar cheaper per ton than the Canadian product.

Scrap and non-ferrous metals are a little stronger, copper being the most active. Yellow brass is weak being pratically a drug on the market.

Small tools and supplies are still active, the automobile trade helping this section considerably. Machine tools are moving, but not very rapidly.

Steel pipe is firm, and oils and waste are selling at a fairly good rate. Linseed oil has gone up slightly in price.

Automobile production in the States is very heavy. Several large makers are producing more cars to-day than at any other time in their history. The number of orders for freight cars is also increasing, nearly 10,000 having been ordered during the week. Structural steel lettings since April 1, have been heavy so that these three avenues of consumption have helped the steel situation considerably. In fact they are using up about 20 per cent. of the present steel output.

Outside of these three lines, conditions in the steel industry are less active, but the market is still firm because the mills are booked up for two months ahead at least.

Steel ingot production shows a further increase the rate being over 37,000,000 tons per year. Several additional furnaces have been blown in.

Steel prices continue to strengthen, and bars, shapes and plates are now quoted at $1.60, against $1.50, during the first part of May. Independent hoop, band, and strip makers have advanced their asking price from $2.00 to $2.25.

Connellsville coal has had a stiff advance during the past ten days. Eastern buying is responsible and the price for steam grade is now $4.00 to $4.50. Pig iron production is unchanged, and consumers are out of the market unless in pressing need.

Toronto

May 23

THE demand for iron and steel continues locally, but compared with last week, we can report no further improvement. In fact every section seems to be marking time, gathering in a fair amount of seasonal business only.

Iron and Steel.—The demand for iron and steel bars, plates, etc., is keeping up, and prices are firm, but not advanced, as several dealers have been expecting for some time past. Although plates cannot be termed a feature, they are selling strongest of all lines, 10 gauge and 12 gauge, being particularly active. One large representative of an American company reports very good business, and says that May will be without question a big improvement over any other month in 1922 so far as he is concerned. The demand in his case is general, orders coming from a very scattered territory.

Gossip on the market states that American mills are going to raise the quantity differential. In other words, refuse orders at straight mill prices on less than five ton lots. At present there is a special charge on small orders of one ton or less, but the representative of one large American firm, states there is nothing to the rumor. What has occurred is this:—

Certain mills will not accept orders on less than 5 ton lots from new customers, but continue to serve their regular consumers as before. The only difficulty when ordering small quantities direct from the mills is to get quick delivery.

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron:—This market is firm, although buying is not as heavy as it was a month ago. A new factor has entered into the situation, viz, British competition. This so far is chiefly confined to Montreal and Eastern territories, but Toronto is beginning to be interested. One large user of pig iron, told Canadian Machinery that he was at present in touch with a British firm and would be able to give us something definite regarding comparison of prices in a few days. From varied sources we find that about 75 cents lower than the Canadian figure seems to be the average. The Toronto price of Canadian No. 1 iron is still $29.15.

Scrap Metals:—Scrap copper is brighter than it has been for some time past. A number of sales are reported and prices are firm. Heavy melting steam has also improved and tonnages have been booked around $12.50 to $13.00 Hamilton. The cast iron market is both active and firm. Dealers however refuse to stock up further, so that the quantity of sales is not as large as the strength of market would warrant under normal conditions. Stove plate is scarce and hard to get, therefore the price is nominal. Following are quotations on several lines.

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	6 75
Aluminum	26 00

Non-Ferrous Metals:—This market is firmer, although the demand has not increased. Consumers are still a little shy about placing orders, but dealers on the other hand are holding to their quotations. The majority of merchants have large stocks on hand, which they are holding on to until the market becomes still firmer, then they will unload. Until that time, they refuse to stock up further and things are somewhat quiet so far as buying and selling is concerned.

Some metals are stronger in tone than others. Copper is best of all, with yellow brass the lowest. In fact the latter is a drug on the market. Local quotations follow:—

Copper, light, per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools:—This section is simply holding its own. There is no change, and although several good prospects are on top, none of these have reached the closing point. One dealer, who felt sure of a certain order, wired to his principals for best delivery, and although having received special concessions, he still cannot close the deal as the prospect has cooled off in the meantime. This incident could be repeated many times over and goes to show the state of the market. Prices are fairly firm, but orders received are for one machine only.

Small Tools and Supplies:—There has been no change over the week. The demand is satisfactory and as good as can be expected considering conditions. Prices remain the same, and the automobile industry is the chief channel of consumption. The class of goods moving is general.

Steel Pipe:—This section of the market is decidedly firm. There is some talk of an advance in the States but so far nothing has occurred. Of course if prices go up on the other side, a similar advance would take place locally. Speaking to one large purchaser of this material, we find that he has ordered well ahead in order to play safe and ensure prompt delivery. He believes prices may advance shortly and refuses to take chances.

Oils and Waste:—Both these lines are moving at the same rate as last week. There is only one change in price, linseed oil having advanced slightly to $1.15 against $1.10. Following are local quotations.

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	0 20
Palacine	0 23
Machine oil, per gal.	0 33
Black oil, per gal.	0 17½
Cylinder oil, Capital	0 61½
Petroleum fuel oil, bbls., net	10 40
Pure turp., single bbls. gal.	1 35
Linseed oil, raw, single bbls.	1 00
Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bbls.	1 15

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

Coal:—The first shipment of British coal is on its way to an American port. This move is creating considerable interest, and if the present American prices continue to advance in like proportion to what it has been doing recently, it will mean that British coal will be able to be sold on a competitive basis.

Montreal

May 23

A LITTLE better tone is in evidence on the local market. Business in practically every department shows a slight improvement, and building activities are still in the limelight. Most of the larger jobs are well under way or are practically finished. There is, however, an increasing number of residential and retail commercial construction contracts being let. This has been responsible for the increased business in nails, spikes and all kinds of building hardware. To a certain extent it has also been the cause of the increased demand for galvanized and blue annealed sheets, and small lots of structural steel. No changes in prices have been announced locally in steel products. Pig iron sales have dropped off still further, and the non-ferrous metal market is very quiet, although there is an undercurrent of strength to all quotations.

Iron and Steel.—The demand for steel products locally, and throughout the province, has shown a slight improvement during the week. The most activity is shown in galvanized sheets. British sources are supplying practically all the material being offered locally. Deliveries have been very good from the mills owing to the increased ocean tonnage available. Those jobbers, who were more or less conservative in their early booking for shipment by the all water route, have found it is difficult to keep any of this material in stock.

Blue annealed sheets are also rather active. Prices have not changed in the last week. Structural sections are moving in small lots but the total tonnage is not great, although in advance of the amount moved during the fall and winter months. Merchant bars are fairly active, a demand for small lots coming from all parts of the province. Spikes, wire nails, reinforcing rods, and a number of miscellaneous products are moving well. Prices in these lines are firm. Sheets are still in poor demand, but on the whole there is a very optimistic spirit among the jobbers and consumers. Local quotations are:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	3 75
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—Subsequent to the last advance in pig iron there was a very healthy buying period. In two weeks it had spent itself and interest in this market is now very slight. Foundries are pretty well covered and they are not melting a large tonnage. The present quotation of No. 1 iron is firm at $31.80. A new factor has been introduced lately in the form of British iron on the local market, which has been quoted a little below the price on the Canadian product. Quite a few fifty-ton lots of this Summerlee iron have been placed locally, and the price is understood to be from seventy-five cents to a dollar a ton cheaper than the Canadian pig. The feature is too new and has not assumed large enough proportions for one to judge what its effect will be, but it may have the effect of making it difficult for Canadian producers to sell their iron to local consumers, also to those within quite a radius of Montreal.

Machine Tools.—Sales of machine tools are not yet up to expectations. Most of the large shops, which really form the best market for the local jobbers in these lines, are not working to more than fifty per cent. capacity, and some not even that. Thus, it is impossible to interest them in new tools. The railways are not showing any desire to come into the market. They are not moving a large volume of freight, and the shops have no difficulty in taking care of the necessary maintenance. Thus, they too are eliminated. The small manufacturing establishments, together with the jobbing and contract shops, present the only outlet for machine tools. These plants are buying a little new equipment but it consists of small-sized machines in lots of one only. Wood-working machinery is moving a little better than iron-working tools, but business is not active even in these lines. Prices remain fairly steady.

Small Tools and Supplies.—The demand for small tools continues to be pretty good. There is a gradual improvement in the demand, local repair shops are fairly busy, as the opening of navigation has brought a fair volume of marine repair work.

Non-Ferrous Metals.—Very little business is offering in this market locally. Quotations are firm owing to export, etc. Copper, tin and lead appear to be very firm, but this feature does not stimulate buying. Local quotations are:

Lake Copper	16 75
Electric Copper	16 50
Castings, Copper	16 25
Tin	34 50
Lead	6 75
Spelter	7 50
Antimony	6 50
Aluminum	23 00

Scrap Metals.—A very small volume of business is offering in scrap. Foundries have not come into the market to any extent, and owing to outside increased demand, local dealers advanced quotations, the result being that business that might have been done at the original figures has been lost, for the time being. Following is a list of quotations:

Copper, light per 100 lbs.	9 50
Copper, crucible	12 50
Copper, heavy	12 50
Copper wire	12 50
No. 1 composition	9 50
New brass cuttings	7 00
Red brass turnings	8 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	12 50
Boiler plate, per gross ton	8 50
Heavy melting steel	10 00
Axles (wrought iron)	9 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	22 00
Pipe, wrought	7 00
Car wheel	17 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	18 00
Cast boring	3 00

Pittsburg

May 23

FREIGHT cars ordered in the past week total nearly 10,000, making about 75,000 since the first of the year, against less than 30,000 during 1921, and an average of 150,000 a year in the ten years 1904 to 1913 inclusive. The present rate of buying is as heavy as could be expected. It should be remembered, however, that freight cars cannot furn-

ish as large an outlet for the steel industry as used to be the case, on account of steel making capacity having been so greatly increased. The present capacity is about 150 per cent. greater than that of 1904, and 50 per cent. above that of 1913, while no heavier freight car buying than in those years can be expected.

Structural steel lettings have been heavy since April 1, equalling approximately the fabricating shop capacity, which is 180,000 to 200,000 net tons a month. Lettings in the first three months of the year equalled 53 per cent. of capacity, while in 1921 it was 35 per cent. Automobile production is very heavy. Studebaker, Dodge, Maxwell, Ford and Chevrolet are producing more cars than ever in their history. Production in April, as reported by the Department of Commerce, with reports from a few small companies lacking, was 196,512 passenger cars, and 21,944 trucks, against 81,638 passenger cars, and 9,204 trucks, in January. Production this month is running a trifle heavier still.

These three important lines of consumption, extremely stagnant in 1921, are the largest outlets for steel at the present time. They represent at the present rate about 500,000 gross tons a month of finished rolled steel, apart from iron castings, etc., which is equal to a rate of 6,000,000 gross tons a year. Total capacity in finished rolled steel is about 40,000,000 gross tons, while the present rate of production is 28,000,000 to 29,000,000 tons, so that these three industries account for a trifle more than 20 per cent. of the present steel output.

Steel Market.—This market in general, outside of the three lines just mentioned, is decidedly less active than in March and April. The lessening in activity has not weakened the situation, because mills are well sold up for a couple of months or more and do not need to secure much of any additional business for nearby deliveries to enable them to maintain operations. General buyers are moderately well covered, but apparently a few would like to have more steel, this being evidenced by some anxious inquiry in the market, against which some of the mills, probably the great majority, are endeavoring to secure delivery premiums.

In other words, the steel market presents an appearance of great strength, yet there is some room for doubt whether this strength will really continue. The lines of consumption outside of freight car building, structural steel construction, automobile and truck manufacture, do not present the appearance of actually consuming 75 per cent. of the steel now being produced. It would look rather as though some buyers and distributors have been replenishing stocks and will not require as heavy deliveries later on unless the ultimate consumption increases further.

The buying thus far is readily explained, for stocks were at an extremely low ebb at the beginning of the year, and fears regarding the coal strike of April 1 caused buying before that date, while when the strike proved to be somewhat bigger than was expected, on account of some non-union regions striking in addition to the regular union fields, a further stimulus to steel buying was given.

Steel Ingots.—Last December steel ingot production was at a rate slightly under 20,000,000 tons a year, there having been a decrease from the October-November rate. By March 1, the rate was up to about 30,000,000 tons, and the end of March saw approximately a 35,000,000-ton rate, the average during March being 32,500,000 tons. In April, on account of the coal strike, the increase was almost interrupted, but as reported a week ago the April production was at about 36,500,000 tons a year. There has been a further increase, and the rate is now about 37,000,000 tons.

Some of the steel companies, those largely dependent upon coal regions where there are strikes, have had difficulty in maintaining supplies, but they are succeeding. Coal and coke have been purchased in different fields, but an extra freight haul is involved, adding to the expense. The steel industry had large stocks of coal April 1, and these have been drawn upon to quite an extent, but they have still fairly large stocks.

The Carnegie Steel Company resumed steel making at the Mingo works the beginning of last week after an interval of more than a month, while late in the week production was resumed at the Farrell works after a long idleness. The Carnegie Company is now operating 35 blast furnaces, against 34 on April 1. The Youngstown Sheet & Tube Company has blown in a fourth furnace, and there is also some increase in the Chicago district.

Steel prices continue to grow stronger. Some of the independents have advanced asking prices, while other producers are more conservative, and restrict their bookings to the most desirable business rather than advance prices. In bars, shapes and plates, however, the market in general seems to be quotable at 1.60c, against 1.50c ruling in April, and the fore part of May, and about 1.35c late in February. Sheets are regularly 2.40c for blue annealed, 3.15c for black, 4.15c for galvanized and 4.50c for automobile sheets. A half dozen or so independents are quoting $5 to $7 a ton higher and offer early deliveries at their quotations. Independent hoop, band and strip makers have advanced their asking price from 2.00c to 2.25c.

Pig Iron, Coal and Coke.—Connellsville coal has had a stiff advance in the past ten days, chiefly on account of eastern buying, and is $4.00 to $4.50 for steam grade. Connellsville furnace coke, which has presented a very narrow market, as furnaces are buying only in exceptional cases, is a shade easier at $6.25 to $6.50. Foundry coke is unchanged at $6.75, with the turnover rather light.

Merchant furnace production of pig iron is at about the same rate as for several weeks past, with furnaces unable to increase output and with the current output well absorbed on old sales, the result being that sales would only be made at prices that are very high compared with those ruling in March, the quotable market being about $26 for Bessemer, $25 for basic and $24 for foundry, f.o.b. valley furnaces. Consumers are out of the market unless in pressing need of some particular lot, and the market in the past fortnight has seen the lightest turnover for a very long time.

IMPROVED FURNACE FOR CAST IRON

In every foundry throughout the world the furnace is accepted as the standard to be used on account of its low first cost, its economy and its convenience. Such drawbacks as it possesses are not of serious importance in ordinary foundries, but they do become troublesome when high grade work is undertaken. A British firm has therefore devised a special type of cupola furnace for the production of the highest grade of castings. The chief peculiarity of this furnace lies in the oil firing of the receiver. The molten metal collects in the hearth of the receiver and the power of the oil flames can be regulated to suit the quantity of metal concerned. In this way any quantity of metal can be maintained for a long time at the correct casting temperature. The approximate consumption of oil is at the rate of three gallons per ton of metal.

Model making as a hobby would appear to be on the increase. The educational advantages, and the aptitude which many people find they possess for building these small models have proved sufficient to attract people in many walks of life. For this hobby the use of treadle lathes and small hand or power operated machines for drilling, surfacing, etc., is a more or less urgent necessity. Another class of user for which these small machines are made is the man with a motor car who is far away from any commercial repair shop and is therefore dependent on the work he is able to perform in his own garage for minor adjustments and repairs. A steadily increasing field for the small lathe has been found amongst this class of user especially. The precision lathe, however, is primarily a works instrument. It costs a good deal more than the machines capable of making the small parts required in a model and its operation often requires on the part of the operator a very high degree of skill and experience in order to achieve the best results. Amateurs rarely achieve these qualities but in some cases, where men have made a hobby of such fine work as clockwork apparatus, they have often found it worth while to use the highly accurate machine tool.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 75
Steel bars, base, Montreal	2 75
Reinforcing bars, base	2 75
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate ¼" and heavier	5 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 2 per cent.

METALS

	Montreal	Toronto
Lake copper	$16 75	$17 00
Electric copper	16 50	17 00
Castings, copper	16 25	17 00
Tin	34 50	34 50
Spelter	7 50	7 25
Lead	6 75	6 75
Antimony	6 50	6 75
Aluminum	23 00	25 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	5.84	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.80
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 9 50	$ 8 00
Copper, crucible	12 50	10 50
Copper, heavy	12 50	10 50
Copper, wire	12 50	10 50
No. 1 machine composition	9 50	8 50
New brass cuttings	7 00	6 00
Red brass turnings	8 50	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 00
Tea lead	3 00	3 00
Aluminum	12 50	10 00

	Per Ton	Gross
Boiler plate	$ 8 50	$ 7 00
Heavy melting steel	10 00	10 00
Axles (wrought iron)	19 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	22 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	18 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto — Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	60
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 40	$4.40
Sheets, blue ann., No. 10	3 80	3,75
Canada plates, dull, 52 sheets	5 75	6 00
Can. plates all bright	8 25	...
Galvanized sheets, No. 28		5 60
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28	....	...
Premier, No. 28, U. S.	6 45	5 35
Premier 10¾ oz	6 00	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	21.06	$
1¼ in.	21.50	
1½ in.	22.00	
1¾ in.	23.00	
2 in.	22.00	17.00
2¼ in.	26.00	18.00
2½ in.	30.00	20.00
3 in.	34.00	25.00
3¼ in.	43.00	27.00
3½ in.	47.00	28.00
4 in.	58.00	35.50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	20
Palacine	23
Machine oil, per gal.	33
Black oil, per gal.	17½
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	10.40
Pure turp., single bbls. gal	1 30
Linseed oil, raw, single bbls.	1 15

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets, 24 gauge and heavier, base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14	Fancy	13½

Colored

Lion	12		
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White 18 Dark colored.13
Mixed colored.14

This list subject to trade discount for quantity.

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$29 00	$27 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	30 00	28 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	35 00
Copper sheet, planished, 16 oz. base	42 00	40 00
Braziers', in sheets, 6 x 4 base	30 00	28 00
Copper tubing, seamless		27

LEAD SHEETS

	Montreal	Toronto
Sheets, 8 lbs. sq. ft.	**$ 8 50**	**$ 9 00**
Sheets, 8 1-2 lbs. sq. ft.	**8 25**	**8 75**
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6 50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

The Georgetown Arena Co., Georgetown, Ont., are contemplating the erection of an arena.

Reynolds Ltd., is the name of a newly organized company in Montreal. The capitalization is $50,000 and this construction company was formerly controlled by Mr. G. B. Reynolds of Montreal.

Sealed bulk and separate tenders addressed to A. Love, secretary-treasurer of High School Board, **Aurora, Ont.**, will be received until June 6, for all trades in the erection of an addition to the present high school.

The Pangborn Corporation sand blast specialists of Hagerstown, Ind., will have a representative line of sand blast equipment on exhibition at the **Foundrymen's** Convention to be held in Rochester, N. Y., on June 5 to 9.

Mr. Thos. Reid of the Hamilton Facing Mills, Hamilton, Ont., reports business as being exceptionally brisk. Car wheels and pipe foundries are particularly active, these branches alone, ordering considerable quantities of material from the facing mills.

Niagara Falls, Ont.—Some important changes will be made to the bridges here. Present plans call for a complete new structure between the present cantilever bridge and the one used by the G. T. R. and pedestrians. The contract for the latter calls for its completion within two years. The lower bridge will also be greatly extended.

Hamilton, Ont.—G. A. R. Emery, Canadian Trade Commissioner, will leave shortly for Shanghai, China. Several local manufacturers have interviewed Mr. Emery, and stated their desire to increase their export trade. Manufacturers of steel goods, tinware, canned goods, roofing material, wire fencing, farm implements and brushes are especially interested.

Following are some new incorporations, with their head offices: E. W. Herring, Ltd., capital, $49,500, head office at Montreal, to carry on general contracting business. Fibre Asphalt Products, Ltd., capital $500,000, head office Toronto, dealing with paving materials and machinery. W. R. Hughes Co. of Canada, capital $50,000, head office at Toronto, to manufacture and deal in paints, varnishes, oils, etc.

McGinnis & O'Connor, highway engineers and contractors, Kingston, Ont., have been awarded the construction of some seven miles of highway near the town of Gananoque. One mile of the work is on the western, or Kingston side of the town, and the rest on the eastern or Brockville side. Work will be commenced at once.

Baker Brook, N. B.—Fraser Co. whose shingle mill was recently destroyed by fire will rebuild at once.

Brockville, Ont.—A rolling mill for E. F. Phillips Electrical Works, Montreal, will be erected in the near future. Tenders closed on this work May 22nd.

The Ford Motor Co., Calgary, Alta., is contemplating the erection of a warehouse and salesroom at a cost of $150,000.

St. Williams, Ont.—McCall Bros. Woodworking plant has been destroyed by fire. The loss is approximately $70,000.

Lindsay, Ont.—The shingle mill, owned by Joseph Hadley, of Burnt River has been destroyed by fire. The loss is a heavy one, and a number have been thrown out of employment.

Westminster Junction, B. C.—Tenders will be received up to June 10, by Hon. Dr. W. H. Sutherland, minister of public works for the erection of a steel highway bridge. The plans are with the governmental agent at Vancouver, district engineer at New Westminster, and with the dept. of public works, Victoria. Accepted cheque is required.

According to official figures, the fire losses in Canada during the week ending April 5, are estimated at $735,800, compared with $1,617,100 the previous week. Fire losses in Canada in March totalled $4,331,750, compared with $4,062,400 in February and $2,112,200 in March last year. This exceptionally high figure is due to the loss of Montreal City Hall and of the church at St. Anne de Beaupre, amounting to about $1,000,000 and $1,200,000 respectively.

The Thomas D. Watson Co., Kingston, Ont., has at present under construction the first two buildings of a factory which when finally completed will consist of five buildings all of reinforced concrete or steel. The foundry and machine shops are the units now being erected, and a twelve ton cupola will form part of the foundry equipment. The foundry will be 110ft. by 70ft., and the machine shop 170ft. by 70ft. The other buildings will be started as soon as possible.

Grand Prairie, Alta.—A flour mill and elevator will be erected shortly by Shaver and Taylor, at a cost of $30,000.

Deschambeault, Que.—Tenders are requested for alterations to wharf to cost about $70,000 for Dominion Government. J. B. St. Laurent, chief engineer, department of public works, Ottawa, is the man to write to. Other plans being prepared, and handled by the same office are repairs to wharf at Grondines, Que.; wharf repairs at St. Antonine de Tilly, Que., the latter to cost $10,000.

The Canadian Pacific Railway Co. plans to spend $50,000 in building an overhead crossing over the Grand Trunk tracks immediately west of Kingston.

C. C. Bradley president C. C. Bradley Co., Syracuse, N. Y., is enjoying his annual two weeks' outing with the Triton Club, Quebec. This means that the trout season is now open.

J. V. Gray Construction Co., general contractors, 541 Queen St. E., Toronto, and 36 London St. W., Windsor, have opened new offices in the Bank of Toronto Chambers, London, Ont.

Medicine Hat, Alta.—Work has started on the construction of a 280-ton mechanical coaling plant for the C. P. R. G. E. Hughes, of Calgary, is the contractor in charge.

The Shawinigan Water & Power Co. Shawinigan Falls, Que., contemplate the installation of an electric lighting system in the town of Riviere A Pierre, Que., in the near future.

The Railway Roller Bearing Co., Syracuse, N. Y., has been re-organizing. Mr. Stacey, former manager withdraws and his place is taken by J. C. R. Bell, formerly with the Gurney Ball Bearing Co., Jamestown, N. Y.

Chipman & Power, consulting and supervising engineers, Toronto, have been retained by the town of Oakville, Ont., to make a report on a suitable auxiliary for operating the water pumps in the event of a tie-up in Niagara power. According to present plans, a capacity of approximately 300 h.p. will be required, which will be a single unit engine, either gasoline or Diesel type.

Ottawa, Ont.—The contract for the excavation of the new Nepean High School, on the corner of Broadway and Princess Avenues has been let to Bate McMahon and company by the High School Board. The work is to be completed by the first week in June. Next week the board will probably call for tenders for the foundation and structural work.

Montreal, Que.—The firm of Messrs. Rochester, Rhind and Fair have been organized for the purpose of marketing and installing the radio apparatus that is now being manufactured by the Marconi Wireless Telegraph Co. of Canada. All three men are graduates of McGill University and have specialized in electricity. They have fitted up a demonstrating set at their headquarters, 15 St. Mark St., where the working of same is fully explained, also the functioning. The firm are making it their business not only to sell, but to install all sets that they dispose of. In this feature they are without competitors at present locally.

Toronto, Ont.—The value of building permits for April totalled $3,555,325, against $2,617,269 for April, 1921.

Preston, Ont.—The Hurlbut Shoe Co. is building an addition to its plant, and when this is completed the present capacity will be doubled.

Manager Moore of the International Nickle Co., Port Colborne, Ont., states that another furnace has been put in operation in order to meet improved conditions. Fresh orders are being received daily.

Toronto, Ont. — Appropriations of $850,000 for carrying on the work of improving the Toronto harbor, also $50,000 for work on the breakwater at Toronto Island, has been voted on at Ottawa.

Windsor, Ont.—Building records for April show a substantial increase over the corresponding month of last year. The total value is now $444,495 against $292,485.

The English and Welsh Railways have announced important reductions in frieght rates. A cut of 50 per cent. has been made in collection and delivery charges. Rates are also reduced on iron and steel, brick, and some other building materials.

According to figures issued by the Labor Department, the volume of employment shows considerable revival during April. At the close of April, some temporary shut downs in railway shops caused reductions in employment, but other increases more than offset this trouble.

Canada's newsprint capacity will soon be increased when the two new mills now in course of erection are completed. The capacity will then be 1,032,600 tons annually, or approximately 50 per cent. of the total newsprint consumption on the American continent. During the last year, seven new machines with a total rated capacity of 558 tons daily of newsprint has been brought into operation.

London, Ont.—Sealed tenders will be received at the office of John M. Moore & Co., architects, up till noon May 31 for the construction of a steel and reinforced concrete bridge over the north branch of the River Thames. Plans can be seen either at the aforementioned office, or at the office of R. E. W. Hagart, consulting engineer, Temple Building, Toronto.

According to figures issued by the Dominion Bureau of Statistics, Canada's exports to Japan for 1921 amounted to $10,094,243, an increase over 1920 of $2,800,000. This means that Japan was Canada's eighth best customer as compared with ranking sixteenth in 1920 and thirteenth in 1919. On the other hand, Japan sold to Canada last year goods amounting in value to $7,923,450, as compared with purchases of $13,859,732 in 1920 and $12,697,297 in 1919. Japan was our ninth largest supplier of imported goods during 1921.

The National Silk Dyeing Co., of Patterson, N. J., have purchased 13 acres of land at Drummondville, Que. They will proceed with the erection of a Canadian plant immediately.

According to latest reports the Canadian Government will send an exhibition train to France this year. An item of $50,000 to cover the cost has been passed, and it is stated that both agricultural and industrial exhibits will be sent.

Calgary, Alta.—City commissioners have recommended the purchase of a Lincoln arc welding outfit at a price of $4,092 f.o.b. Calgary, from the Electrical Engineers, Ltd., Calgary. Lee Drumheller of the same city has announced that steps have been taken by the Drumheller Land Co., to erect a new generator to replace the one lost at the Callie mine fire recently.

Among the leading articles that will appear in June issues of Canadian Machinery are the following: June 1, Punch Presses and What They can Accomplish; June 8, Machine Shop Problems of Interest; June 15, Belting—Its Uses and Proper Care; June 22, Reducing Costs by Means of the Planer; June 29, Value of Keeping a Product Clean.

Owen Sound, Ont.—The city council have authorized the issuing of debentures up to $200,000, for the work necessary in the building of the new technical department at the Collegiate Institute. Present plans provide for a building about 375 feet in length, 48 feet in width, and 35 feet high. It will be erected west of the present building and joined to it, physical and chemical laboratories, technical and home making classrooms, domestic science, gymnasium, woodworking shops, forge shops and principal's office all on the main floor. On the second floor will be a draughting room, typewriter and commercial rooms, two part-time classrooms, a lady teachers' room and a girls' restroom. Rooms for dressmaking and millinery are also provided.

ELECT OFFICERS FOR COMING SEASON

The following officers were elected at the annual meeting of the Peterborough branch of the Engineering Institute of Canada. Hon. Chairman P. L. Allison, Canadian General Electric Co.; Chairman P. P. Westbye, general manager and chief engineer, William Hamilton Co.; Vice-chairman, R. L. Dobbin, water works superintendent, Utilities Commission; Secretary, R. C. Flitton, Wm. Hamilton Co.; Treasurer, A. B. Gates, Canadian General Electric Co.; Executive committee, H. O. Fisk, manager Electric Department, Utilities Commission; E. R. Shirley, Can. Gen. Electric Co.; W. M. Cruthers, Can. Gen. Electric Co.; A. L. Killaly, Supt. Trent Canal; A. A. Richardson, Res. Engineer Utilities Commission; B. L. Barns, Can. Gen. Electric Co.

The Canadian Pacific Railway Co. have announced a reduction in tourist fares which will save money to those attending the Good Roads Association at Victoria, B. C., June 13 to 17. A rate of $110.65 has been set from Toronto to Victoria and return, limited to Oct. 31.

Ottawa, Ont.—The steel tow barge Brighton has been recently rebuilt and converted into a wrecking lighter by the Canada Steamship Lines. A Browning hoist and powerful double acting pulling machine have been installed. She, with the tug H. F. Bronson, will form the company's wrecking fleet and will be stationed at Prescott prepared for future salvage work, as necessary.

The Dominion Bridge Co., Montreal, have the contract for installing an 80 foot travelling crane in the plant of the Lackawanna Tube Co., Welland. This plant is being equipped to produce boiler tubing, the first of its kind in Canada. It is reported that its output for the first year of operation is practically sold. Billets for this mill will be made in a rolling mill which is now preparing to locate in Welland.

It is stated that the Lackawanna Tube Co. is in some respects a subsidiary of the Lackawanna Steel Co., which recently formed an amalgamation with the Bethlehem Steel Co.

The Volta Mfg. Co., Welland, Ont., have perfected an electric soldering furnace, which has just come through a satisfactory test in a radiator plant. In a report on this test it is pointed out that the consumption is only about 840 watts per hour, and that 1,200 degrees are required to heat the iron. It takes from ½ to ¾ of an hour to heat up to the required temperature for 1½" coppers and 3 minutes to heat a pair of coppers after the furnace is hot. Dressing and cleaning of coppers are no small items and with an electric furnace this is done in one-half the time required by gas.

Working conditions in the vicinity of the furnace are greatly improved, since the heat is almost entirely eliminated and there are no noxious gases. The cost is also slightly in favor of the electric furnace and the plant in question is making complete installation of 12 furnaces.

BOOKLETS

The Canadian Engineering Standards Association has just issued a book of standard specifications for steel railway bridges. This treatise is intended to give to the bridge designer, detailers and manufacturer, guidance along definite lines that will lead to uniformity in the provisions to be made for strength and utility. The various clauses have been prepared without any intention of limiting the engineer's choice as to the type of bridge, and it is believed that no unnecessary restriction has been placed on the designer as regards details of construction. This edition is new and considerably revised and superseded that issued in 1920.

LOCOMOTIVE INDUSTRY IN GREAT BRITAIN SHOWS DECIDED IMPROVEMENT

SPEAKING on the locomotive industry in Great Britain, F. W. Field, H. M. trade commissioner at Toronto, remarked to Canadian Machinery that the average British builder has in the past devoted himself to supplying certain well-defined markets, a policy which has from many points of view stood him in good stead in the post-war period when costs were high and most foreign buyers were unable to purchase, and the constant fluctuations of the exchanges made fair competition between nation and nation practically an impossibility. The Indian Government, the private railways of India, the Crown Colonies, and, to some extent, the Dominions, have given him a measure of welcome assistance and have enabled him to weather the financial storm.

The recent general improvement has, however, produced a great change, and practically every builder in the country is actively attacking the whole of the South American Continent, European countries outside France, Germany and Italy, and practically the whole of Asia. Technical and commercial agents have been established, directors and managers are making frequent tours, the special requirements of these markets are being studied, and designs to suit the expressed tastes of the authorities concerned are being submitted whether tenders are invited or not.

Recently quite a number of orders have been secured in this way. Russian, Chinese, and small Argentine orders are now on the books and it is confidently expected that at an early date Roumanian and Bulgarian orders will be forthcoming. The policy of building their own stock, which is now observed by the home railway companies, has left the private builders free to devote the whole of their attention to overseas work and has resulted in their being able to give good delivery at reasonable prices, and of the detailed construction required by the foreign buyer.

The results of the operation of these new factors are making themselves apparent at the present moment. It is rumoured, on good authority that the State Railway Department of the Roumanian government is about to place extensive orders for main line locomotives with British builders to the amount of 344.

The price quoted for each engine is £12,000. Negotiations are also known to be proceeding with some prospect of success between a British group and the Roumanian railway authorities for the reconstruction and management of the Roumanian repair shops. Active competition has been put up for the locomotives required for The Sorocabana Railway Co. of Brazil, the Patagonian Railway, the Buenos Aires Docks and the Chilean State Railways, and although the results are not yet known, some of the builders feel that they are likely to secure some of these orders.

An order for 45 locomotives for the New Zealand Railways has recently been secured by the North British Locomotive Co., which has also been receiving several small orders from other quarters, and though for these reasons its order books are fairly full, it is ready and able to entertain further enquiries for later delivery.

The two latest additions to the ranks of British locomotive builders, viz., Sir W. G. Armstrong, Whitworth & Co., and Wm. Beardmore & Co., have been kept extremely busy since converting their works for this purpose and have executed the orders so far received with credit to themselves and British prestige. Excellent reports have been received of the working power of these engines.

"It may be stated in brief," concluded Mr. Field, "that the past month has brought a very favorable turn in the tide of locomotive affairs, and this industry promises to enjoy in the near future a period of prosperity."

INDUSTRIAL

Condon's Ltd., have begun construction of a store and office building on the site of their old building, Barrington Street, Halifax, N. S., recently badly damaged by fire.

Tenders for the erection of a new school building at North Sydney, N. S., are to be in this week and the town council has decided that local labor must be employed except where special technical qualifications cannot be filled by local men. This is with the idea of relieving the local unemployment situation as far as possible.

The Ford-Smith Machine Co., Hamilton, Ont., are at present working on some interesting machines, which are special in character. They are building a machine to make metal lath, also several roll-edge mattress machines, which are made under what is known as the Droll patent. The latter mentioned are for Canadian export trade, and the Ford-Smith Co., are going to make all these machines in Canada.

The group of buildings erected on the Halifax Commons for temporary housing by the relief commission after the great explosion of 1917 has been purchased by a salvage company which is to raze the buildings, sell materials therefrom and erect some dwellings in other parts of the city. The group of relief buildings on the citadel has been purchased for removal by Mr. Patrick and he has men at work on some of them that are now unoccupied, dismantling them in preparation for razing.

The Ford-Smith Machine Co., Hamilton, Ont., are now handling a self-contained grinder and buffer complete with motor, made by the Marathon Electric Mfg., Co., Wausan, Wis,. U. S. A. This grinder is equipped with a ¼ h. p. single phase motor, totally enclosed. It is an alternating current motor for 110 or 220 volt, 60 cycle, service, but a direct current motor can be supplied at slightly added cost.

A 6 x ½ in. abrasive wheel, and 6 x ⅜ in. cotton buff wheel forms part of the equipment, and the machine has a switch in the base. The grinder is fitted with 10 ft. of cord and standard plug ready to attach to any light or power circuit.

The firm of Kelvin, Bottomley & Baird, Glasgow, Scotland, which was founded about fifty years ago by the late Lord Kelvin for the manufacture and sale of navigational instruments, has just established a branch company in Montreal under the name of Kelvin, Bottomley & Baird (Canada) Ltd. The Montreal company will keep a large stock of instruments, and they have secured as manager, Captain Alexander Andrew, who is an expert compass adjuster and navigator, who also carries an Extra Master's Ticket. He is located at the company's offices, No. 111 Commissioners street, Montreal, and will always be at the service of vessels coming to the port. Drummond, McCall & Co., have until the present acted as agents for Kelvin, Bottomley & Baird, and they will continue to be intimately connected with the new company. Mr. J. T. McCall will be president, and associated with him are Mr. M. B. Field of the Glasgow Company, and Mr. Wilfred O. White of Boston.

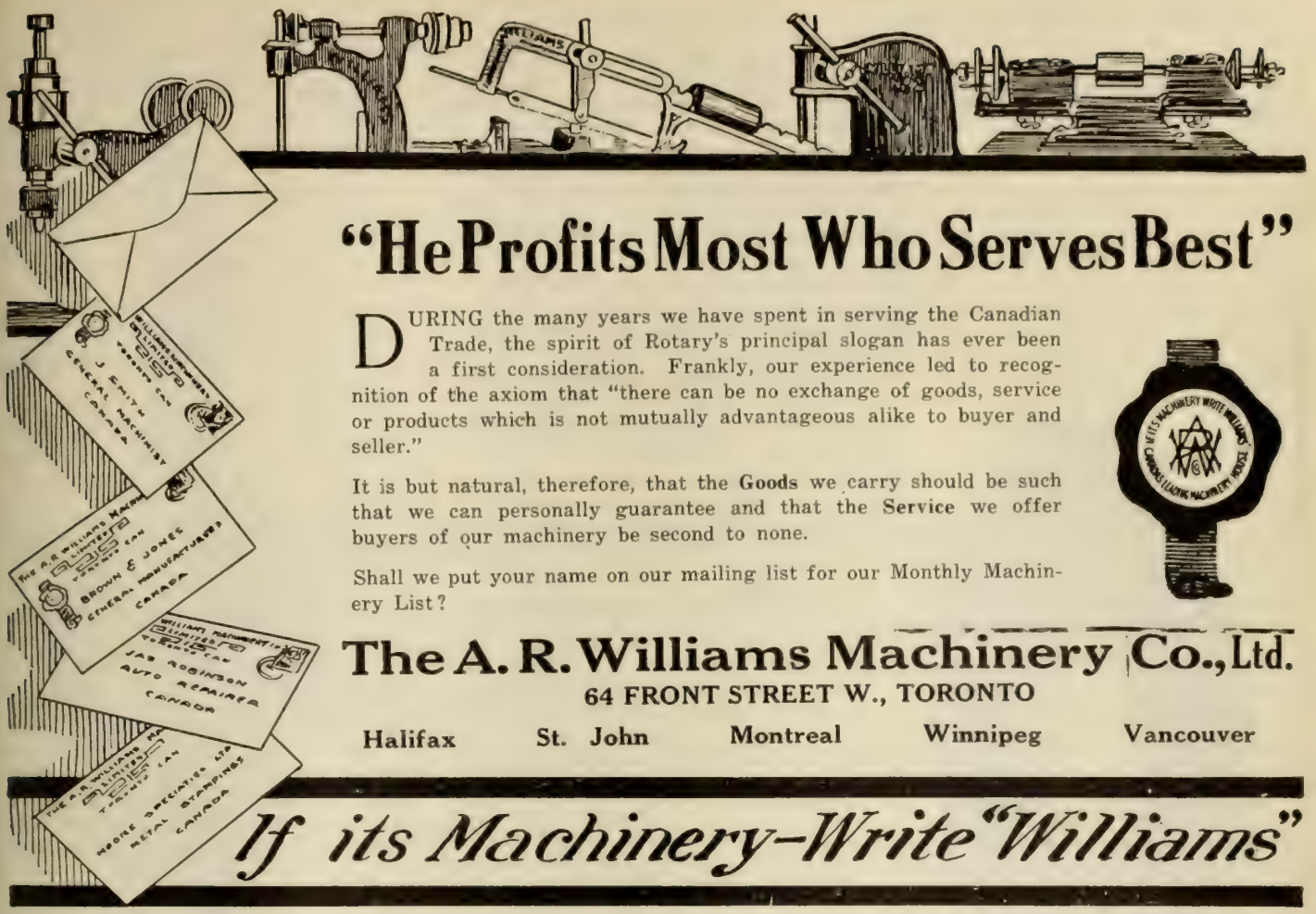
W. H. Coverdale has been appointed president of the Canada Steamship Lines. He has already left on a personal inspection of the company's properties to familiarize himself with all the details of the company's operations and various activities.

Mr. Coverdale is partner of Coverdale and Colpitts, consulting engineers, but now intends to spend a large part of his time in Montreal during the season of navigation. He is a former Canadian, is deeply interested in the development of the Dominion's resources, and believes that one of the most effective ways of attaining that end is the provision of efficient means of transportation, both by land and water.

He is also chairman of the board of directors of the Pittsburg and West Virginia Railway company and of the Pittsburg Terminal Railway and Coal company, a director and member of the executive committee of the Gulf State Steel company, of Chicago and Eastern Illinois Railway company, and of Gulf, Mobile and Northern Railway company

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For plane surface grinding, single grain, or what are known as "straight grain" wheels are used, because such wheels are more open grained than combination wheels, and consequently there is more room between the grains for the removal of chips.



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DURING the many years we have spent in serving the Canadian Trade, the spirit of Rotary's principal slogan has ever been a first consideration. Frankly, our experience led to recognition of the axiom that "there can be no exchange of goods, service or products which is not mutually advantageous alike to buyer and seller."

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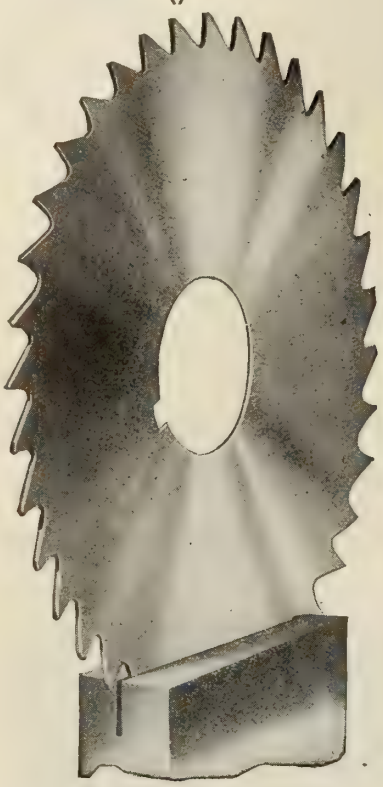
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In many Machine Shops and Metal Working Industries the Simonds Metal Slitter is used as a universal saw. It is a high-grade saw, made of exceptionally tough steel, hardened and tempered to the proper degree for efficient cutting.

Write for catalog and prices.

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DESIRE INFORMATION

This is a period when everybody is looking for new channels through which to dispose of their goods. The Commercial Intelligence Journal, a weekly publication of the department of trade and commerce at Ottawa, secures from time to time, enquiries for Canadian products, and for convenience of classification gives each of these enquiries a key number. We have compiled several which will interest our readers, and when following these up, write direct to Ottawa, mentioning the key number, thus avoiding delay.

4661. **Machinery and tools.**—A firm of machinery merchants in Malö is desirous of importing all machinery for iron, steel and woodworking purposes; also pipes, pumps, sanitary goods, elevating goods, transportation goods, railway materials, rolling stock, small tools of all kinds, belting, fixtures, oil, greases, hardware, casters and machine tools.

4669. **Machinery, tools and supplies.**—A large firm in Copenhagen are interested in importing all kinds of machinery, tools and supplies, for metal work, iron foundries, and machine shops, as well as woodworking plants; also tinsmiths' tools, belting transmission and sharpening wheels, and all similar products, in which they have an old and established connection.

4671. **Machinery.**—A Norwegian concern wants to have the sole selling rights for Norway for a Canadian firm in a position to export all kinds of woodworking and metal working machinery.

4662. **Machine Tools.**—A firm of machinery merchants in Copenhagen are open to import machine tools of all kinds.

4663. **Hand Tools.**— A Copenhagen firm desire quotations for hand tools for mechanics: pincers, pliers, hammers, taps, dies and drills.

4664. **Pumps.**—Canadian manufacturers of pumps, especially centrifugal and triplex pumps, should send catalogues and prices to a Copenhagen house.

4665. **Machinery supplies and machines**—A Stockholm firm are interested in sole agencies for Sweden for machinery supplies and machines.

4666. **Woodworking machine tools.**—A firm in Sweden are desirous of representing a Canadian firm in a position to export woodworking machine tools; also mechanical steel working tools.

4668. **Belting, leather, rubber, cotton, etc.,** are demanded by a firm in Stockholm.

4620. **Agricultural implements.**— A firm in Goteburg would like to hear from a Canadian exporter of hay forks, 2 and 3 prong, manure forks, 4, 5 and 6 prong, and spreading forks with 4 prongs; also shovels and rakes (iron), with 12, 14 and 16 prongs, and wooden grass rakes with 24 prongs.

4627. **Agricultural implements.**—A firm of hardware merchants in Copenhagen would be glad to have catalogues and prices from Canadian exporters of agricultural implements.

4628. **Agricultural implements.**— A Swedish importer desires to import hay forks, 2, 3, and 4 prongs, mangle forks, 4 and 5 prongs, manure forks, 4 and 5 prongs, rakes (iron), 10, 12, 14, 16 prongs, and wooden rakes, 10 prongs and larger.

4672. **Tools, etc.**—A Christiania concern desires to import all kinds of tools, as electric and pneumatic tools, etc.; also belting, steam pumps, fans, transmission ropes, packings, etc.

4673. **Tools.**—Canadian manufacturers of files, hammers, pliers, etc., should send catalogues and price-lists to a firm in Copenhagen.

4670. **Mechanics' tools and machinery.**—A Norwegian concern would like to import mechanics' tools and machinery, also rails up to 12 kilogrammes per metre.

4654. **Leather belts.**— Established manufacturers' representative in Jamaica wishes to receive offers from Canadian manufacturers of leather belts. He reports a fair demand for the above-mentioned commodity, and if prices are right, he can supplant considerable United States supplies.

4655. **Tubular wheelbarrows.**—A Johannesburg firm of hardware manufacturers' agents are looking out for a manufacturer of tubular wheelbarrows, with a view of representation in South America on a commission basis. All business transacted to go through a shipping house of repute.

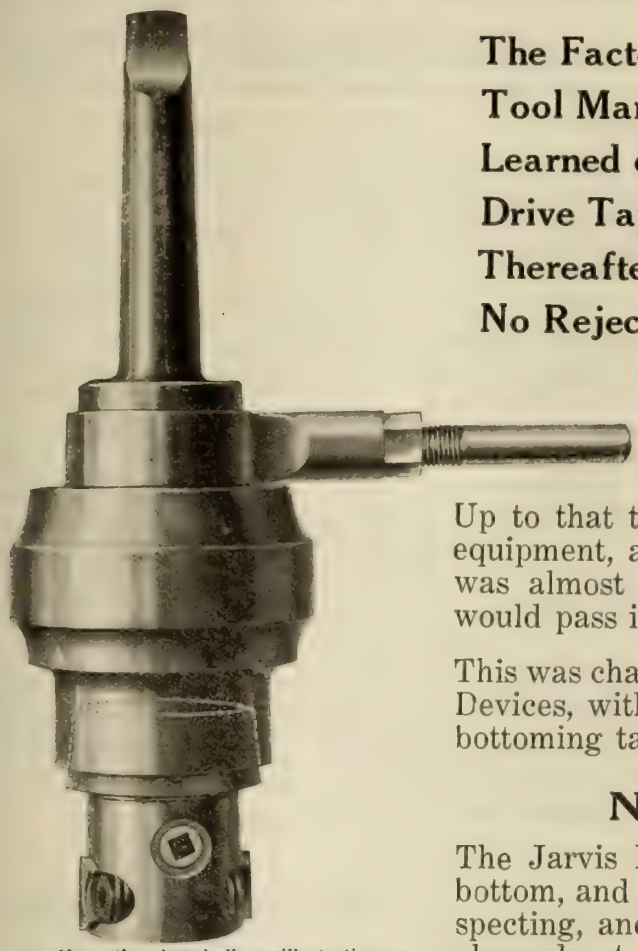
4656. **Wrapping paper and paper bags.**—A Cape Town firm, with branches in all centres of the Union and Rhodesia, make enquiry for the representation of Canadian wrapping paper and paper bags.

4658. **Zinc spelter.**— A Japanese firm in Yokohama, is anxious to receive quotations on zinc spelter, 98 and 99 per cent. This firm advise that they can use about 100 tons per month, and wish to import direct from Canadian producers.

4659. **Open hearth steel ingots.**—A responsible foreign firm of long standing is in the market for 24,000 tons of open hearth steel ingots. Delivery 2,000 per month. Quotations desired immediately.

No degree of care can eliminate every possibility of danger from grinding wheels revolving at a high speed. If there is an unknown defect there may be some interruption say a sudden jamming—that may result in a bursting of the wheel. Against an accident of that kind the wheel should have guards. These are usually in the form of protection hoods strong enough to arrest the broken fragments. Only sufficient surface of the wheel should be left to permit of operations. The remainder should be carefully hooded. An expanding or contracting rim provides a useful method of regulating the aperture. Of course, the hood should be of robust construction, with a secure connection to the floor. It may have to be removed for some jobs, in which cases flanges of some kind are indispensable.

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SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

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FORTY TONS BAYONET STEEL $1\frac{1}{8}$ x 5-16

Will sell whole or part, write for samples

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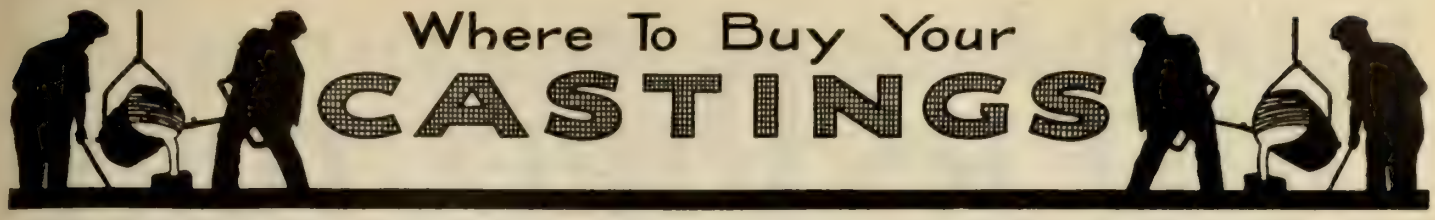
Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

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Dominion Engineering Works, Limited
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Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

HANNA

HANNA

M.A. HANNA & CO.

Chicago Toronto Cincinnati
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Philadelphia New York Toledo
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Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it . Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
National Electro Products Co., Ltd.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Pritain, Conn.

BABBITT METAL
Canada Metal Co., Toronto., Ont.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, DIE-CAST
Fisher Motor Co., Ltd., Orillia, Ont.

BEARINGS, JOURNAL
Fisher Motor Co., Ltd., Orillia, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.

BELT FASTENERS
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Company, Waterbury, Conn.

BELT LACING
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont.
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

BRONZE, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

See "WHERE TO BUY YOUR CASTINGS" Section. Page number may be found by turning to Advertisers' Index.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

BLOCKS, PILLOW
Can. Link-Pelt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Beardmore & Co., Ltd., Wm., Montreal, Que.
Goldie & McCulloch Co., Ltd., Galt, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

BUSHINGS
Fisher Motor Co., Ltd., Orillia, Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg., Co., Jersey City, N.J...

CEMENTS, IRON
CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Aikenhead-Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Pritain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

BUYERS' DIRECTORY

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence,
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago, Ill.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.

CLUTCHES, FRICTION
Can. Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can.-Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., land, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS, CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can.-Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

CRANES, TRAVELING
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCH-LIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond Stephan Co., Hamilton.
Wheel Trueing Tool Co., Windsor, Ont

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendley Machine Co., Torrington Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton
Wheel Trueing Tool Co., Windsor, Ont

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John, Dundas, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W. Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, COMBINATION CENTRE
Preston & Schwartz, Galt, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc. E.C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W. Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

BUYERS' DIRECTORY

FITTINGS, PIPE
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill.

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.
National Electro Products Co., Ltd.,

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton,

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R. Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES, LAPWELDED
Beardmore & Co., Ltd., Wm., Montreal, Que.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto, Ont.

CRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto. Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Pliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. P., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

HYDROGEN
National Electro Products, Ltd., Toronto, Ont.

HYDROGENATING PLANTS
National Electro Products, Ltd., Toronto, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

BUYERS' DIRECTORY

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg Co., Muskegon, Mich.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drauw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co. ,Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Prybil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Can Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O.

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine S rew Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can, Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATES, BOILER AND SHEET
Beardmore & Co., Ltd., Wm., Montreal, Que.

PNEUMATIC TOOLS
Beardmore & Co., Ltd., Wm. Montreal.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass
Brown & Sharpe Mfg. Co., Providence.
Prybil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilon.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hmilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Pitt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence.
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound, Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, CENTRIFUGAL
Beardmore & Co., Ltd., Wm., Montreal

BUYERS' DIRECTORY

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchner
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, SEMI-ROTARY WING
Beardmore & Co., Ltd., Wm., Montreal.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown, Boggs & Co., Ltd., Hamilton,
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Pertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Buterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N.Y.

RECORDERS, TIME
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Fittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Mchinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Pulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Manteral, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E.C., Indianapolis.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Manteral, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, MILLING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Islnad, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Islnad, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, One.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Moutreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SECTIONS, SHIP AND BOILER
Beardmore & Co., Ltd., Wm., Montreal, Que.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS, HAND
Can. Blower & Forge Co., Ltd., Kitchener.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Pertrams, Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

SHEETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B.A. AND BLUE ANNEALED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Prown Engineering Corp., Ltd., Toronto.
Bisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Pryibil Machine Co., P., New York City.

SPRINGS, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Q.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS, TOOL
British Empire Steel Co., Montreal, Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL CASTINGS
Beardmore & Co., Ltd., Wm., Montreal.

STEEL, CRUCIBLE, SPRING
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

STEEL FORGINGS
Beardmore & Co., Ltd., Wm., Montreal.

SHEETS, OPEN HEARTH STEEL
Steel Co. of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Beardmore & Co., Ltd., Wm., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

STEELS, ALLOY, OPEN HEARTH AND ELECTRIC
United Alloy Steel Corp., Canton, Ohio.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can. Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

STEEL, MAGNET
Vanadium Alloys Steel, Latrobe, Pa.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

STUD SETTERS, SELF-OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E.C., Indianapolis, I

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.
Toronto Iron Works, Toronto, Ont.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule, Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Putterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwart, Ltd., Galt, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die, Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwartz, Galt, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

TOOL WORK
Brown Engineering Corp. Ltd., Toronto, Ontario.

TORCHES, BLOW
National Electric Products, Ltd., Toronto, Ontario.
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound,
Petrie, Ltd., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.

TREATED BITS
Vanadium Alloys Steel, Latrobe, Pa.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd. Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

TURRETS, TOOL POST
Gisholt Machine Co., Madison, Wis.

TYRES
Beardmore & Co., Ltd., Wm., Montreal, Que.

UNIONS, PIPE
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meridan, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meridan, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

VISES, WOOD WORKERS'
Charles Parker Co., Meridan, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Toronto, Ont.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominon Oxygen Co., Ltd., Toronto, Ont.
National Electro Products Co., Ltd.

WELDING APPARATUS
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd., Toronto, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd., Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Canada Metal Co., Ltd., Toronto, Ont.
Carter Metal Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd. Toronto.
Liquide Air Company, Toronto, Ont.
National Electro Products Co., Ltd., Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd., Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Q.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE LEAD
Canada Metal Co., Ltd., Toronto, Ont

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.
Shuster Co., F. B., New Haven, Conn.

WIRE, WELDING
Canada Metal Co., Toronto, Ont.
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto,
National Electro Products, Ltd., Toronto

WIRES, SPECIAL
Canada Metal Co., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Weland, Ont.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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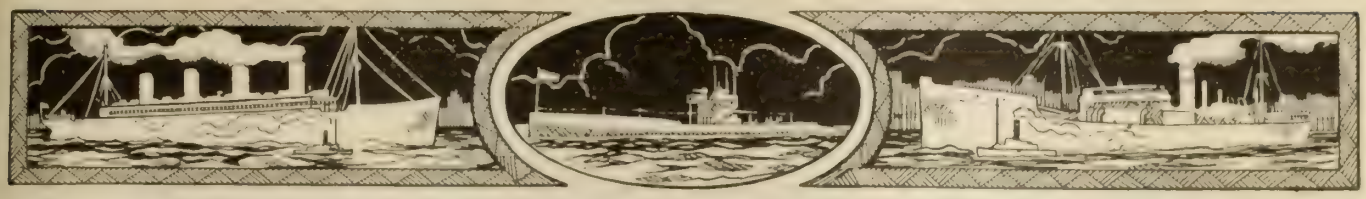
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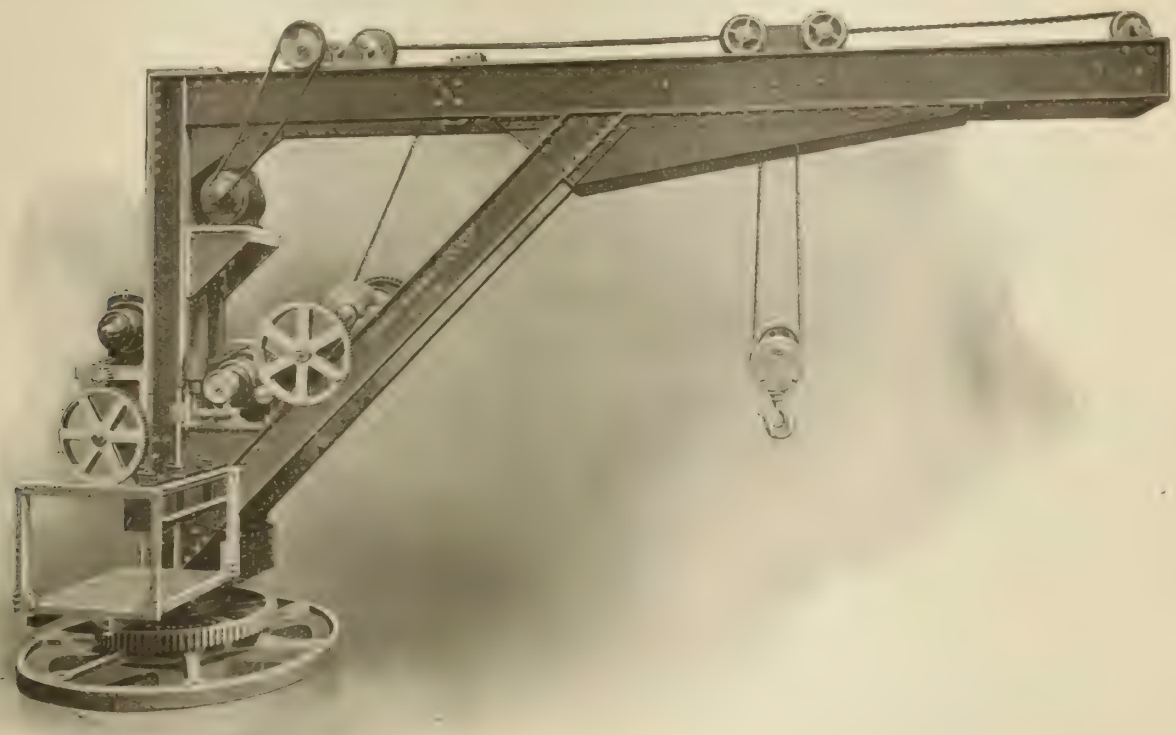
HYDRAULIC ENGINEERING SPECIALISTS

LEEDS, England

Codes: A.I., A.B.C. (5th Edition), Engineering, Everybody's Pocket Code, Marconi International.

Canadian Fairbanks-Morse Co., Ltd.

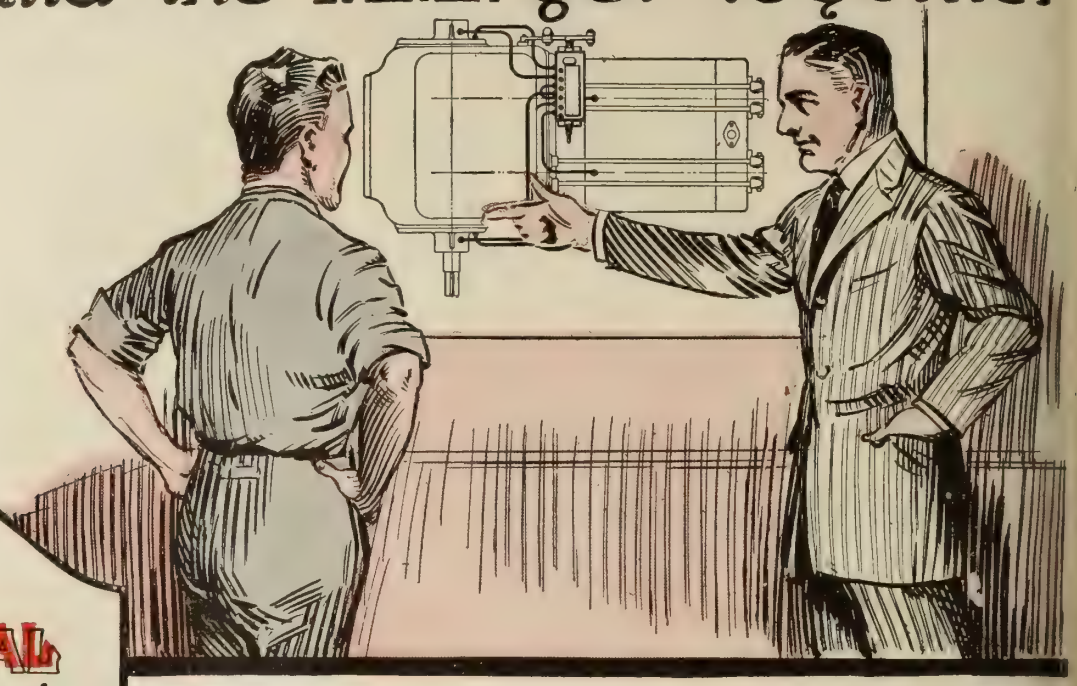
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VARIOUS TYPES AND SIZES
OF
ELECTRICALLY DRIVEN JIB CRANES



The P.E. and the I.L.E. get together



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Two heads beat one—that's why Plant Engineers so often call in the Imperial Lubrication Engineer when they are confronted by difficult lubrication problems or want to get to the bottom of an old trouble.

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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVII. No. 22 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | June 1, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

What Are You Waiting For?

A study of charts, reports and general statistical data clearly shows that business is coming back—slowly it is true, but very certainly.

Many manufacturers, financial men and others have long since accepted the inevitable, realizing that business, having hit the bottom, is not going to immediately rebound to pre-depression levels. Business rolled downhill with considerable speed and force, but it gathered no momentum for the uphill journey. It will require a steady pull and lots of power to climb out of the valley and up the slope to the next peak.

There's going to be no quick-cure for present industrial ills. Good exercise and a good diet is required. The arteries of your business may have commenced to harden, blood pressure may be high and your reserve force low. The healthy exercise of hustling for orders will do a lot to restore health and advertising will supply the vital vitamines.

There's no use waiting like Micawber for something to turn up. We are living to-day just about where we left off in 1914 to go to war. The four or five years of easy-come, easy-go have got to be forgotten. They were abnormal, freak years — by-products of the world's greatest upheaval. Forget their sales records—their profits.

When business comes back it's going to be chummy with the man who goes out to meet it. If you need equipment to enable you to manufacture more efficiently—buy it. If you have something to sell—go out and sell it. Get back of your salesmen and convince them that the time for waiting is past. Give them, particularly, the encouragement and inspiration that good advertising always gives.

Canadian Machinery and Manufacturing News
153 University Avenue **Toronto, Canada**

KAELIN ELECTRIC STEAM GENERATORS

Their Field

Any mill or factory developing its own power which has surplus electric energy during the whole or any considerable part of the day.

Any mill or factory operating on bought power purchased on a "flat rate" basis, but which is not using all the power allotted to it.

Capacities

These Electric Steam Generators are built in sizes from 600 to 25,000 K.W., corresponding approximately to 60 to 2,500 Boiler horsepower.

They can be operated by alternating current only, and are built for voltages varying from 550 to 12,000.

Advantages

Their first cost including installation is low compared with any type of coal or oil-fired boiler plant.

They are safe, clean, easily regulated, require but little attendance and take up very small floor space.

They can be operated in parallel with existing boilers or can be installed close to their work.

Information and prices promptly submitted on receipt of particulars as to your conditions.

Telephone: MELROSE 700

Dominion Engineering Works Limited

Cable Address "Domworks Montreal"

MONTREAL, CANADA

R. F. MATHER, Western Representative, London Bldg., Vancouver, B. C.

The Reason for .000,005" Accuracy

Every gage you use, whether it's a master, inspection or a working gage, is based on some standard of measurement. If this basis of measurement is a set of gage blocks, built-up to form various dimensions, the nearer those blocks individually are to absolute accuracy, the smaller the errors in the built-up stacks.

That's why Hoke gages are made and **guaranteed** accurate to within five-millionths of an inch. They give you a basis to work from that practically eliminates error at the start and ensures closest possible accuracy in your gages and in all the measuring you do with them.

Even though shop tolerances are usually to thousandths, gages set to Hoke block "millionth of an inch" accuracy are bound to be more accurate — and keep your work more accurate — than when set to other standards.

And remember this, Hoke Gages cost no more than other high-class gage blocks of less guaranteed accuracy. They are so reasonable in price that any shop can well afford a set. They're sold singly, too, or in sets of 5, 10, 34 and 81 blocks

The Hoke Gage Catalogue should be in your reference library—it's yours for the asking.

PRATT & WHITNEY COMPANY OF CANADA, LIMITED

Works : Dundas, Ontario

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723 Drummond Bldg.	32 Front St. West	103½ Sandwich St.
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355

HOKE

PRATT & WHITNEY

PRECISION GAGES

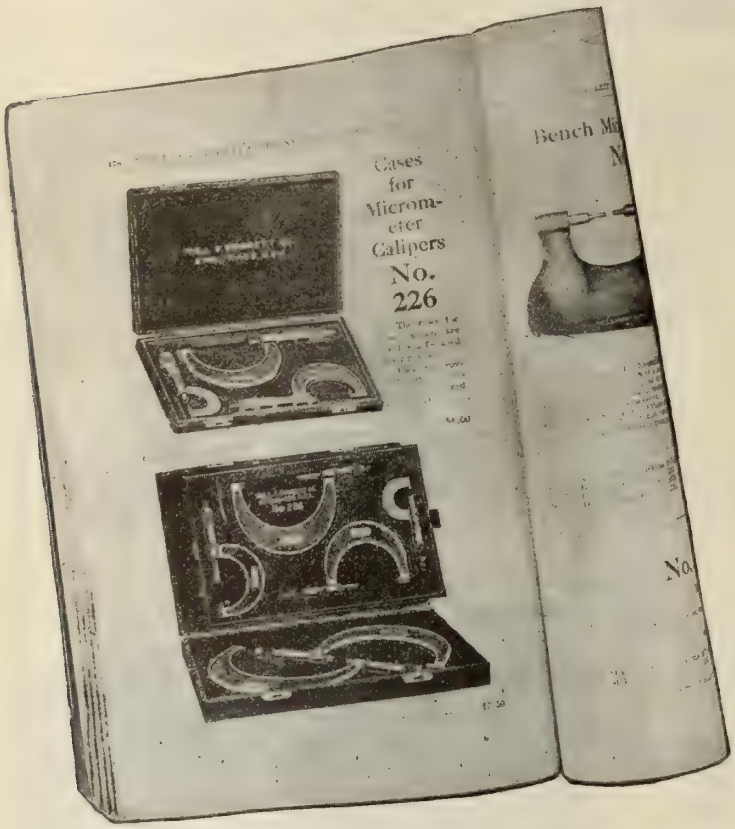
Laboratory Accuracy at a Toolroom Price



The 81-block set shown here will handle measurements between .200 in. to over 10 inches by increments of .0001 in.

Sets of 103, 85, 34 and 5 blocks are also sold and single blocks or any combination of standard blocks can be bought, if desired.

Have You Seen These Tools?



MICROMETER CALIPER SET
No. 226 L

Four Starrett Micrometer Calipers reading to ten-thousandths—sizes 1-inch, 2-inch, 3-inch and 4-inch. The sizes included afford sufficient capacity to cover a very wide range of work. Each of the four micrometers in the set is equipped with the Starrett lock nut and ratchet stop. Details of this and other sets of Starrett Micrometer Calipers are given on pages 172 and 173 of the new Starrett Catalog No. 22 "3" If you have no copy of this catalog at hand, we will gladly send you one free. Write for it.



42-325

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hack Saws Unexcelled

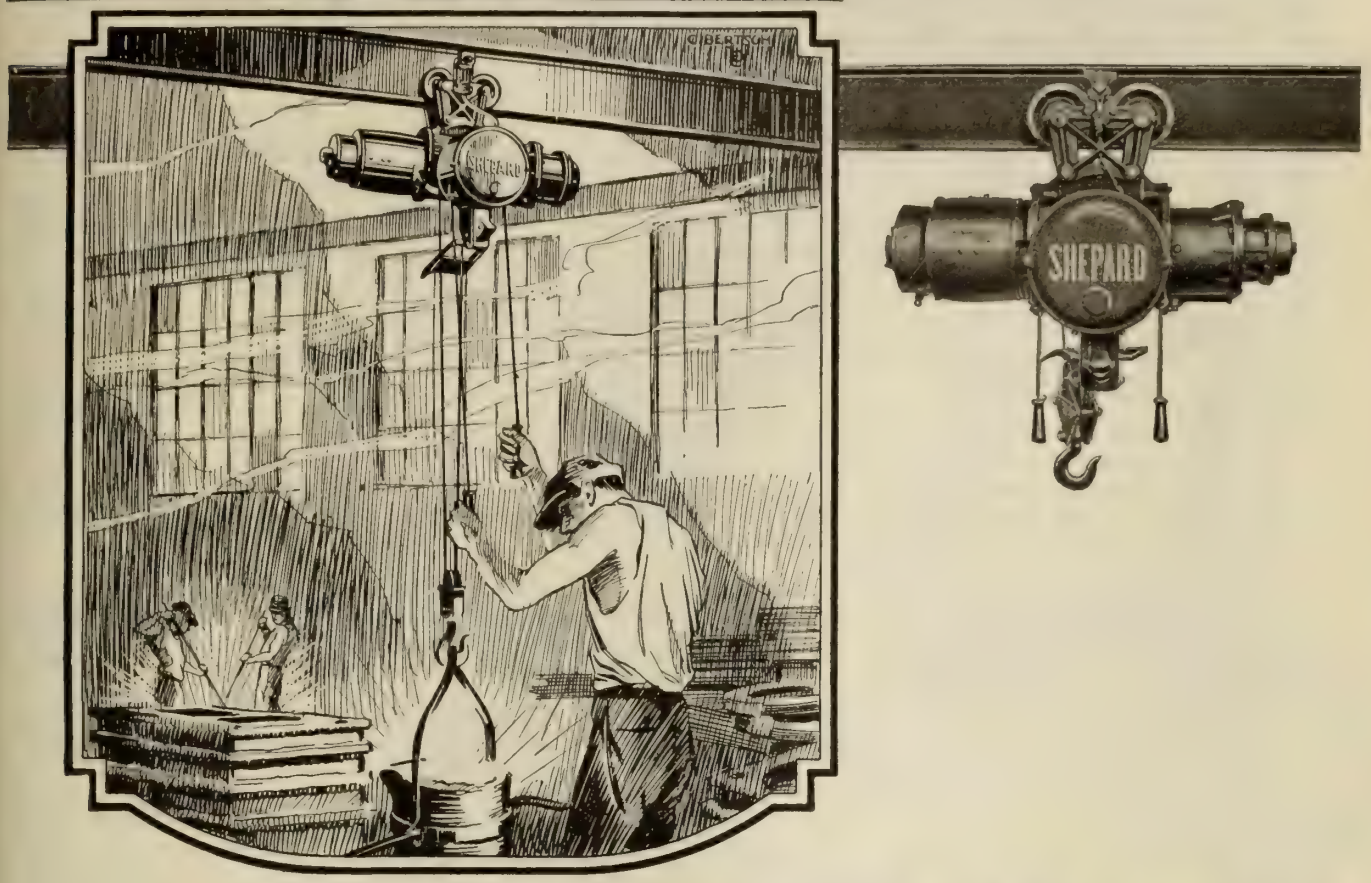
ATHOL, MASS.

Every man interested in fine tools should have a copy of the Supplement to the Starrett Catalog. Send for this Supplement showing the latest additions to the Starrett line.

STARRETT TOOLS — STARRETT HACK-SAWS CUT QUICKER LAST LONGER

Use Starrett Tools

THE SHEPARD ELECTRIC LIFTABOUT



For Precision of Control

A CHANGE in elevation of only a few inches; slight shift to right or left. All accurate and exacting work is possible with a *LIFTABOUT*, for it is always instantly responsive to its operator. In the foundry this new and smaller electric hoist with foundry control is adaptable to every lifting and conveying job—the precise work of pouring crucibles, handling patterns, flasks, casting, and lowering copes, as well as general rehandling in and around the plant.

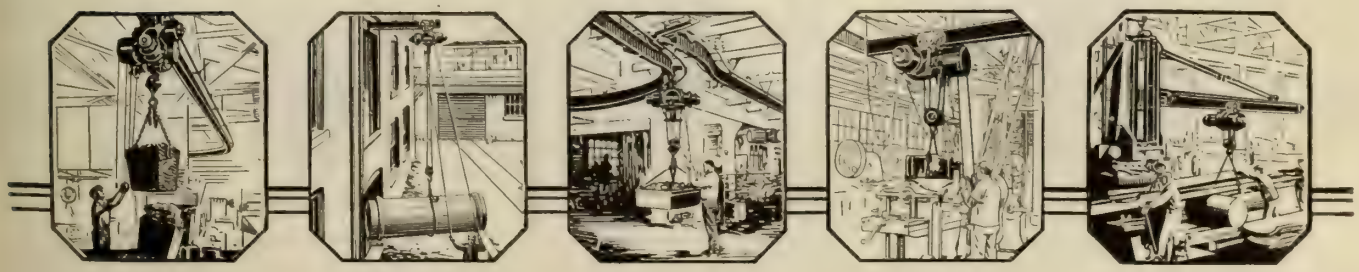
A *LIFTABOUT* and one man, its operator, provide a perfect combination of speed and precision, which performs necessary handling work in less time and with far more efficiency than is possible by manual methods. All parts, both mechanical and electrical, are protected from dirt, dampness and fumes by tight metal housings.

Now is the time to scrutinize your load moving costs, to "weed out" inefficiency and to slash overhead costs. The *LIFTABOUT* method for lifting, carrying and putting down loads could not be offered at a more opportune time. It effects savings in time, labor and money that make it a paying investment from the very first day of installation. Due to quantity production and standardized manufacture, it is surprisingly low in cost.

Investigate *LIFTABOUT* economies for your plant. Shepard Engineers will gladly acquaint you with its many advantages.

Shepard also builds electric cranes and hoists in capacities to 30 tons.

Shepard Electric Crane & Hoist Co.
426 Schuyler Ave., Montour Falls, N. Y.
Branches in principal cities
Member Electric Hoist Mfrs.' Assn.



Increase the Consumer's Interest

Create a Livelier Demand for Machine Shop, Power House and Foundry Equipment

ARE you manufacturing equipment for Machine Shops, Metal Working Plants, Power Plants and Foundries? Does the consumer know your products? Does he know their quality sufficiently to insist upon getting them when he places an order with his hardware dealer? Carefully weigh these questions. Then consider the advisability of reaching the consumer through the columns of MacLean Technical Newspapers. You can probably use one of the following group.

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POWER HOUSE—published twice a month, serving steam, electrical, water and gas power plants, in addition to refrigeration plants, in all parts of Canada. It, too, reaches the men who buy equipment; it, too, is the leading authority of the Dominion in things pertaining to its field.

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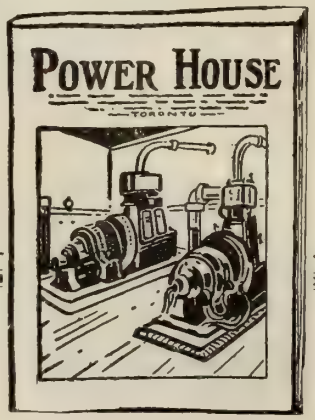
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Complete Small Tool Equipment for Every Industry



GTD QUALITY—

the Kind that Endures and Performs

The quality of tooling equipment and measuring devices often has a more important bearing on output than the machines on which they are used. In this connection the accuracy, convenience and stamina of GTD small tools for machining and measuring show to advantage.

The "Acorn" Die, the "Gun" Tap (the original spiral pointed tap) GTD *High Speed* Screw Slotting Cutters, GTD Limit Snap Gages, the GTD Special Oil Drill and the GTD Adjustable Reamer are a few special tools known wherever high production requires the best tooling equipment.

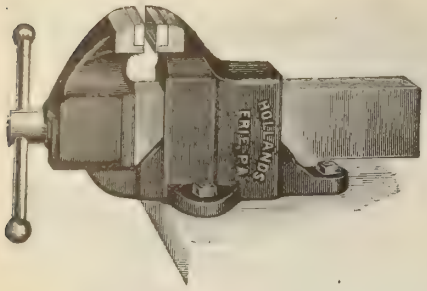
The quality and remarkable performance of these special tools, we believe to be a very fair index of the excellence of our *standard* threading tools, drills, reamers, etc., stocks of which are available all over the country.

We can give you *concrete samples* of GTD tool performance on production jobs in metals varying from soft brass, through cast iron to monel metal and vanadium steel, all of which will show you that GTD can furnish the proper tool to give the maximum results on *your particular job.*

May we send you our new No. 46A catalog? Your copy is ready *now.*

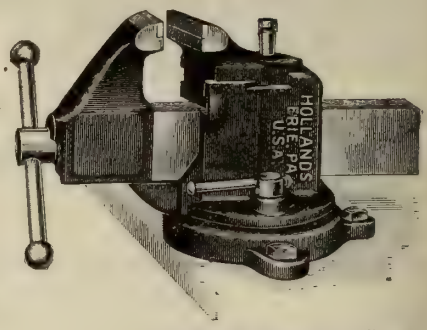
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Have a record of thirty-five years of satisfactory service.

If your dealer cannot supply you, write direct for circular No. 25.



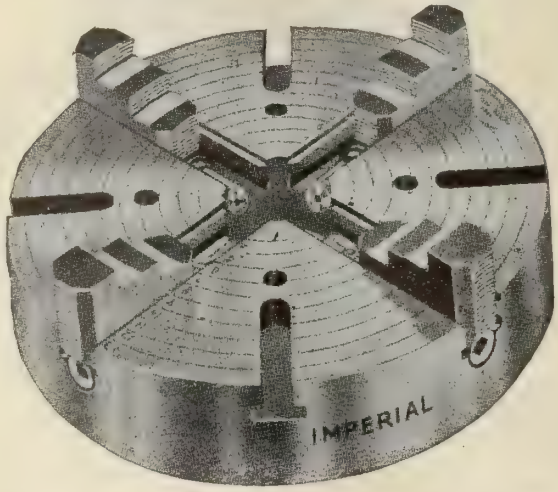
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Sturdy long-wearing "Made-in-Canada" Chucks that are making good everywhere. Specify them in your next order.

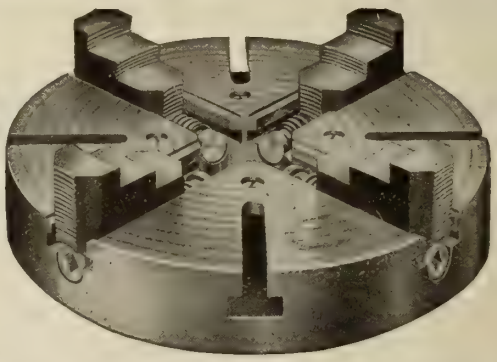


Ker & Goodwin Machinery Co.
BRANTFORD, Ont. LIMITED

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.

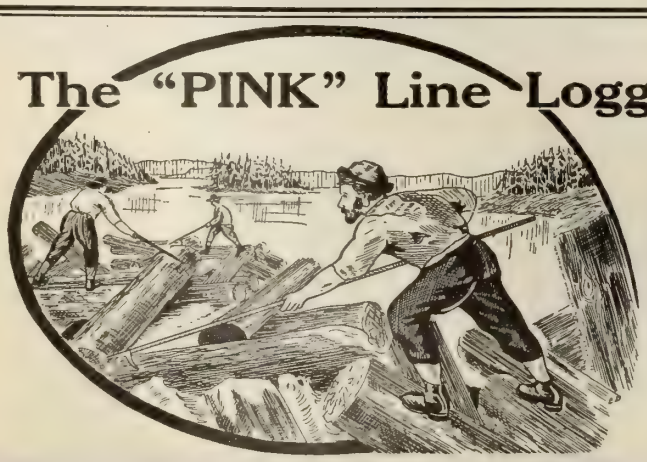


THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

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New Britain, Conn.
New York Office: 26 Cortlandt Street
Makers of a complete line of chucks

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MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

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We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited
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THE MORSE CHAIN CO.

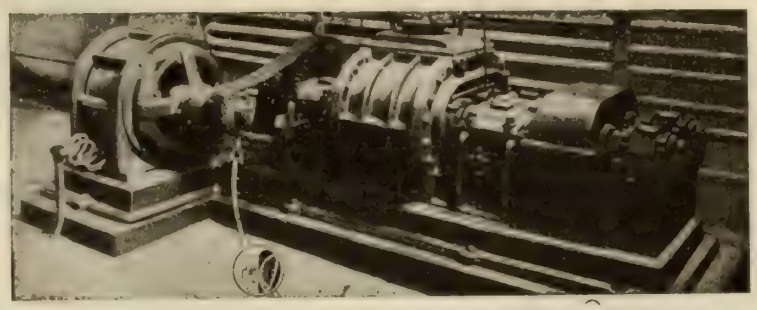
are the
Largest Manufacturers in the world
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High Speed Silent Chains

The superiority of Morse Rocker Joint Silent Chain has never been seriously questioned.

They speed up production, cut belt expense and overtime wages.

Catalogue Free.

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—The Reliable
POWER PRESS

Cranks Built from Solid Forgings. Long Strokes.

This press has a reputation for long service. It must conform to a definite standard for strength. There are no inherent weaknesses. Quick adjustability is a feature.

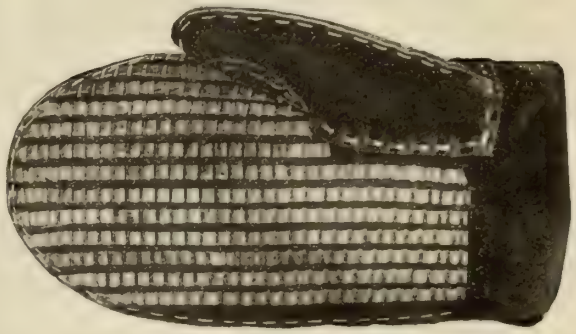
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Engineers and Iron Founders

18-60 VAN HORNE STREET, TORONTO, ONT.

Hand Protection

Means Better Work



Mitten Style No. 681

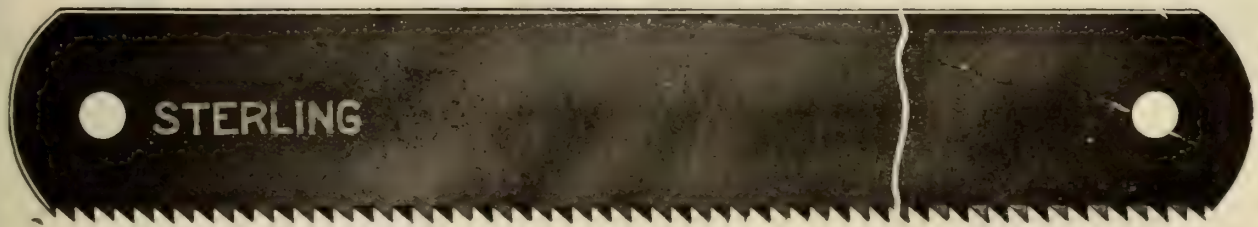
Steel-Grip WORK MITTENS

and work gloves give complete hand **protection** plus hand **comfort.** The same reinforcement (small steel ribbons over strips of tough leather) that protects the hand also gives so much extra wear that these mittens and gloves last almost indefinitely. Sewed closed with steel thread, they are absolutely rip-proof. The steel reinforcement does not interfere with flexibility. Your workmen equipped with Steel-Grips will dig in with a will.

Write us to-day for suggestions on your hand protection problems. We can save you money on your work glove purchases.

Industrial Gloves Corporation
424 Wellington St., W., Toronto

HACK "STERLING" SAWS

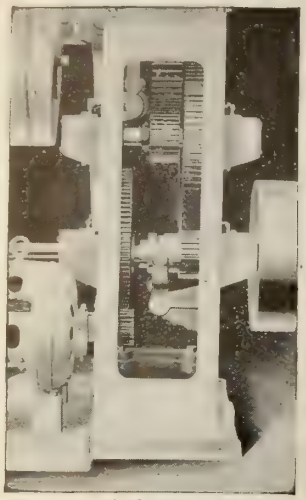


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THE JOHNSON FRICTION CLUTCH

IS USED ON THE

PEERLESS DOUGH MIXER



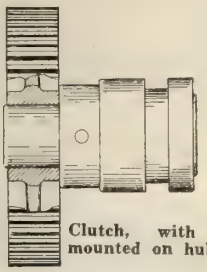
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Lubrication is a necessity for all running bearings and frictions and an occasional application is all that is necessary.

Adjustment of the Johnson friction clutch is simple. A small screw moves two taper blocks in toggle levers, giving greater expansion to ring — thus more gripping power.

The Johnson friction clutch is a small, compact and very powerful device for machinery of all kinds where medium or light power is transmitted.



Clutch, with gear mounted on hub.

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STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
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Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED

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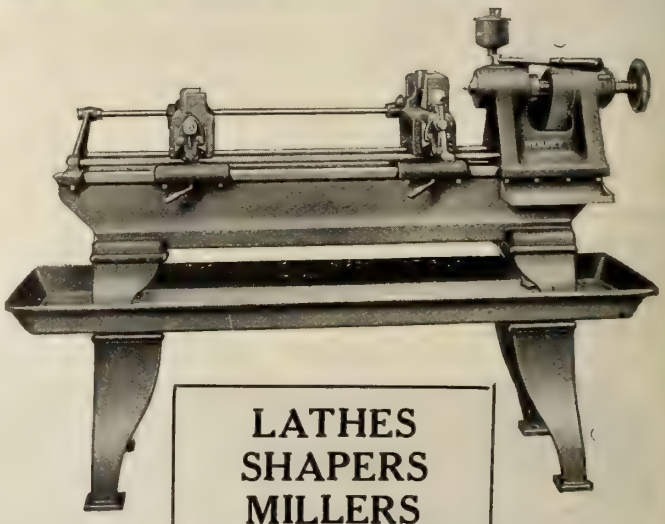
ESTABLISHED 1860

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Centering Machine Cuts Costs

You know that the name Hendey on any tool means fast, accurate, low-cost production. Here we have it applied to a 4-inch Single Spindle Centering Machine.

Will center a finished bar within .001" of dead center. Also made in double spindle pattern for centering both ends of short shafts in one operation.



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ELECTRIC WELDING MACHINES



The Cost-Reducing Method

THE most economical and effective method. Is displacing the slow and expensive riveting methods. Our Canadian-made Welders will give you the highest service, for we are here to follow our sales with Service.

Illustration shows our standard Spot Welder, adaptable for all classes of Spot and Lap welding up to 1 ¼" thick.

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WIRE
BARNES CANADIAN SPRINGS
STEEL
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Precision





Springs



Best Grade Flat Tempered and Annealed Spring Steel; Phosphor Bronze, Music, Brass and Tempered Spring Wire

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POCKET-IN-HEAD RIVETER

A high speed Riveter that cuts cost of operation and speeds delivery.

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Boilermakers like the Cleveland as their product demands tight rivets.

The---- Lightest Fastest and Hardest Hitting Hammer

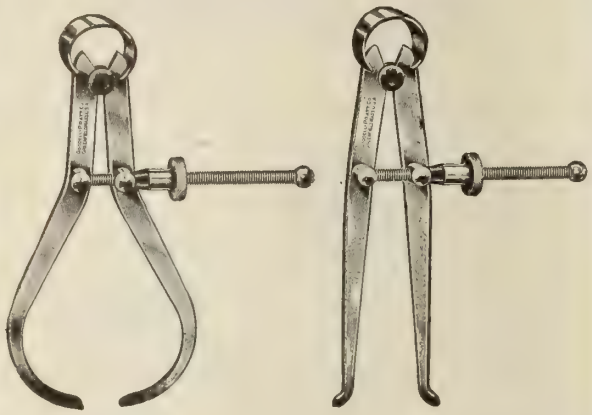
Every Rivet Is A Tight Rivet

CLEVELAND PNEUMATIC TOOL CO. OF CANADA LIMITED
84 Chestnut St., TORONTO,--337 Craig St. W., MONTREAL

GOODELL-PRATT

1500 GOOD TOOLS

We Welcome Any Kind of Tests for Accuracy



You may be prejudiced about machinists' tools, but standards are not. If you give our precision tools the most exacting tests for accuracy in comparison with other makes, the results will be more convincing than any words of ours.

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Look at Goodell-Pratt Calipers, each one has well-proportioned legs of tempered steel—we don't make soft ones. The points are well shaped and come together accurately. The springs are strong and screws are smooth and even. Quick nuts work freely and do not bind.

If you are proud to own good tools write for "Tools for the Toolmaker"

Goodell-Pratt Company

Toolsmiths

Greenfield Mass., U. S. A.

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You can depend upon



THE dependable qualities of RAYMOND SPRINGS are due, primarily, to our excellent facilities for scientific heat-treatment—facilities that are unsurpassed anywhere

Our line includes Extension, Compression and Torsion Springs; Shapes; Oil Rings; of Carbon Steel, Vanadium Steel, Brass, Phosphor Bronze, of Round, Square or Flat material. Send for catalogue.

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HEAVY FORGINGS

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Up to
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Machine Finished

Send Blue Prints for Prices
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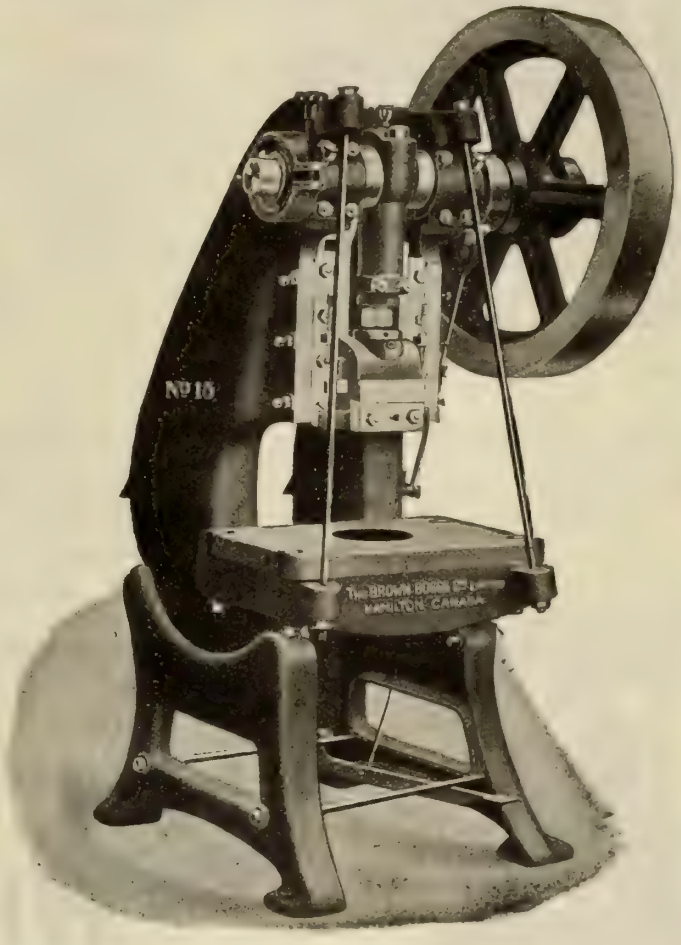
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B B

Make Sure of the "B-B" Trade Mark

It is a Guarantee of Reliability



The "B-B" trade mark on power presses, shears, tinsmiths' tools and canners' evaporators, and sheet metal working tools of every description, is an iron-clad guarantee that it will give satisfaction on the work for which it is built. And because every tool before it leaves the factory is rigidly tested, we **know** that its merit is beyond question.

We shall be glad to send you catalogs fully describing those machines in which you are interested.

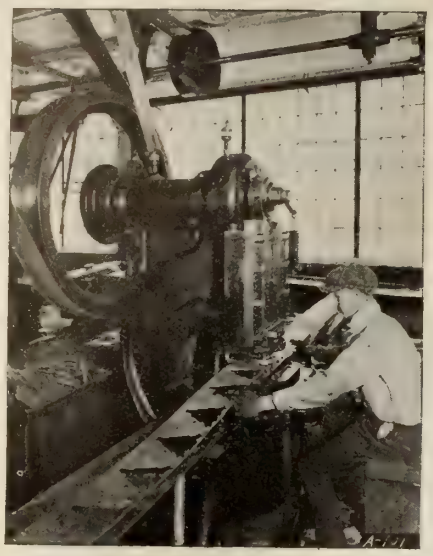
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HAMILTON, CANADA.

SHEET METAL WORKING MACHINERY

BLISS



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"STILES" PUNCHING PRESSES

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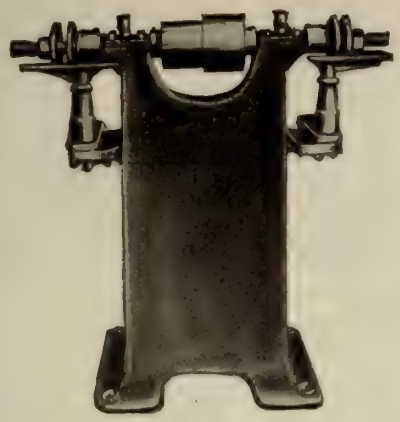
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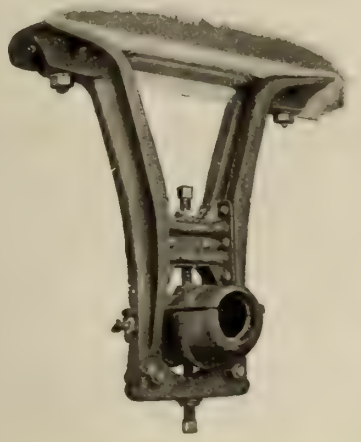


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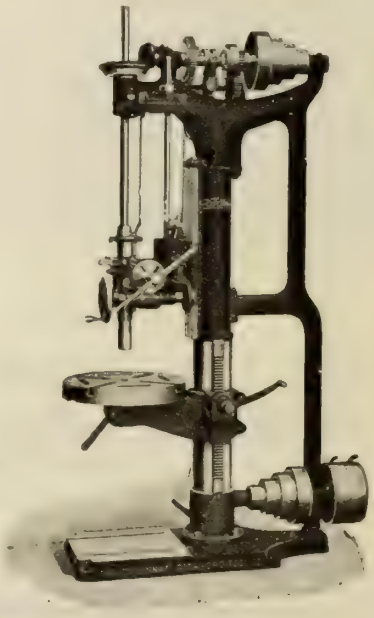
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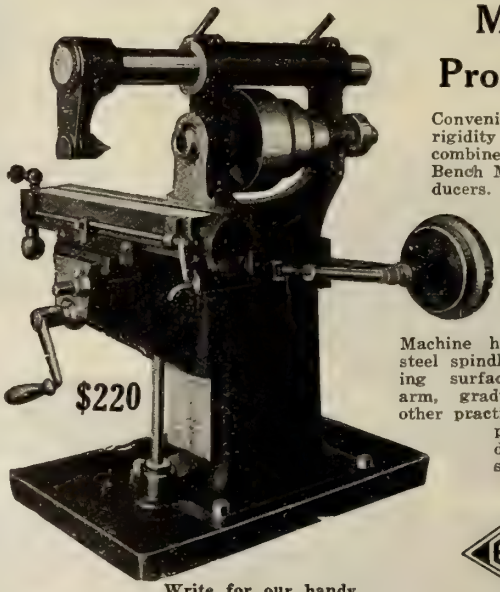
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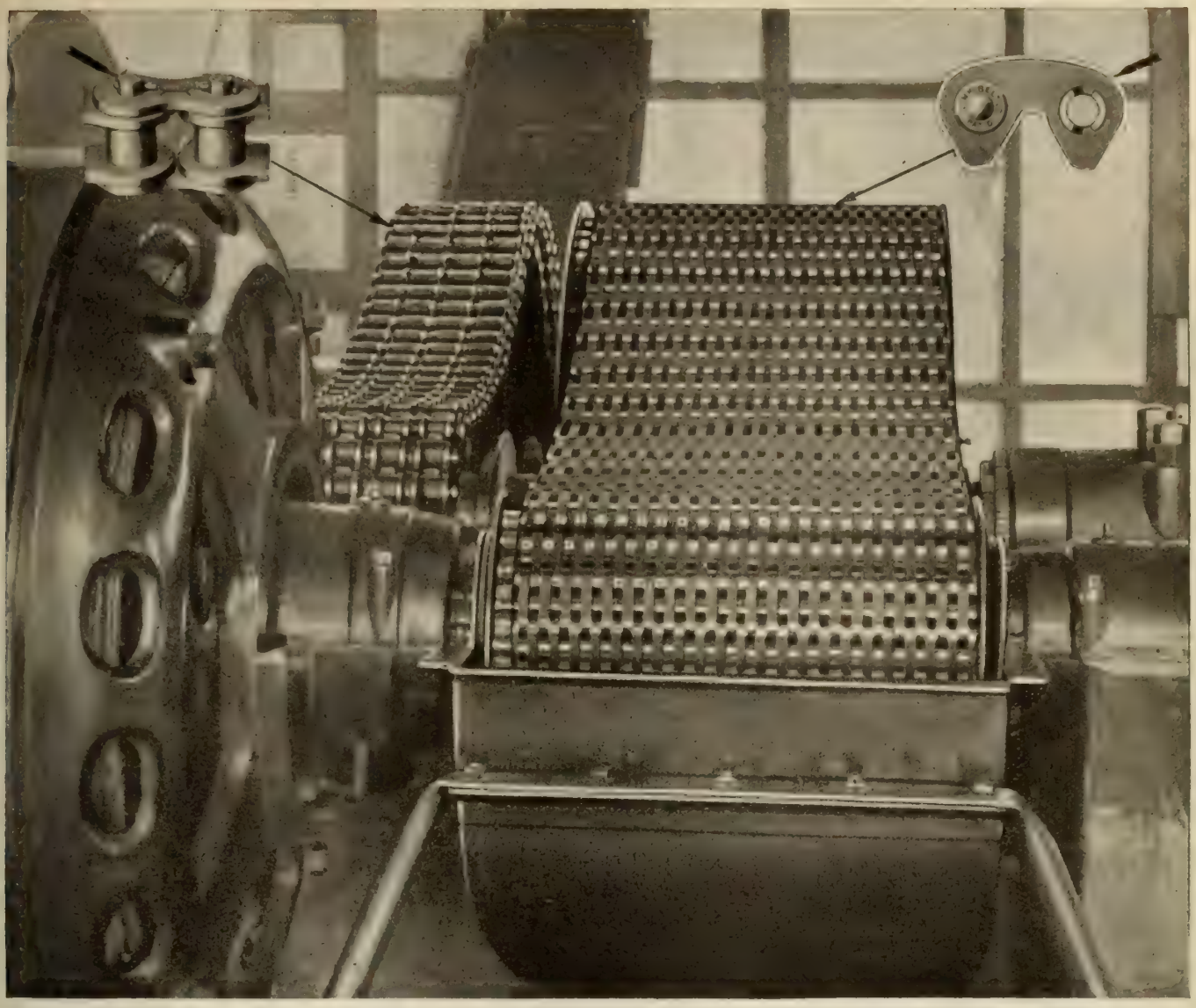
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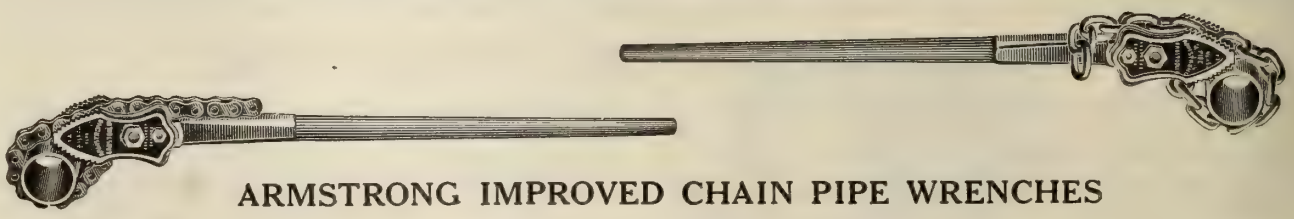
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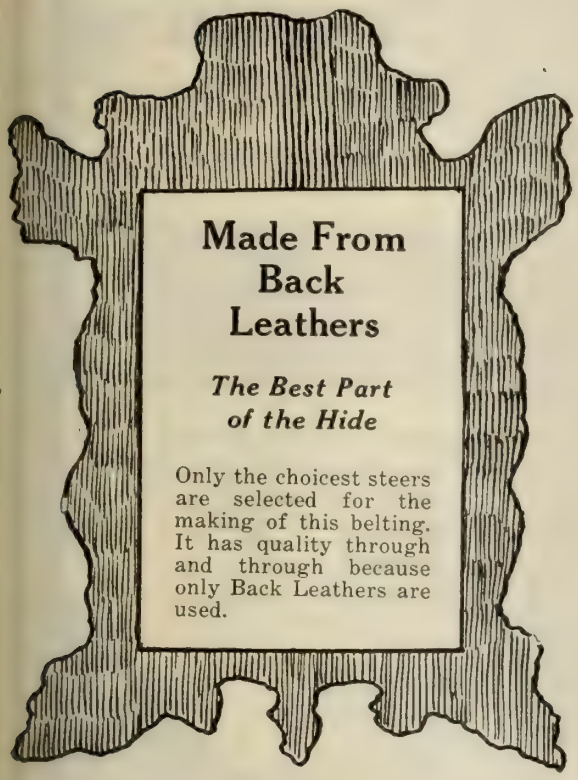
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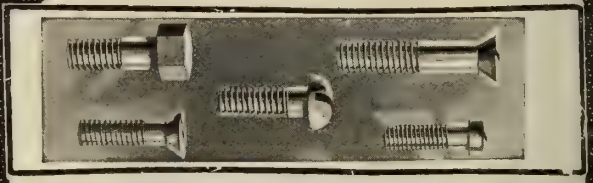
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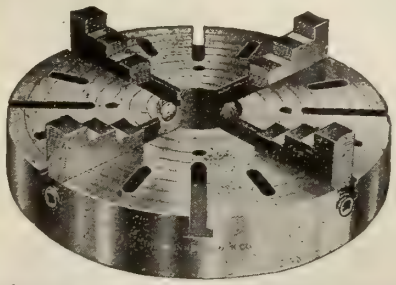
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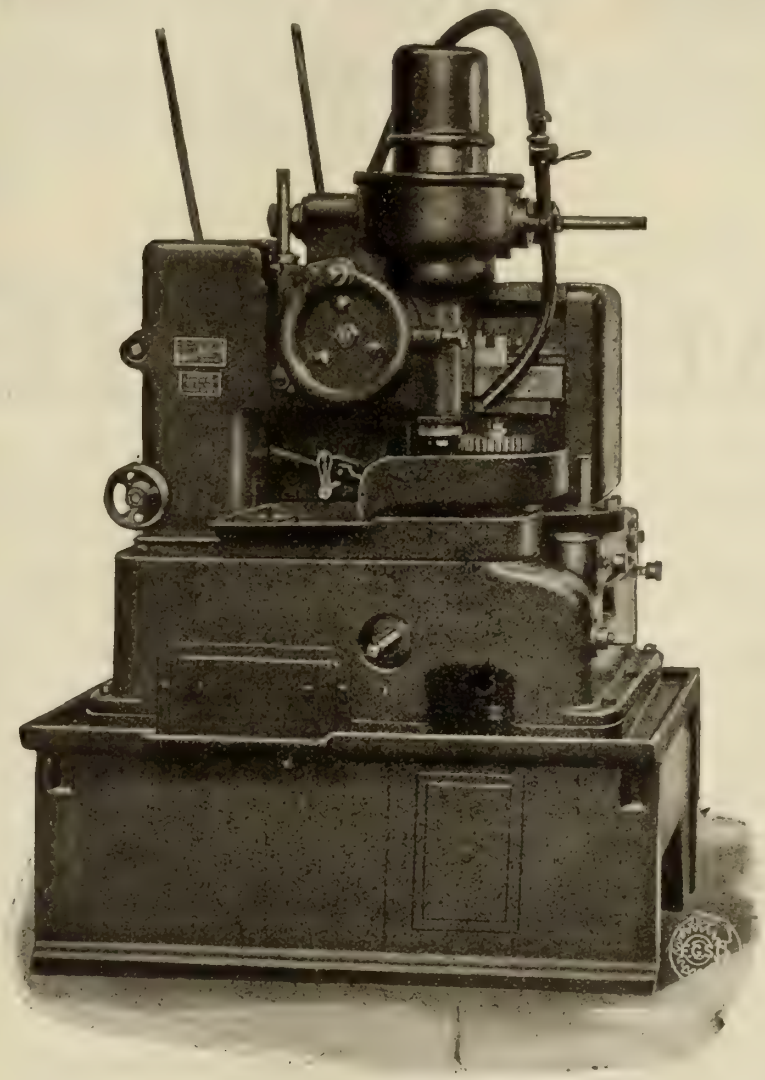
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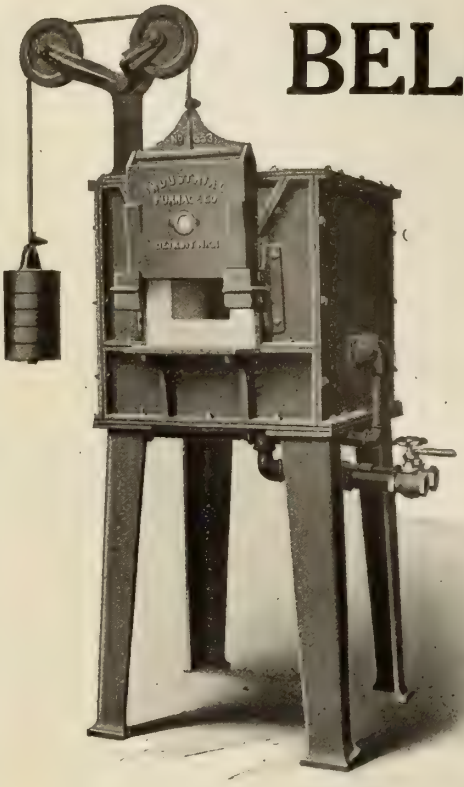
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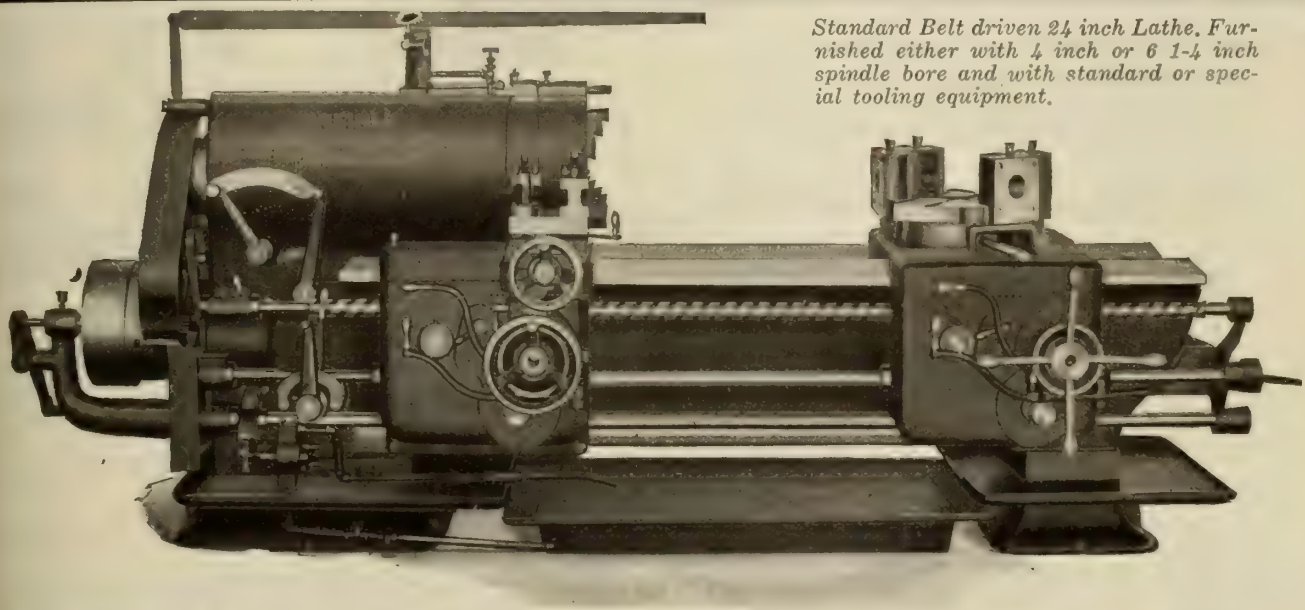
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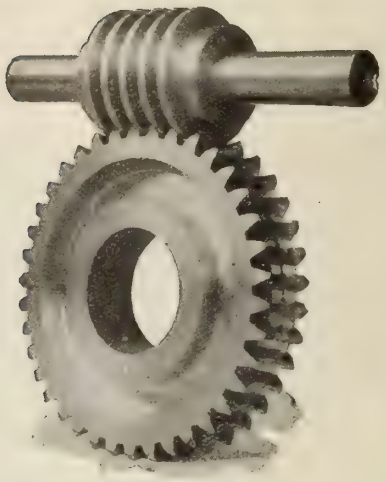
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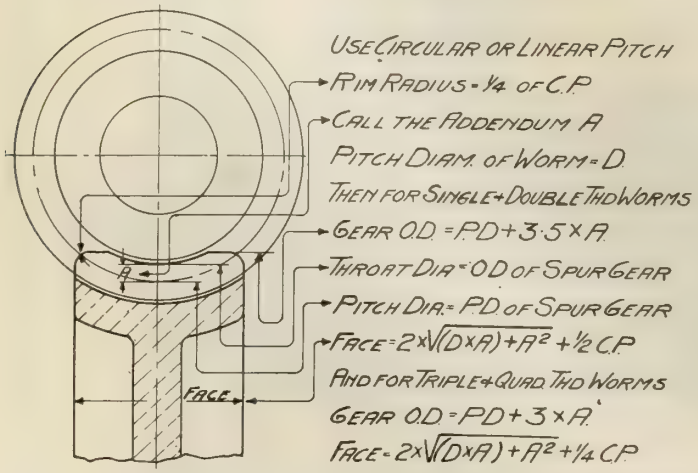




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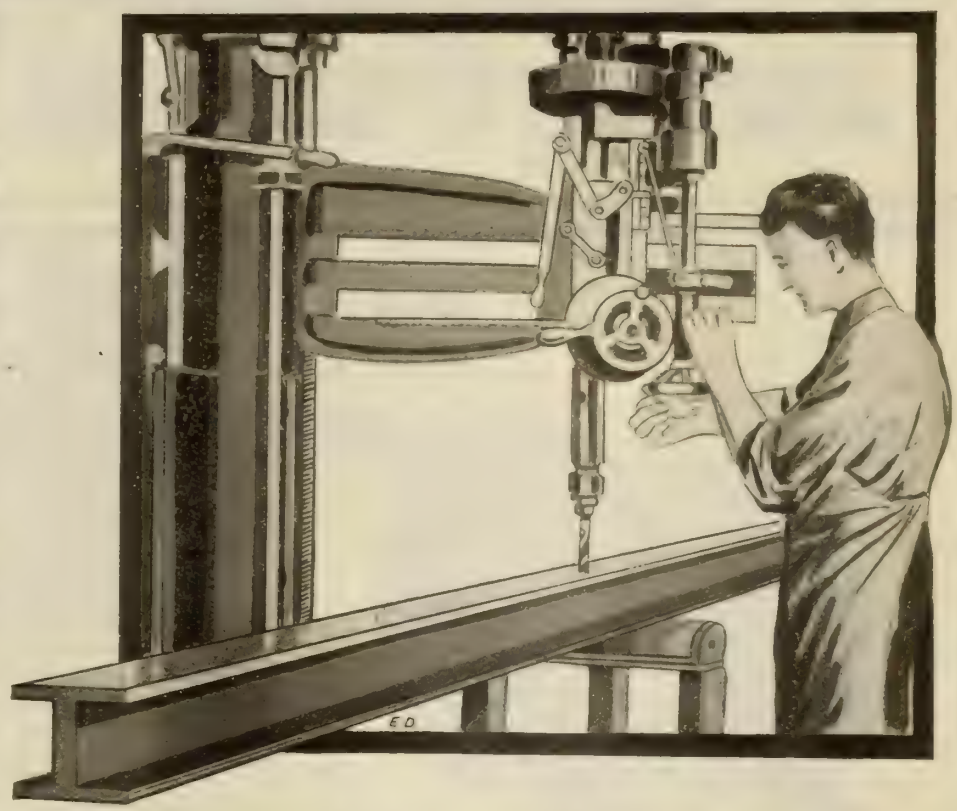
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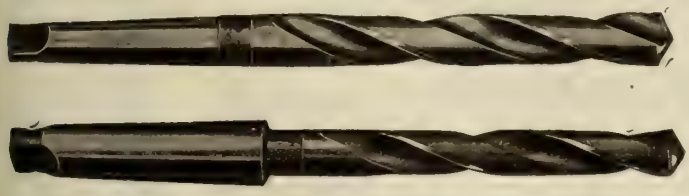
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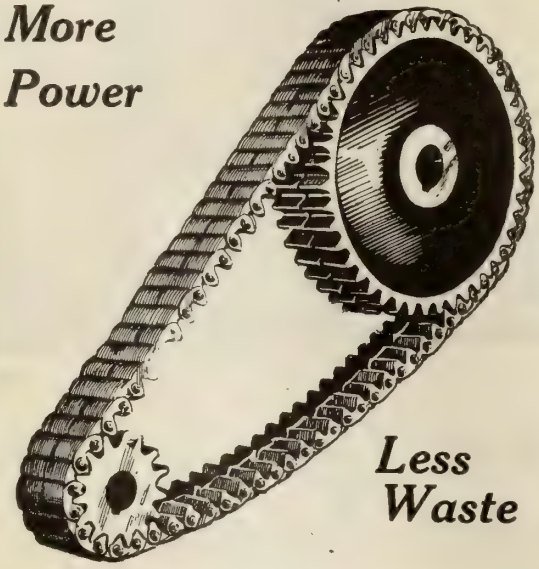
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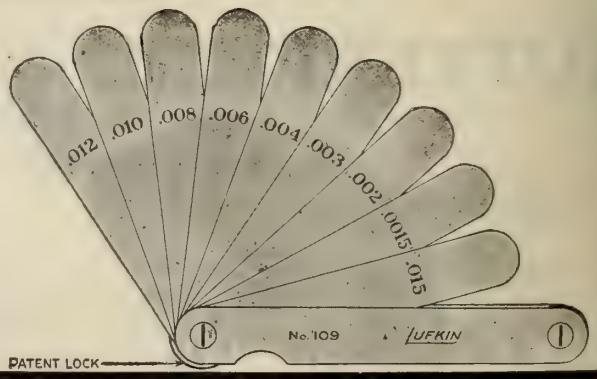
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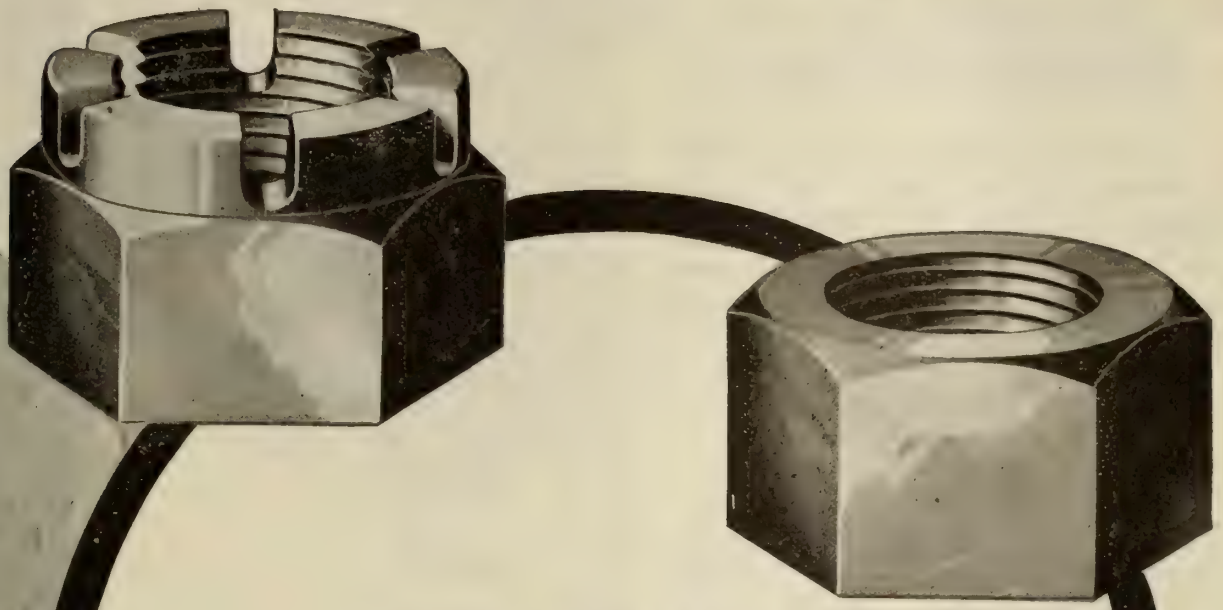
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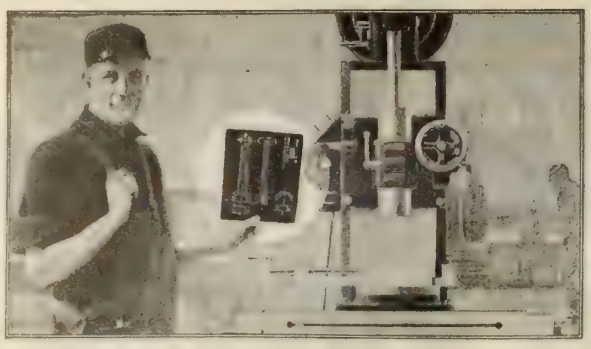
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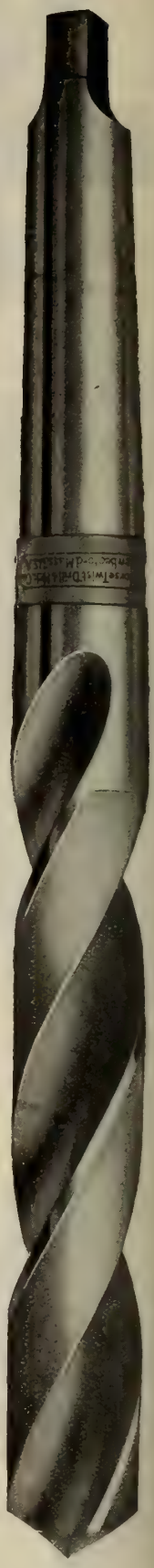
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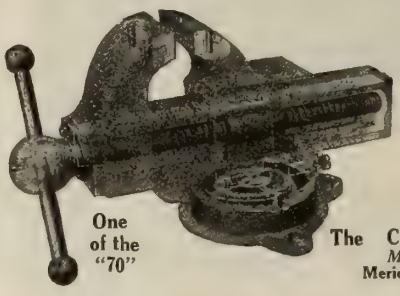
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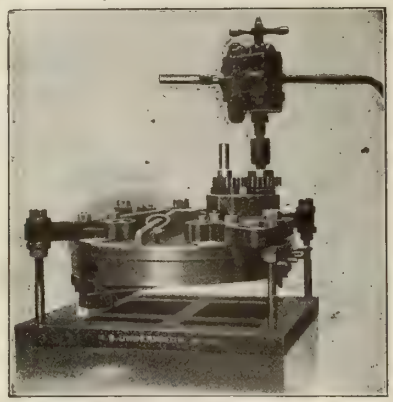
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

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Punch Presses and What They Can Accomplish

Getting the Most Out of the Machine by Observing Certain Principles and Adopting Time Saving Devices—Hub Punching Die —Blanking and Embossing Die—Special Extension Gauge

By J. H. MOORE

THE versatility of the punch press is unquestioned. It is used in practically every industry, and the variety of parts blanked, punched, drawn and formed on such machines is almost without number. Like any other machine tool its productive capacity largely depends upon the care taken from the date of installation, so that when one speaks of what punch presses can accomplish, they must take into consideration many factors.

For example, the foundation. Unfortunately some shop foremen do not consider this an important point, and place the machines on poor flooring with the result that constant operation makes everything loose, and excessive vibration takes place. For ordinary sized presses, a good stout flooring is sufficient for the purpose but make sure that the base is well secured to the floor. When installing heavier presses, a cement foundation should be provided, the size depending upon the weight and capacity of machine.

The Question of Belts

The belt on a press seems a small item yet it is a very important point, because it can easily spoil the machine's production. Every time the belt slips off the flywheel it means a loss of time, so that when installing any press, the possibility of this danger should be watched carefully. The solution to the trouble is perfect alignment. Make sure the flywheel of press lines up with pulley on shaft, and watch carefully the lacing of belt, so that it runs smoothly. Should readers imagine all this care unnecessary read the following true story. In a certain plant not far from Toronto, a complete line of presses were all addicted to the same habit, viz, throwing off their belts. Unfortunately, they would always throw off to the inside, the belt would get mixed up in the clutch, the result being it would come out considerably chewed up. The loss in time was enormous. Finally, a careful inspection was made of the alignment, adjustments took place, and since then, production at this particular plant has increased wonderfully. The same presses are now completing parts steadily, the operators are better satisfied, and naturally the management are pleased, all through a small belt problem having been successfully solved.

Setting the Ram

Although the press operator should know better, it is a recognized fact that considerable wasted time is consumed during setting up. Allowance should be made for the thickness of stock to be punched or drawn and lest this should

Drawings obtained through the courtesy of Brown, Boggs Co. of Hamilton.

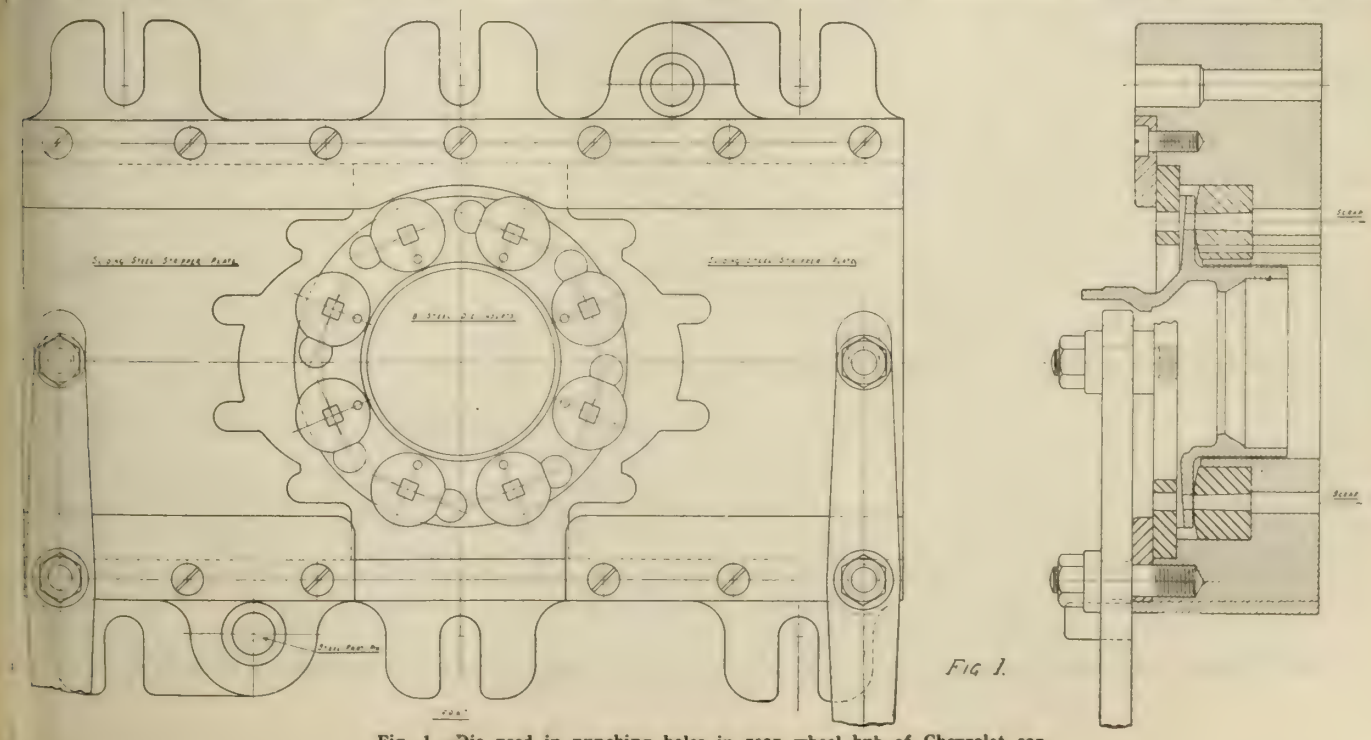


Fig. 1.—Die used in punching holes in rear wheel hub of Chevrolet car.

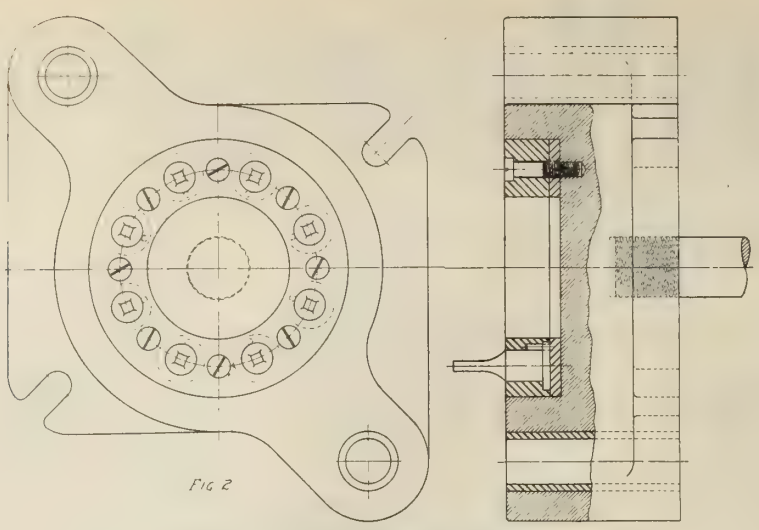


Fig. 2.—Showing method of holding punches in position.

seem an unnecessary warning, we will tell another true story.

Not long ago, a set up man, who had been on the job for several years, started to line up a pair of dies. He turned over the ram by hand until he had everything correct, or at least, to his mind correct, then tightening both upper and lower bolster in position he decided to try out the dies by power. "Are you sure you made allowance for the stock, Bill?" asked another workman. "What do you think I am? Sure, I allowed for the stock," and with that he inserted a strip of material, pressed the treadle, after which things happened very quickly.

First, he discovered he had NOT allowed for the stock and the press jammed. The jerk on the belt, pulled the machine clean off its foundation and carried it up to the shafting. Luckily, some one shut off the power, and the belt managed to support the press, otherwise it might have dropped through the floor to the next storey, for this incident occurred on the top flat of a large manufacturing establishment. The story proves that you cannot be too sure, and that hand power is quite sufficient until you are absolutely certain everything is O. K.

Design of Dies

The production secured from a press largely depends upon the equipment used. A poor set of dies on a good press will not help production. Whenever possible, use guide pins, and have them well lubricated, for these ensure proper alignment of upper and lower die and punch. Consider the question of replacement and make the steel parts in sections if at all possible, backing these up with a heavy cast iron wall. A solid chunk of tool steel does not necessarily mean a good die and by carefully planning the design you reduce not only the first cost, but subsequent renewal of parts.

Where sheet metal parts are produced on a press and when a high rate of production is very essential, you can often increase the output of machines by the use of automatic feeds. Not only does the placing of such feeds increase production, but it makes it safer for the operator, as he never needs to put his hand near the dies. He can also attend to more than one press. Usually, the simple or double roll, grip gravity or dial feeds are employed; the first two being automatic, the next mentioned partially automatic.

When a single or double roll feed is fitted to the press, the stock is usually carried on a spool in strip form. The operator merely enters the strip between the rollers and the press accomplishes the rest. Every time the ram ascends, either a rachet or rack operated feed is automatically operated through a connecting rod between the end of the crank shaft and feeding mechanism. We are not interested, however, in the various methods of applying such feeds as we are in the value of them, viz, aids to production.

The same fact holds good on gravity feeds, for the operator has no time to waste. The press is operating continuously and it is up to him to keep the hopper, or inclined slide, filled with blanks. The push, dial and rotating feeds are also splendid, for again the operator must be right on the job, filling the dial completely. Dial fed presses are widely used by makers of hardware stampings and for any industry using articles having several forming operations. The use of the feed mechanism permits a series of dies to perform the different operations on the one press.

Because you have a press, or number of presses in your plant, which have been turning out a certain volume of work for several years, is no reason why the same machines cannot produce still more. What a press will accomplish depends to a great extent on how well the owner makes use of it. We have so far discussed the foundation, belt troubles, setting of ram, designs of dies and possible types of feeds to use, but how about guards?

Value of Guards

A plant superintendent, who is prejudiced against guards, said to us recently "Guards—they are a nuisance and only hold back production." Our answer was brief and to the point. "If they are unnecessary why should one firm alone spend more than $10,000, feel satisfied and after the workers' first grumbling had ceased, increase their production over 10 per cent." We proved this point to him, with the result that he may become a convert. Without question, properly designed guards will increase production. At first, you may have difficulty with the men who are

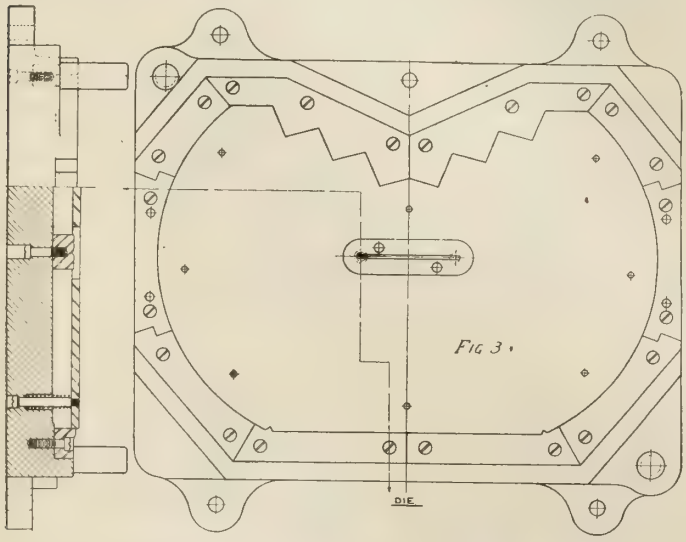


Fig. 3.—Blanking and embossing die for washing machine part.

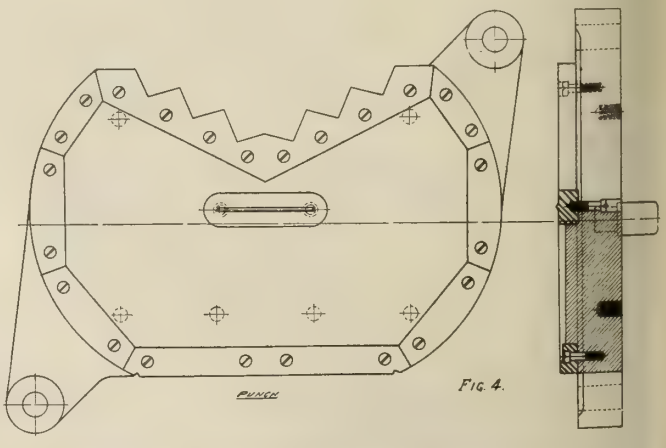


Fig. 4.—Blanking and embossing punch for die shown in Fig. 3.

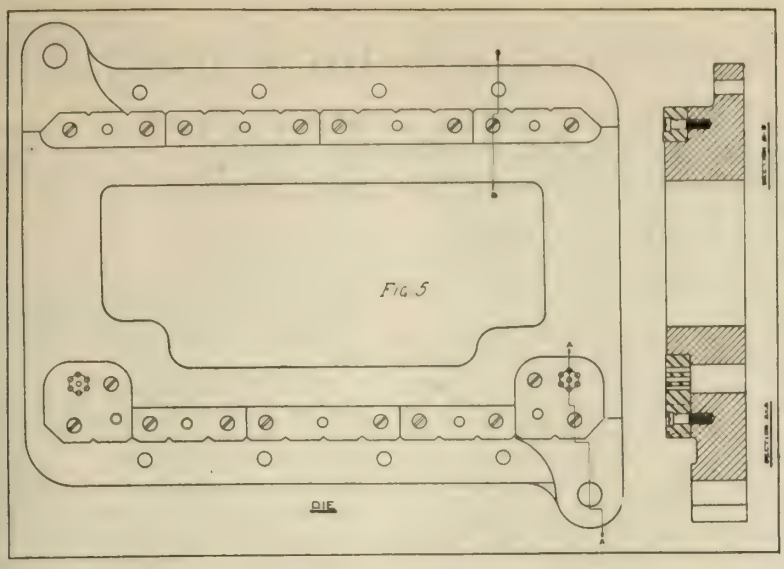


Fig. 5.—Construction of notching and perforating die for washing machine parts.

not in favor with the safety move, but if you persist in their use, the final results will be gratifying. Make the guards as simple as possible. Once you get into any intricate design you will find something going wrong with them continually you will become disgusted and discard them. Do not condemn the use of guards because of some unfortunate experience, but rather design a simple type, using it to help the press accomplish the best that is in it.

Leaving these points for the reader to think over at his leisure, we will illustrate several dies which have helped to increase production, and have also reduced manufacturing expense. For example Fig. 1.

Here we see a die designed to punch the rear hub of wheel for Chevrolet car. Eight 25/64 in. square holes are punched at one time, and as will be noted from the sectional view, special stripping arrangements had to be provided for, owing to shape of piece.

The hub is placed in position, and the stripper, which is in two pieces, is slid over until it covers the part. The arrangement of the stripper is simple, yet very effective, for the operator merely grasps both handles and pushes outward. It will be noticed that two steel pilot pins are used to align up the top and lower members of die.

Fig. 2 shows the upper holder, and the method of holding punches in position is worth noting. Each punch is flanged and fits into a steel ring. The flanged head hits up against another steel ring and both rings are fastened to the cast iron holder by means of eight filister head screws as shown. In addition to this, each punch is pinned in position to prevent any chance of turning. The square style of punch makes this precaution necessary.

Washing Machine Dies

The next illustration Fig. 3 shows the lower half of a blanking and embossing die used in one operation on a washing machine part. This die is an excellent example of the use of small sections of steel in die design. Note how fully they are tongued in some cases to ensure proper fastening and location. The sectional view illustrates method of holding. This also shows the spring stripper used, and the two steel guide pins. Note the small embossing die in center. Fig. 4 illustrates the design of punch, and as this is self-explanatory we will pass on to Fig. 5 which shows a notching and perforating die, also used in washing machine parts. This die handles two sides, and again we notice the value of small steel sections in making up a die of this nature. The sectional view depicts the details clearly, and in plain view it will be seen how corners of die blocks are arranged. There is no need to show the punch block, as Fig. 6 illustrates the assembled die. The guide blocks in this case are fastened to the lower bolster, and the spring stripper is attached to the upper punch block.

The remaining illustration, Fig. 7, depicts a special adjustable hold down extension gauge used in conjunction with brake band dies. In this case, the stock

(Continued on page 38)

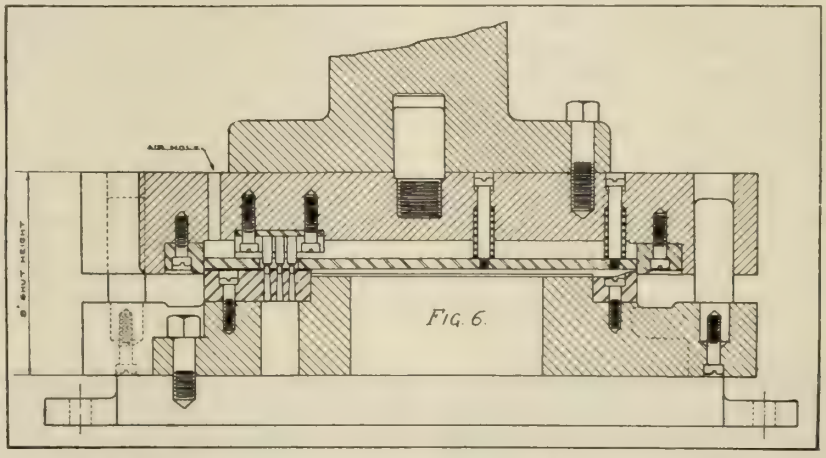


Fig. 6.—Assembly of punch and die, die of which is shown in Fig. 5.

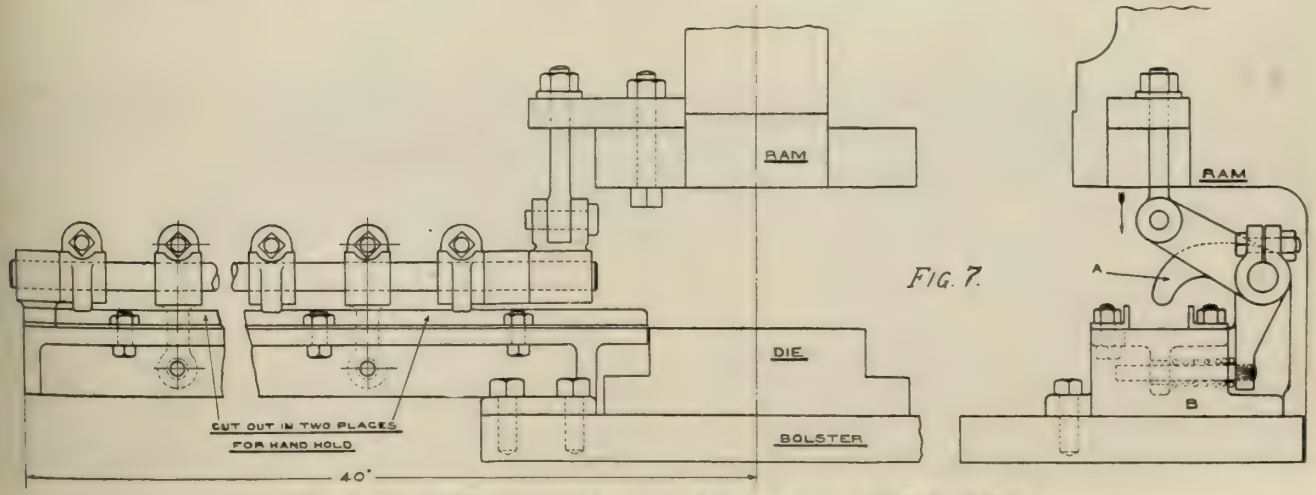


Fig. 7.—Special adjustable hold down extension gauge used on brake band dies.

Getting the Best Results Out of Your Export Trade

Manufacturer and Export Merchant Should Co-operate—Intensive Selling Campaign Can Be Carried On Through Exporter—Prices and Complete Information Should Be Given Promptly

By GLOWACKI R. PARKER

IN approaching this somewhat broad subject I am fully aware of the danger of generalization, which too often does not cover the specific point or problem, while similarly the risk of contradiction is great in attempting to pyramid a generalization upon the isolated instance. My intention is to try to outline the real functions of the merchant house in foreign trade and to show that the interests of the manufacturer and exporter are mutual.

I may add this is not a plea for the abandonment of direct selling, which admittedly has its merits under certain conditions, nor yet a general condemnation of past practice in the relations of manufacturer and exporter.

The war period created conditions quite without precedent in the annals of American foreign trade, and it is not surprising that there grew into being almost over night an extraordinarily large crop of foreign traders whose overseas experience was largely limited to a trip to Coney Island by ferry boat, and whose decline was destined to be as rapid as their rise. That certain disastrous experiments in foreign trade would result might readily have been predicted.

To properly treat the subject of the relationship between manufacturer and exporter, it is first necessary to briefly examine the function of the latter, and to establish the fact that he is a useful economic link in the chain between American producer and foreign consumer.

The author is a member of Frazar and Company and this paper was presented at a recent group session of the Ninth National Foreign Trade Convention, held in Philadelphia.

There is perhaps in some quarters an undercurrent of feeling that success in the foreign field can only be achieved by direct dealing with buyers. It is argued that this permits of:

1—A more intensive selling campaign
2—Direct control of markets
3—Control of selling organization
4—Building up of good will in the manufacturer's own name
5—The elimination of the exporter's profit, and consequent reduction of cost.

Now without denying the force of these arguments, and their undoubted application to specific cases, the answer to most of them can be found in the subject of this paper, i. e., closer co-operation between manufacturer and exporter. The latter is quite justified in replying somewhat as follows:

Points to Watch

1—An intensive selling campaign can be carried on quite as effectively if the manufacturer will only regard the exporter as a part of his own selling organization, and will support him, and supply him with needed information to the same extent as he would his own salesmen.

2—The manufacturer can control the foreign market to at least the same extent as he can the domestic market. He can and should examine the costs laid down in foreign port, and in consultation with the exporter establish the foreign selling price, raise or lower it to meet competitive conditions, in the same manner as an eastern manufacturer would regulate prices in San Francisco.

3—The advantage of direct control of the selling organization is at best theoretical. Neither branches nor permanent salesmen of the parent company can report to head-quarters in person with any degree of frequency, nor can their movements and operations be closely watched. The merchant house on the other hand, whose profits are derived solely from successful selling, must see to it that unprofitable sales do not occur, and that traveling and other expenses are incurred where they will do the most good.

4—So far as the good will attaching to the specific product is concerned, it is to the interest of the exporter to foster a particular brand or trade mark, and encourage its sale under its own name.

5—The theory of saving in cost by eliminating the exporter's profit or commission does not bear the light of investigation. Let us suppose the manufacturer decides to open his own foreign office in a given country. A branch office of the most modest pretensions costs in the neighborhood of $2,000 a month. A first-class manager's salary will be about half that, while a minimum of two or three assistants, rent, cable bills and travelling will absorb the balance. This would hardly provide for very much local advertising, entertainment, or miscellaneous expense. How-



General view of Montreal port, Canada's chief water terminus.

ever, using this figure, we have an annual cost of $24,000 per year.

Assume now that the exporter charges 10 per cent. (he seldom gets that much), and that this same percentage can be alloted as branch office expense. It is evident then that $240,000 of business must be done to break even. At 5 per cent. this figure must be doubled. Furthermore, the office must be maintained in and out of season. I submit that the average manufacturer who can count on that much business from the territory which can be served by one foreign office and maintain it year after year, is over optimistic. The merchant can afford it because of the diversity of his sales.

Exporter's Arguments

In addition to the foregoing, the exporter can advance a few arguments of his own, which may be summarized as follows:

a. The exporter takes the merchandise off the manufacturer's hands at the latter's factory, and pays for it on at least as favorable terms as domestic buyers.

b. He takes the credit risk and if the foreign buyer fails to pay, the manufacturer gets his money just the same, and need, therefore, concern himself with only the exporter's credit.

c. Of necessity, considerable capital is required to finance an export shipment, which, if it were not supplied by the exporter, would have to be furnished by the manufacturer, and, in consequence, so far as foreign business is concerned, the working capital and credit of the manufacturer are increased by those of the exporter.

d. The exporter, through his branches or affiliations abroad, lives with his clients. In most cases an intimate association of years' growth has been built up. Buyer and seller meet socially, they belong to the same clubs, Chamber of Commerce, or other civic bodies, they have many common interests quite apart from the purchase of goods. Traveling salesmen can never build up such a relationship, and even a permanent branch must take years to develop it.

e. Perhaps the most important point of all is that the exporter is often an importer as well. He is then in a position to foster reciprocal trade, thereby building up good will toward this country, to say nothing of increasing the purchasing power of buyers. The incidental contribution to stabilization of exchange, and the creation of credit balances constitute an asset which cannot be overestimated.

The exporter might readily go much further in his exposition of the service he performs, but the foregoing is sufficient to indicate in a general way that he occupies a useful position. Admitting this to be the case, it remains for producer and merchant to sit down across the table and determine how to eliminate sources of friction when they exist, and to examine ways and means of furthering their mutual interests.

To illustrate co-operation or the lack of it, I can hardly do better than cite a few instances which have recently come under my personal observation.

Prices and complete information should be promptly given. There is no warrant for the assumption that because a customer is some thousands of miles away there is no hurry about quoting. Delay may readily result in business being awarded elsewhere.

Recently an inquiry was sent out for a gas engine driven air compressor. The manufacturer did not get his prices in for over two weeks. Meanwhile the business was placed elsewhere. An identical instance was in railway motor cars, where similar delay resulted in losing the business.

Not only must quotations be made promptly, but they must be complete. Frequently prices will be given with no delivery date, or with no weights and measurements. It is a waste of the manufacturer's time to offer incomplete information, for the exporter must withhold cabling at all until he has all the required data. Thus on a government tender for railway equipment prices were promptly received, but no delivery date specified. By the time this was finally given, the tender date was past, and this particular equipment was not considered.

In another case inquiries were issued for some heavy punch presses, rolls, etc. The manufacturer's reply neglected to give either the weights or measurements of the individual shipping packages, thus rendering it impossible to figure up a c. i. f. quotation. This illustrates a point that cannot be too strongly emphasized, i. e., that correct weights and measurements are just as essential as the f. o. b. price. Moreover, in measurement of cargo, the size of the package not only influences the ocean freight, but sometimes determines whether it is more economical to ship from the Atlantic or Pacific coast.

Follow the Specifications

In other respects the specifications must be followed exactly, without the substitution of something "just as good." An order was placed for steel shafting which called for 1⅝ in. diameter. On delivery about two-thirds was found to be 1 9/16 in., and was in consequence rejected. The maker, with a fine spirit of co-operation, undertook to stand the cost of making good, but he could not compensate for the loss of prestige which both he and the exporter suffered.

Another order called for a concrete mixer driven by a 5 h.p. engine and a 6 h. p. boiler. Without advising the exporter, the manufacturer supplied a 6 h. p. engine and an 8 h. p. boiler. He naturally felt that he was being very liberal in furnishing something larger and better than the order specified. What actually occurred was that the freight was higher than estimated and the buyer was dissatisfied because the outfit did not fit the foundation he had provided.

It is worth remarking, while on the subject of specifications, that occasionally neither the exporter nor his customer knows exactly what is wanted, in consequence of which the inquiry may be very broad and lacking in essential detail. In such cases it is a mistake to reply to the effect that quotation cannot be made because insufficient information has been furnished. The proper course is to offer something—whatever may seem most likely. This at least gives the buyer some ideas. He may come back and order just that, or, if not, he will state what modifications he requires.

Having covered a few of the points, up to the time the order is placed, we come to the somewhat delicate question so often touched on in these conventions that it requires some hardihood to mention the word, namely, packing. And before going further, I want to say that great progress has been made. As a rule we no longer have shipping packages dropping to pieces on the dock before being loaded. The great majority of manufacturers can and do supply very satisfactory export packing. But here again close adherence to the exporter's specifications is essential.

For example, an order was placed for some locomotive parts. The manufacturers specified that those would be shipped in two large cases. When shipment was made, however, it was found that the entire shipment had been packed in a single box. The weight of this single piece was such that additional heavy lift charges were involved, greatly increasing the estimated freight. The manufacturer, no doubt, thought he was performing a real service, in that the total weight was reduced, yet actually the total cost was materially increased.

One of the most interesting cases on record was where the exporter received an order for old newspapers, baled, and bound up with red iron straps. This was passed on to the suppliers exactly as received, with the wording: "red iron straps" underscored. Shipment was made as requested, except that the bales were bound up with black iron straps. On arrival at destination payment was refused, solely because of the color of the straps. It appeared that in this particular market red bands had been used for years, and had assumed the proportions of a trade mark, so much so that anything else was regarded as an imitation. The supplier, by the way, refused to make good, and the exporter had to sell the shipment elsewhere at a considerable loss.

In another case certain material was supplied which, because of its character, hardly required any packing at all. The manufacturer, however, for good measure, put it all in barrels. On delivery to dock these showed slight signs of breakage, enough at least for the steamship company to endorse on the bill of lading "barrels frail." In such cases if loss were discovered on delivery, the steamship company could not be held liable, because it had given the

shipper a receipt, not for so much material, but for so many barrels, and had specifically called attention to the frail character of these.

It must be emphasized that packing estimates, i.e., weight and measurement, must be as accurate as circumstances will permit, and not merely figured with large factors of safety. Thus in checking up a large supplier, it was found that his packing was always well within the weight and measurement promised. The result was, of course, an actual saving in freight estimated, but the manufacturer had failed to realize that c. i. f. quotations on his material were always high, by just that much, with consequent risk of loss of business to competitors.

Exchange Information

Let us now turn to one or two other phases of the situation.

A manufacturer of a popular specialty unloaded many thousand dollars worth of stock, held abroad, on his agent, just before putting a new and improved article on the market, selling at the same price.

Co-operation between manufacturer and exporter should largely take the form of constant interchange of information. Advance notice of new designs, improvements, etc., greatly strengthen the exporter's ability to get business. Sales helps, such as suggestions for new uses of material, advantages and adaptability to certain conditions, in a word the same sort of data supplied local salesmen, are eagerly sought by the exporter.

Foreign advertising should be done by the manufacturer, but generally in consultation with the exporter. Useful energy is wasted when a supply of literature in Spanish is forwarded to Yokohama (an instance which recently happened). Nor is there much use in advertising a device for thawing out frozen water pipes in a publication having its principal circulation in India. Furthermore, it is not quite reasonable to ask an exporter to do all the advertising in his district out of his comparatively meagre commission. I would venture the opinion that most costs on which export prices are based include, along with other overhead, the total cost of domestic advertising. Should not some of this be allotted to the foreign field?

And this brings us to another closely related point. Does not the average so-called commercial cost of an article generally consist of the bare factory cost of labor and material plus a percentage running all the way from 50 per cent. to perhaps 150 per cent to cover so-called "general overhead?" And does not this "general overhead" consist, in large measure at least, of the cost of traveling salesmen, branch offices, entertainment, not to mention domestic advertising and miscellaneous selling costs, solely arising in the domestic market? At the risk of unlimited condemnation, I venture the opinion that foreign costs should be figured on a materially lower basis than domestic, and that foreign buyers be given the benefit thereof.

The foregoing gives an indication of some of the means whereby greater co-operation will lead to better results. It is, however, only fair to state that there are a very large number of cases where perfect understanding and accord prevail, and where, if the exporter fails to secure and hold business, it is not the fault of the manufacturer. Without taking the time to cite any large number of these, a few typical instances stand out, and are worthy of special mention.

Create Good Will

A large manufacturer of tin plate received an order for a considerable shipment at a time when prices were still high. Subsequently the exporter requested that delivery be postponed. Meanwhile price declined. To insist on shipment would have meant a heavy loss. The manufacturer not only held the goods, but when shipment was finally made adjusted the price to conform to the then existing market. The good will created with both the exporter and his buyer in the long run will make up many differences in price.

A motor car manufacturer had shipped a number of cars to China, and was aware that his agent had on hand fairly large stocks. A price reduction was put into effect, and the agent notified that he would receive an equivalent rebate on all cars paid for but not sold. A manufacturer of gas engines did precisely the same thing, though the original shipment had gone forward a year previous. They may both confidently look forward to increased and sustained business.

A manufacturer of lead pencils received word that his product was being offered by unauthorized dealers in his agent's territory. He promptly investigated, stopped the source of supply in this country, and went to extraordinary effort to protect the interests of his representative.

A maker of boilers and radiators has such confidence in his agent's representations that, when he receives advice of particularly close competition, he adjusts the price to meet it, being well satisfied.

One of the principal railway suppliers constantly maintains its own representative in the foreign office of the exporter, not to attempt to do business direct, but to supply technical information and assist in securing business. Others are following substantially this same procedure, and the exporter welcomes the presence of such representatives, and affords them every facility.

BOOKLETS

The Athol Machine & Foundry Co., of Athol, Mass., have just issued an interesting little catalogue, No. 35, covering the range of vises and grinding equipment manufactured by them. A section at the back is devoted to a detailed reference of parts, so that replacements or repairs may be quickly obtained by ordering by part numbers.

PUNCH PRESSES AND WHAT THEY CAN ACCOMPLISH

(Continued from Page 35)

goes between the two short angles and as the ram descends, the fingers shown at A, drop down and grip the stock. As the ram ascends, the spring B, forces the fingers back allowing the operator to remove the material. This same idea can be used on other work of extreme length where the stock is thin and must lie down to the gauge point without trouble.

The future possibilities of press work are almost without limit. We now have presses stamping and forming parts which a few years ago were considered casting propositions. At one time door knobs were made from castings, but now the press stamps a steel disc out of a large sheet, draws the disc to a cup shape, bends it over and makes one half of the knob. The other portion is also formed in the press and a spot welder fastens both parts together. Thus, we have a lighter knob, a more economical one, and a smoother finish to the complete article. Of course in some cases, knobs are made without spot welding but this explains one method only.

What holds true of doorknobs is likewise true of thousands of other parts. The toggle drawing press has allowed operations to be completed which were unthought of a few years ago, until we now have large automobile parts drawn on these presses, where before hand work was necessary in the great majority of cases.

The piercing of armature discs is another operation which the press has mastered successfully. Imagine piercing 7,000 discs per day from 27 gauge steel, 19½ inches wide, yet this production is being secured daily in one large plant.

Then we have the variety of household utensils, which are procurable at the store at comparatively low prices. Again the press is the answer, for now the drawing of open hearth steel is made possible through the use of such modern machines. We might refer indefinitely to work produced on this type of machine but it is sufficient to mention only a few. Automobile lamp shells, railway gongs, cow bells, automobile parts of all kinds, keys, roller bearing parts, agricultural implement parts, oil stove bases, washers, electrical parts, telephone parts, cans and in fact almost any shaped piece made from sheet metal or sheet steel.

Of three tenders submitted for the construction of the proposed street railway extension to Chippewa park a distance of one and a third miles west of the city, one of $8,100 was the lowest. The city council believed the bid too high and new tenders will be called for. Much of the material for the construction of the road will be supplied by the city.

Theory and Practice Should Go Hand in Hand

When Fault Arises Eliminate the Cause—All Conditions Subject to Fixed Natural Laws—Technical Trained Man Better Able to Reason Out the Cause of Trouble and Remedy Defects

By JOHN S. WATTS

A HABIT that is well worth forming, particularly so with people who are engaged in the manufacture and use of machinery, is that of always striving to understand the cause of all those happenings which affect their work. This may be better understood by stating that it is the opposite to the all too common habit of being satisfied with knowing that under certain conditions, such and such a result will occur, without a full knowledge of the reasons why it does so, or of what will be the effect of a slight change in the conditions.

That many of us are guilty of being too lazy to use our brains to avoid minor difficulties can be proved by observation of our conduct when matters are not progressing normally. Consider for example, the average man running a lathe, if the belt slips off the pulley, he will put it back, ad unless this slipping is repeated at such short and frequent intervals as to render it impossible to make any headway with the work he will be satisfied to simply replace the belt as fast and as often as it slips off. When it becomes imperative to do something to stop the belt from coming off, it is common to do the easiest and most obvious thing namely, reduce the cut until the belt will drive, without studying the conditions to determine whether the belt is really over-loaded, or if it is prevented from delivering the power it is capable of by reason of slackness, mis-alignment or other cause. Similar examples without number can be cited by anyone from their own observation, indeed the practice of merely starting off again after a mis-hap, without attempting to find its cause and so arrive at the means of preventing its recurrence is so common as to have become a fixed habit with almost all of us, which is possibly what led the poet to say "hope springs eternal in the human breast."

Granted that there are occasions upon which it is impossible owing to pressure of time, to stop for an investigation of the cause of the mishap, it is in the great majority of cases a saving of time to do so. In any case an effort should be made to discover the cause even if only after the accident has been repaired, for the sake of preventing its recurrence later on, as unless some action is taken, the same conditions are practically sure to be repeated some time, with the same result. At the same time, we should not confine our studies to those cases only where trouble has resulted, it is just as, if not more, important to know the reasons why a certain method gives effective results. While it is good to know that certain actions will produce a certain result, this limited learning, if unaccompanied by accurate knowledge of the laws of nature which are responsible for the result gained, will never help much to enable us to accomplish similar results by more efficient means.

Forecasting Results

The so-called practical man, whose knowledge of what can be done, and what cannot be done, is limited solely to that which he himself has achieved or seen others accomplish, is apt to consider all knowledge that has been gained otherwise than from personal execution of work as purely theoretical. This attitude is based upon a misconception of the true state of affairs, seeing that every event that occurs in this world is caused by effects which are subject to unchanging laws of nature and that if we know and understand the laws that control a given set of forces we can forecast exactly what will be the result of their application under any given circumstances.

The practical man will pride himself on knowing by actual experience such matters as that a certain size of belt will drive a certain machine, but if called on to decide what size of belt should be used to drive a similar machine of a different size, will have to guess at it, because he has no real knowledge as to why the belt in the first machine was able to do the work. That is, not being familiar with the laws which govern the action of a belt drive, he is unable to say whether, to deliver say double the power, a certain belt should have double the thickness, or double the width, or if some other combination of width and thickness of belt would be better. On the other hand a man who by education or by his own observation and reading, has mastered the basic laws of the subject, would, even without the experience of the practical man with the first machine, be able to calculate the size of belt to use on the new machine, from a study of the conditions to be met. If the educated man had the same experience as the practical man had, his calculations would of course be based upon the performance of the belt used in the first machine and would be that much more dependable, because there are in all problems relating to mechanics certain factors, such as friction etc., which cannot be exactly pre-determined, except from experience with similar machinery. Nevertheless by reading the technical publications we can practically always find some data bearing upon these indeterminate factors, the use of which will permit us to forecast the requirements sufficiently close for all practical purposes.

Torsion of Shafts

Without such knowledge of the laws of nature, a man is very apt to make many errors in basing answers to new problems on experience with other similar work. From several examples, I will quote only one instance, where a shaft being required to transmit double the horse power of the one then in use, and at the same speed, a shaft having double the area of the old one was installed. The torsional strength of shafts varying as the cube of their diameters, while the area varies as their squares, the new shaft was really capable of delivering 2.83 times the horse power of the old one. Further the original shaft had been made larger than was required to transmit the horse power as it had to support the pull of belts located away from the bearings. So that, as a matter of fact the new shaft did not need to be even twice as strong in torsional strength.

Undoubtedly the man who has studied the laws of mechanics, being human, does also make mistakes, but mainly through not having at his command as much experience as the practical man, he is apt at first to give insufficient weight to some of the factors that experience alone can determine. But he has the advantage of being able to study out the reason of the failure, and in the end has gained knowledge through his mistake, whereas the practical man, is seldom any wiser than before, particularly as he generally errs by making his mistakes on the safe side so far as strength is concerned. This however leads to failure on the commercial side when in competition with some one who can accomplish equal results with less material. It would help the practical man to dissipate some of his assumed contempt for theory, as he mis-calls knowledge acquired by study, if he will consider how this knowledge is gained. The various laws of nature have been determined, are not as he thinks, purely theoretical using the word in its true sense, that is that a theory is some statement that is in all probability true, but which cannot be absolutely proved. On the contrary almost every known rule is based upon actual experience, and has been determined by working tests, and proved over and over again in use.

Rectangular Beam

For example the fact that a rectangular beam on edge will carry a much greater load than it will if laid upon its side, as a matter of common experience, and was undoubtedly known centuries before the beam formulae were worked out. All that the students of science have done was to determine by study, and experimental tests the exact relationship between the

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Geometric Control of Gear Cutter Movement

Careful Grinding of Cutters is Necessary to Maintain Proper Shape—Using the End Mill Type of Cutter—Machines for Cutting Double Helical Gears Are of Special Design

By CHESTER B. HAMILTON, Jr., B.A.Sc., M.E.

WE ARE here continuing the description of the different methods of forming gear teeth, as outlined in our issue of May 25.

The Sellers system uses 20 degree angle, with addendum of 0.3, dedendum 0.35 and clearance 0.05 of the circular pitch. The Fellows system is the most modern and in many ways the best in results, though it is argued against it that it has no fixed ratio of pitch and addendum. It is used in nearly all automobile spur gears and is pretty well established as the standard for generated spur gears, that is, those cut on the gear shaper or the hobber. In this system the pressure angle is 20 degrees and the addendum varies from 0.264 to 0.226 of the circular pitch. The pitch is given in terms of diametrical pitch and is written as a fraction, the numerator specifying the diametrical pitch from which it takes its tooth thickness and space width. This pitch is calculated in the usual way, being the number of teeth per inch of pitch diameter. The denominator of the fraction gives a finer diametrical pitch which governs the addendum, dedendum and clearance according to Brown & Sharpe proportions. That is a 6/8 pitch Fellows stub tooth gear has the same pitch diameter, tooth thickness, space width and circular pitch as the six diametrical pitch Brown & Sharpe gear of the same number of teeth, but has the addendum, dedendum and clearance of an eight pitch Brown & Sharpe tooth. The Fellows' pitches are 2-2½, 2½-3, 3-4, 4-5, 5-7, 6-8, 7-9, 8-10, 9-11, 10-12, 12-14, 14-18. The standard Fellows machine will not cut coarser than 3/4, but heavier pitches even than shown above can be cut on large hobbing machines to the same proportions.

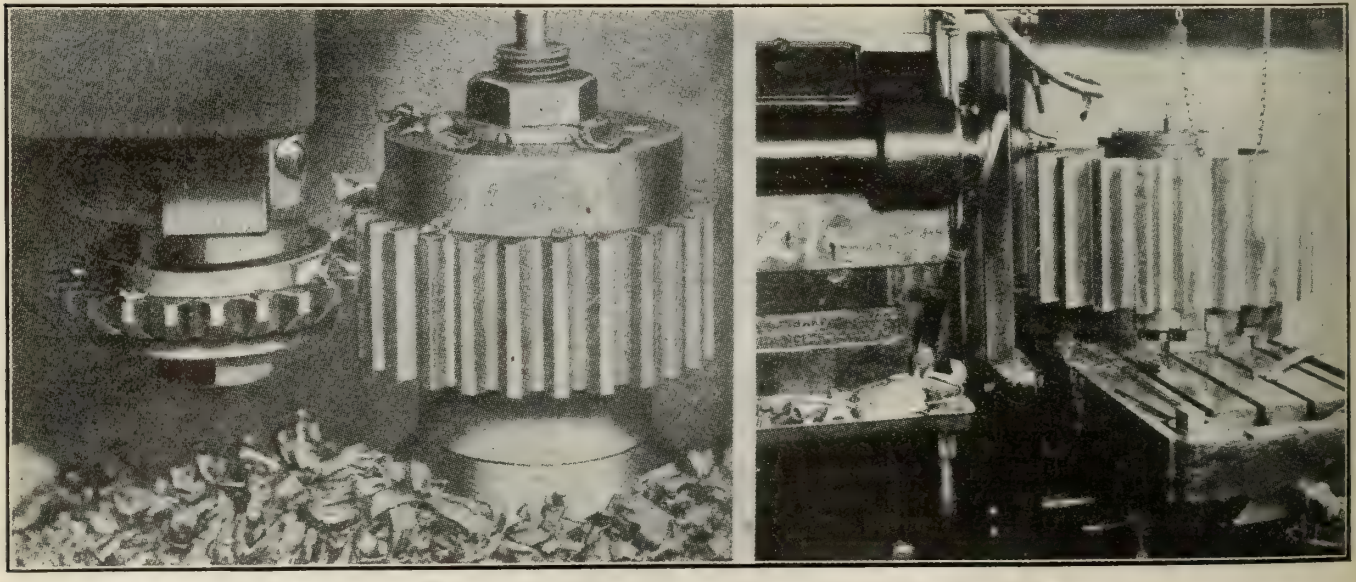
The Stub system is not so largely used for bevel gears as for spurs, for the single reason that bevel gears with shafts at right angles do not belong to an interchangeable system, being made in pairs and to run with none other than the mate originally laid out. This being the case, the long and short addendum method of preventing under cutting and interference is perfectly feasible, and is better in giving a smoother action at the high ratios used in automobile rear axles. There is a slight sacrifice in efficensy in the longer flank, but not serious, and it is outweighed by the advantages. The Gleason templet type of bevel gear shaper uses templets of any pressure angle desired, and on those of low angle there is a correction to prevent under cutting after the same manner as in the Brown & Sharpe system.

There are three ways of producing the tooth curve. The first method may be copied from the actual form of the cutting tool by direct contact in the act of cutting. Second, it may be copied from a templet, which is attached to the machine to guide the cutting tool in a suitable path to describe the required curve. The form of the tool in this case does not resemble the form of the work. The first way is most used for small work, and the second for large. The third, and most modern way, is to generate the curve of the tooth by certain geometric motions of the machine which control the action of the tool (or tools) in a way to cause its cutting edge to describe the required tooth curve on the work, as well as move in the direction to cut away excess metal. The tool and the work nearly always have relative motion in three dimensions, and sometimes a fourth motion is introduced, as for indexing from tooth to tooth.

Circular Milling Cutter

The circular milling cutter with its edge formed to the size and shape of the tooth space is the commonest tool for cutting gears. The periphery of the cutter is relieved, or "backed off" from the cutting edge in a spiral curve, so that the face of the cutter can be repeatedly ground to sharpen it without changing the profile. The grinding is radial on finishing cutters, though not necessarily so on stocking cutters used on coarse pitches to do the heavy preliminary work of roughing out the slots. These cutters may be used in a variety of machines ranging from the common milling machine with dividing or indexing head on the table up to such highly specialized forms as full automatic rack cutters. The standard type of automatic gear cutter is produced in a variety of sizes by such firms as Brown & Sharpe, Gould & Eberhardt, Cincinnati Gear Cutting Machine Company, Flather Manufacturing Company, and Whiton Machine Company.

Author is President of the Hamilton Gear and Machine Co., and a member of the American Society Mechanical Engineers; Engineering Institute of Canada; Society of Automotive Engineers; American Gear Manufacturers' Association, Steel Treating Research Society; Standardization Committee of A.G.M.A.; Member of Canadian Engineering Standards Association.



Left.—Cutting gears in a Fellows gear shaper. Right.—Cutting gears with end mill.

Helical gears can be cut on a universal milling machine by using the "spiral feed" through the dividing head, but in such work one is confined rigidly to gears of the normal circular pitch for which cutters are at hand, and as explained in another section, the centre distance of the two gears must then be made to suit the gears which can be made. With a generating process the pitch can be adjusted by enlarging both blanks proportionately.

Bevels and Worms

Bevel gears can be made with a rotary cutter, but not good ones, nor with even an approach to correct theory. A skilled man with a special narrow pointed cutter and a universal milling machine can, by the "set over and roll" method make a gear that ran be filed into shape with not too much hand work, but this is not gear cutting.

Worms can be milled with a single formed cutter, which requires to be specially made for the job, as mentioned in another section, on account of interference of the trailing edge of the cutter with the finished side of the thread on one side. Worm wheels cannot be made with a rotary disc formed cutter, nor can spiral scrolls, nor spiral bevels.

End Mill Cutter

The second class of formed tool for gear production is the end mill. The longitudinal section of the tool, which includes its axis, shows the profile of the gear tooth space. The tool axis is perpendicular to the work axis, and it is fed parallel to the work axis along the tooth space. The end mill may be a solid fluted tool or have inserted blade cutting edges. This process is adapted to cutting heavy spur and double helical gears, the latter having been highly developed by Andre Citroen, at Paris, France. He has also cut bevels by this process, but their correctness is very doubtful. The quality of spurs and helicals by this process is good, but the rate of production not as high as by other methods.

Reciprocating Cutters

The third class of formed tools includes those having a reciprocating motion, parallel to the axis of the gear. In this class are the slotter or shaper tool, now little used; the broach, used for planing the teeth of internal gears, and the punch and die for stamping small gears either external or internal, out of sheet metal. All of the above refers to spurs.

Template Control of Cutter

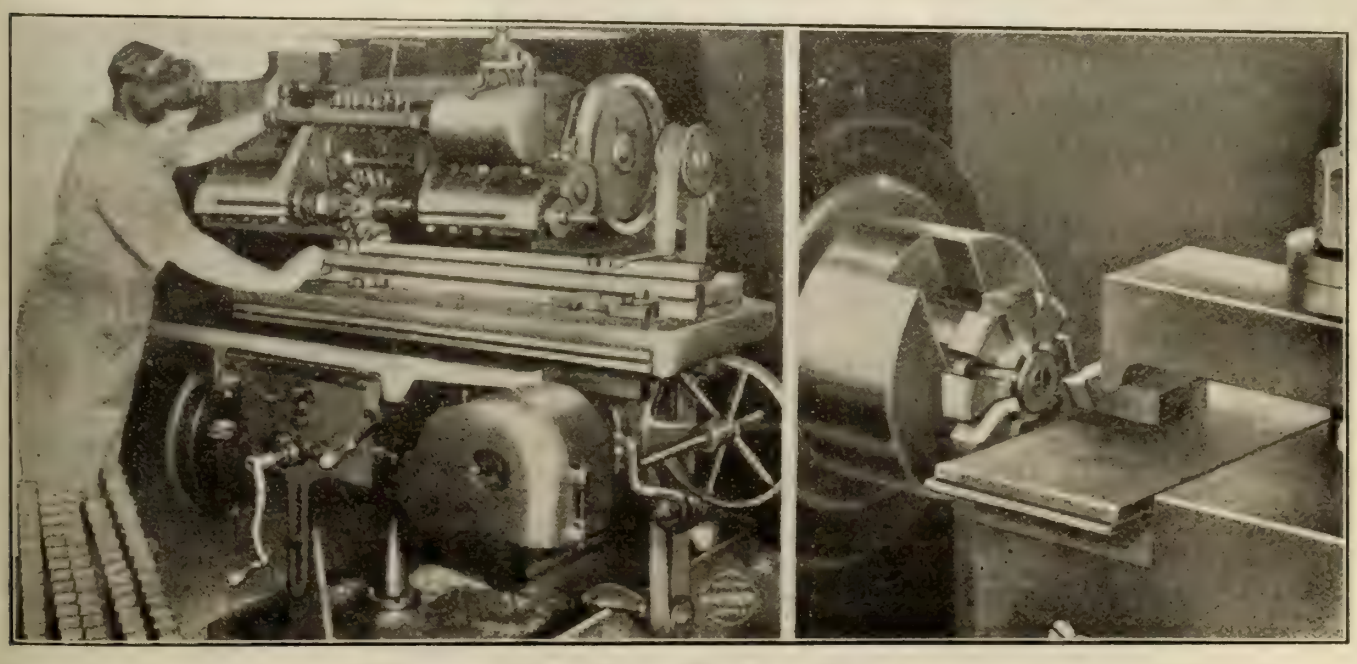
The second general method of producing the tooth curve is by copying it from a templet which controls the path of the cutting tool. Generally the gear cutting machines employing this method are of the shaper, planer or slotter type. The tool is an ordinary straight or forged planing tool with the cutting edge at the tip rounded to the same radius as the fillet at the root of the gear tooth. Then the point where the straight side of the tool is tangent to this curved end may be considered the describing point. Tools are cut with side rake and are right and left hand, and the templets are convex and concave to work on the upper and lower curves of the tooth. The process is applicable to spurs, bevels and double helical gears in medium and large pitches, and in the case of bevels there is a Gleason machine which will work down to quite small pitches. In the bevel machines one end of the tool carriage guide is mounted on a double pivot construction, the two axes intersecting at the cone of the machine, so that the guides may swivel universally about the centre point.

The length of the tool is fixed by gauges from the guide, so that the describing point on the tool always travels exactly towards the cone centre. The other or outer end of the guide carries a roller which rides on the curved templet, the centre of the roller traversing the tooth curve on a magnified scale. The Gleason machines are the best examples of the spur bevel planers. The Newton is perhaps the best known of the vertical slotter type, although these are not common. The larger Gleason bevel machines are universal and can be used to plane spur gears by swinging the guides to a position parallel to the work axis, and changing the tool carriage. Arranged in this way the machine will plane internal as well as external spurs. The machines to plane double helicals are of specialized construction for this work, and are used almost exclusively for heavy rolling mill gears, and especially mill stand pinions which are of very coarse pitch.

Range of Cutters

On all formed tool and templet work, account must be taken of the fact that the form of the tooth is not the same for gears of different numbers of teeth. In the Brown & Sharpe system eight different cutters are supplied, each of different shape, and each covering a portion of the range from a twelve tooth pinion to a rack. In the Templet system, the Gleason bevel machines have twenty-five pairs of templets covering the range from a pinion of small pitch angle to a gear of large angle approaching a crown gear. The thirteenth templet is for mitre gears of one to one ratio. It is to be noted that with spurs the selection of the cutter is according to the number of teeth, while with bevels the selection of templets is according to the pitch angle, or, what is the same thing, the ratio of the pair. This is because the shape and action of the teeth in a bevel gear depend not on the number of teeth in the gear itself, but upon the number there would be in a spur of radius equal to the back cone radius of

(Continued on Page 48)



Left.—Cutting racks on the milling machine. Right.—Relieving gear cutters.

The Proper Heating and Cooling of Steel

Less Trouble Experienced With Small Masses—All Portions of a Piece Should Be Subjected to Same Temperature—Human Element the Weakest Link—Temperature and Time Most Important Factors

By JOHN A. SUCCOP

ONE of the most important sciences in the mechanical field to-day, and one which necessitates the most careful and skilled application of its principles, if correct results are to be obtained, is the heat treatment of steel. There are certain fundamental facts which are worthy of attention. Of these facts, one of the most important is uniform results, which minimizes the possibility of low standard work. Uniform results are obtained through proper heating and cooling, and proper loading of the furnace charge. Less trouble is expected with small masses, for they do not present the same difficulties that are encountered with large furnace loads. It is well known that the molecular changes which occur in steel are not fixed and unchangeable, but depend on both the temperature at which they take place and on the duration of time of changing, upon the rate of cooling and the initial temperature to which the steel has been heated.

It is generally assumed that the proper heat treatment of steel requires nothing more than a uniformly heated product; that a uniform product requires nothing more than a uniformly heated furnace; and that a uniform pyrometer record assures a uniformly heated furnace; consequently, a uniformly heated product within that furnace. When the pyrometer rod is used in a heat treating furnace, it should be so placed that by looking in the furnace door, a direct comparison can be made by the eye as to the temperature of the charge with the temperature at the end of the rod. The pyrometer rod should never be hidden from the eyes of the operator unless the couple be buried in the center of the material and protected from the flames.

Frequent Variation

From the study of metallurgical results of the finished products, heat treated in an indicated, uniformly heated furnace, we find that a variation frequently is found. There is a greater problem to heat treating than the maintenance of a uniform temperature in the heating furnace. These variations are not confined only to furnaces of different types, for the variation is found in the same furnace, the pyrometer readings being the same in each case. Such variations are brought about by the position of the load in the furnace and by a difference in the heating of the load.

The best test of the uniformity of a heat treated piece of steel is the manner in which the load cools, for it is the uniformity of the steel as it passes through the critical range and takes its final and permanent set, that gives to steel the results of the heat treatment. To heat uniformly, it is necessary that each piece be subjected to the heat in the same manner, at the same temperature, and for the same length of time in proportion to the size of the section.

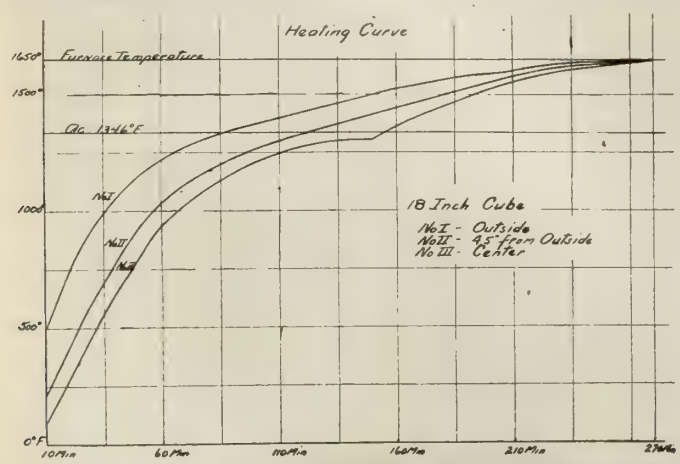
If a large amount of material is placed on one end of the furnace charge, it is likely that the outside pieces will be heated to and cooled from a higher temperature than the pieces at the centre of the mass. Likewise with cooling, if a large mass is plunged into a quenching tank, there is a tendency for the temperature of the bath to become irregularly heated and also for the outside of the mass to cool at a different temperature and in a different period of time than the centre.

Effect on a Large Mass

With large masses it is unreasonable to suppose that each portion of the section receives the same amount of heat that the other portions received, and that it is subjected to the same heat treatment. Unless all pieces are heated and cooled exactly alike, the pyrometer indications of uniform temperature serve merely as evidence, but cannot be accepted as proof of a uniformly heated furnace, or a uniformly heat treated furnace charge, or a uniformly heat treated product, as a final result. There should be better appreciation and understanding of the difference between a pyrometer record, which indicates a uniform temperature and of the conditions which bring about the uniformity desired in the furnace.

The following is a quotation from Dr. Howe in his book, "Iron, Steel and Other Alloys." "You cannot make a bad beefsteak good by the cooking; you can cook it better or worse, and it will be a worse or less bad beefsteak, but always bad. On the other hand, you can easily spoil a good beefsteak by bad cooking. Now, just as cooking is to food, so is heat treatment to steel. Indeed, a pedantic cook might reasonably call cooking, heat treatment." This simile of Dr. Howe's is right to the point; for the application of heat to industrial material is but a cooking operation, like the cooking of food or the baking of bread; each must be thoroughly done—that is, it must be heated uniformly to the centre. To cook or heat to the centre with the temperature being equal from the surface to the

Paper presented by the author at the May sectional meeting of American Society for Steel Treating at Pittsburgh. Author is associated with the Heppenstall Forge and Knife Co.



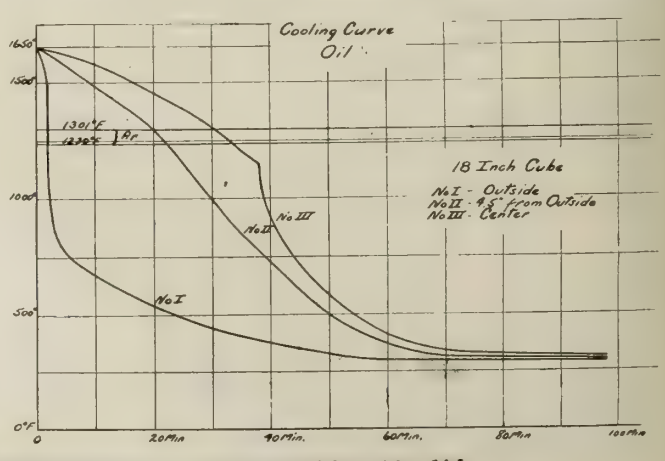


Fig. 1.—Left; curves representing the heating of a steel block 18 in. sq., showing rapidity with which heat penetrates the centre of mass. Fig. 3.—Right; curves representing the cooling of a steel block in the furnace. The cooling takes place slowly.

centre requires a slow fire and time in proportion to the amount of material to be heated. Overloading, as well as improper loading, will prevent the proper circulation of heat, and it is likely that a part of the charge will rise to the desired temperature in a non-uniform condition, and will cool with even less uniformity than it heated. The indicator on the outside of the oven does not tell the story of the food being well done. This is accomplished by observation of the material.

The Human Element

Even with all our modern present day practice and equipment we must take into consideration the importance of the human element. The heat treater, although the weakest link in the chain of perfection of the product, is the one that puts the metallurgical finish on the material at a great expense to others, and it is the skill and judgment that either perfects or spoils the material. Have we not all heard of the manufacturer who thinks he is protected from all the evils of heat treatment because he has the best pyrometer system that money could buy, with automatic recorders in the office, so that at all times, he knows the condition of the furnace and what each heater is doing? Besides this, he has a man whose sole duty it is to watch these instruments and the temperature recorded on the pyrometer, and to indicate to the operator by a red, green, or blue light just when his temperature is low, high or just right. He is sincere in his belief and he thinks he knows what good heat treating is, but his standard is low, due to the reasoning that a uniformly heated product requires only a uniformly heated furnace, which reasoning leads to the development of the pyrometer to indicate the uniformity of the product.

This is all right as far as it goes, but it does not go far enough, for it may be an indication of the temperature of that particular part of the furnace, but it surely is not proof that the product in the furnace is at that particular temperature, as indicated. The proof for this statement is the trouble we encounter with variations in the finished product, although the pyrometer chart gives no indications of a temperature variation. The uniform heating of a furnace and of the product within that furnace are two entirely distinct operations, and while the former must accompany the latter, yet the former does not prove the existence of the latter. The final conclusion of this analogous reasoning is that it is neither logical nor conclusive, and the actual results all hinge on the experience and knowledge of the man at the furnace.

Skill of Operation

There are a number of elements that directly affect heat treatment. They are not indicated by the use of pyrometers or other heat determining devices, whether mechanical or electrical, but are determined by the judgment and skill of the operator at the furnace, as the cook judges the quality of the food baked in the oven.

When the pyrometer indicates the desired temperature, what determines when the charge in the furnace is completely saturated?

What determines proper loading conditions as regards to mass heating and gas circulation?

What determines when the temperature of the bottom of the mass is equal to the temperature of the center, and when the top equals the sides?

What regulates the flow and combustion of the fuel into the furnace, causing an oxidizing, reducing, or neutral action?

What regulates the uniformity of each piece, compared with each other piece in the charge that they might all be treated the same?

The four factors which govern the heating and cooling of all material, whether it be food or an ingot of steel, are temperature, time, surface and mass.

Temperature. This is the degree of heat required to produce the desired molecular structure and grain size.

Time. This is the period required to saturate the piece to the desired temperature, and to permit the metallurgical reactions to take place.

Surface. This is the area of the section exposed to the heat, which influences the rate of absorption, the time of soaking and the uniformity of the piece.

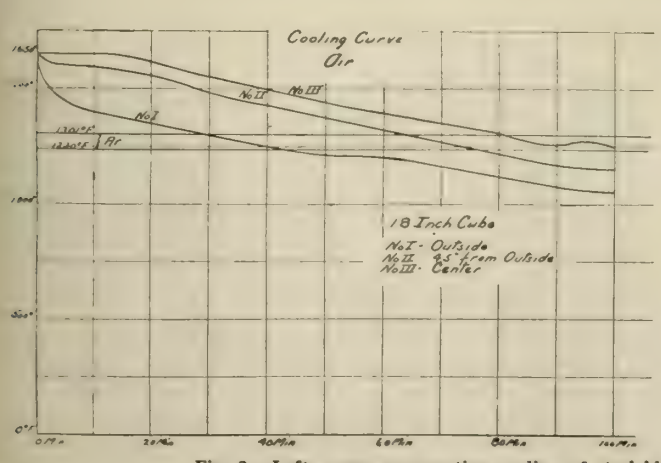
Mass. This is the amount of material to be heat treated, which influences the time of heating and the time of saturation and uniformity as well as the manner of supplying the heat.

Of these four, temperature and time are the important factors. Temperature is determined by the metallurgical effect that is desired, but time is governed by the surface and mass and also by the type and composition of the material being treated. That is the time necessary to soak a piece of low carbon steel might vary from the time necessary to soak a piece of alloy steel. Soaking means the completion of the metallurgical reactions that take place upon cooling and heating the steel. Often our time for allowing the sections to become saturated is not enough and our results are not uniform. When loading, the largest surface should be exposed to the source of heat to insure the minimum time and maximum uniformity. The reverse would mean that it would be necessary to expose the surface of the mass to the heat for a greater length of time than the section at the bottom of the mass. Ideal cooling is just the same condition reversed.

A striking example of this is found in a large die block, where the corners heat and cool much more rapidly than the main body of the die. Every possible effort should be made to prevent overheating the corners, or exposing them to the extreme final temperature any longer than is absolutely necessary. This might be accomplished by thoroughly saturating the dies at a temperature slightly below the final temperature. The corners of a die, because of the greater surface, heat first and cool off first, and cause an unequal expansion and contraction in the steel.

Study of Curves

The effect of mass on the heating and cooling of steel might be clearly shown by a study of the curves developed by Law. These curves are produced under as ideal a condition as possible, and they represent the changes that are found in



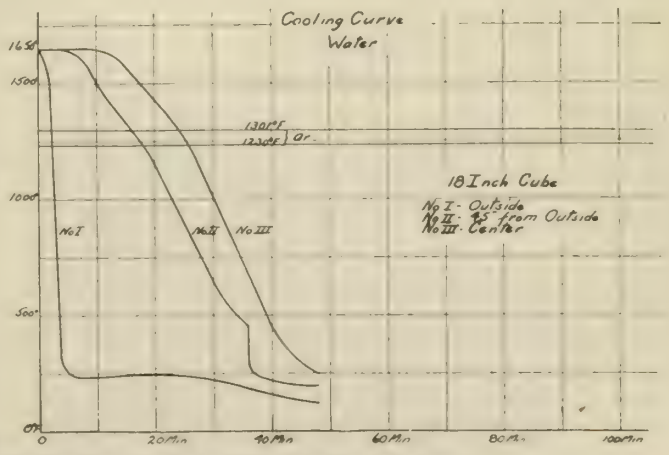


Fig. 2.—Left; curve representing cooling of steel block in quenching oil, the rapidity of cooling being due to large volume of oil and its rapid circulation. Fig. 4.—Right; curve of steel block heated to 1650 deg. F. and cooled on knife edges by a high pressure water spray. Cooling is more rapid than in water quench.

a large mass of steel during the heating and cooling. The curves were developed by the followig means: Eighteen-inch cubes were forged from a 25-inch ingot, only the soundest part of the ingot being used. The thermocouples were inserted into the cubes to be treated—one in the center; 4½ inches from the center, that is midway between the center and the outside; and one ¼-inch from the center of the surface.

Fig. 1 represents the heating of a block of steel 18 inches square, and shows the rapidity with which the heat penetrates to the center of the mass. The center and outside temperatures approach each other before going through the critical range but at this point, the absorption of heat due to the change causes a greater lag at the center than anywhere else, and the two temperatures fall away from each other for a period of time. However, after being in the furnace for about 4½ hours longer, the cube attains a uniform temperature throughout its mass, and practically coincides with the temperature of the furnace.

Fig. 2 represents the cooling of a block in the furnace. These curves require no explanation. The cooling takes place slowly and as in the case of the heating curves the evolution of the heat is most marked in the center of the mass.

Fig. 3 represents the cooling of a block in quenching oil. The rapidity with which the block cools in the oil bath is due to the large volume of oil and the rapid circulation.

The block shown in Fig. 4 was heated as before to 160 degrees Fahr. and cooled on knife edges by a high pressure water spray. The block, as would be expected, cools off more rapidly than the oil quench. The curve also shows an evolution of heat in the center. Attention is called to the abrupt halt in the cooling at about 250 degrees Fahr. It is hardly likely that this halt is caused by the water getting into the thermocouple hole, because the temperature remains constant for so long a time, and at 50 degrees above the temperature of boiling water. Experiments repeated on various sizes of blocks show that the phenomenon occurs with remarkable regularity and is not affected by mass.

The existence of a low critical point has been verified by a large number of scientists, and if proved correct, will throw a new light on the phenomenon of hardening in steel.

Essential Features

Law sums up the essential features of the curves as follows: "The extreme slowness of air cooling as compared with either water or oil cooling, is too obvious for comment. A comparison of the curves obtained by oil and water cooling, is of great interest. The important difference between the two methods of cooling is to be found in the almost sudden slowing up of the cooling in oil shown in the lower ranges of temperature, as compared with the cooling in water. For example, the time required for the center of the cube to cool from 1650 to 1000 degrees Fahr., a temperature well below the critical range, is almost the same whether oil or water is used as the quenching medium. In cooling from 1000 to 600 degrees Fahr., however, the cube cooling in oil requires twice the time, and in cooling from 600 to 300 degrees Fahr., it requires nearly four times as long. The differences are even greater on the outside of the cube. The oil cooled surface takes six times as long as the water cooled surface to cool from 600 to 300 degrees Fahr. It may be observed with interest that both in oil and water cooling, there is a period during which the metal in the center of the cube is cooling down more rapidly than the metal midway between the center and the surface."

These factors hold good with a furnace loaded with both large and small pieces where, in order to cut costs, the load is heated according to the perfection of the small pieces. Although the initial costs are increased, the best results are obtained by heating according to the largest section, which undoubtedly will pay in the end for the additional time necessary, but an ideal condition would be to heat treat as nearly as possible, loads made up of parts of uniform side.

The practice of heat treating without regard to the mass and surface and with an eye only on the record of the pyrometer, will always produce a nonuniformly heated product. The mass should be heat treated and not the pyrometer. The pyrometer does not indicate anything concerning the temperature of the mass, but only the temperature of the portion of the gases in the furnace or the material with which it comes in contact.

Proper consideration must be given to the human element involved. Those in charge should be educated and should in turn educate those within their charge, for upon them lies the future of subsequent operations.

From the foregoing discussion, the following conclusions might be drawn:

1. That a uniformly heated product requires more than a uniformly heated furnace.
2. That material cannot be heat treated satisfactorily when the record of the pyrometer is the only guide.
3. That the human element plays an important part in the proper heating and cooling of steel.
4. That great care must be exercised in the handling of steel to insure proper thermal expansion and contraction. This is secured only through proper loading, charging at a low temperature, and by slow firing.

Another division of the General Motors Corporation has located a factory in Canada. This concern is the Delco-Light Co. of Dayton, Ohio, and the Canadian plant will be started at Oshawa in conjunction with other activities of the General Motors. The new firm will be known as the Delco-Light Co. of Canada. R. L. Meyers will be the manager of the Canadian branch.

THEORY AND PRACTICE

(Continued from Page 39)

width and depth of a beam, and its strength of such a beam varied as the square of its depth, and directly as its width. Further study of the problem brought out the reason why this was so, and has enabled us to evolve formulae for any or all sections of beams. Hence it can be truly said that such formulae are not in any sense theoretical, but are most intensely practical and the result of actual experience coupled with a determination to understand the reason why.

The progress of the mechanical arts depends almost entirely upon the knowledge gained in the attempt to study out all the reasons for all occurrences, as in the case of James Watt. Had he been satisfied to rest content with the knowledge that the lid of a boiling kettle was raised by the steam in the kettle, he would never have discovered the laws under which the steam engine functions. His conclusions, from the study of the kettle, may be said to have been a theory but only until the first successful run of the first steam engine.

The main point that I wish to make is that it always pays well to study until we know the laws governing the forces which we are controlling in our daily work, and that sometimes such study will bring out unexpected information of great value which would never be discovered in any other way.

WONDERFUL NEW ALLOYS

IN GREAT Britain vigorous efforts are being made to develop alloys of various metals with special properties of great usefulness in everyday life. At a recent trade exhibition held in London several examples were shown of water taps and other fittings made of a remarkable aluminum alloy discovered at the National Physical Laboratory during researches carried out under the auspices of the British Government. These taps are completely satisfactory from the point of view of the water companies, and they have the merit of being noncorrodible, retaining their polish for an indefinite period. Experiments are also being carried out with the object of replacing nickel by tin in the covering of iron plates, and these experiments are expected to lead to the production of a rustless plate which will be of immense benefit to the industry all over the world. A certain nickel alloy which has great stain-resisting qualities is now being made in the form of spoons and forks and many other articles of household utility. Stainless steel knives have also been developed a step further towards the ideal. Hitherto, stainless steel has been somewhat lacking in elasticity, and a new form has been brought out in which a knife blade can be bent almost double and will spring back into its original shape instantly without its quality being in any way impaired.

Using the Camera to Help the Machine Shop

Sketches Are the Universal Language of Machine Shops—First Cost of Electric Blue Print Outfit is High—Taking Photographs of Originals for Distribution in the Plant Satisfactory Method

By ROBERT MAWSON

DRAWINGS are now used universally in almost every machine shop in the world to convey the ideas of the engineering department to the manufacturing plant. During the past 15 years the writer has visited hundreds of machine shops in various parts of the world, and during this period only one shop that I went to was doing the work in the shop without the use of drawings, it might be said this concern made only one type of machine and the workman was supplied with a sample to work from. Though they arrived at the desired results by this method I often thought that drawings would have been a much better method especially when new men were placed to work in their shop, and I have been informed that recently they have engaged a draftsman and are now preparing drawings to the parts to be machined and assembled at the plant. Better late than never.

It might well be said that drawings are the universal language of the engineer; what books are to the reader so are drawings to the engineer and machinist—a necessity. Of course there are quite a variety of drawings, from the rough sketches on brown paper in the small back-woods' town to the rather complicated perfectly designed and worked out details of the large up-to-the-minute manufacturing establishment, of which we have many. However, in all of these there are some objections to the using of drawings in the shop in the usual manner. I refer to the making of blue prints, which are sent out to be worked from. First, there is the making of the prints. This requires sushine, if a sun printing frame is used, hence no sun no print, except by a long exposure to the light.

If the more modern method of printing by electricity is used, equipment is expensive at first cost, and afterwards the cost of current to operate the machine must be taken into account. Some concerns send out their work to be printed by firms who make a specialty of this matter, but this often entails waits and at best is not quite satisfactory. A print is wanted at once and it must be sent out and often a day is lost waiting for the print.

Another disadvantage is the large size to which drawings are often made and when the prints go to the shop they are folded and creased; if a figure should come in the crease, as it often does a chance for error presents itself. Some plants mount their prints on tins or bristol board to prevent folding, but, owing again to their large size these present awkward mediums to help the man doing the work in the shop, often drawings being made as large as 24 x 36 in. or larger.

We recently installed a home made equipment at our plant to try and solve this problem and it has proved very successful and this is illustrated in Fig. 1. It consists of a camera A, suitable for taking a photo 5 x 7 in. with an ordinary commercial lens, as speed is not required for this work, and by closing the shutter, or stopping down as it is called the object taken can be as sharp as desired, every part being in focus. The camera is mounted and fastened to the wooden frame as may be seen by referring to the illustration. At the rear of the camera is placed a clock B, which can be purchased at any photo supply house having the entire surface of the dial to represent one minute, in other words the hand of the clock travels around the face in one minute. This however is not essential as when the camera shutter is stopped down a minute extra exposure will not make any material difference to the results obtained. At the rear is an open box or case C in which are placed a number of electric bulbs, of the small size used in any factory, the voltage of course depending on the source of electric current used, and will make no difference to the reproductions obtained. This case can be slid along the stand by means of the crank D that operates a rope attached to the under side of the case, the rope being wound around a sheave fastened to the crank shaft E.

The drawing we wish to reproduce is held to the glass of the case by means of paper clips F. We found that time could be saved in our work by placing guides and lines as at G so that when we were working on a size say 24 x 36 in. of tracing and wished to reduce it to the camera size of 5 x 7 the index pointer would be placed to an index line as shown, and of course would be indexed to another position for a different size of tracing, the reproductions being made of one size. This indexing is only a short job and once obtained, the card board slips were fastened to the frame as shown and the size of tracing or blue print to which they referred marked on them so that it was only necessary to move the pointer to the correct position for any size in question.

The final focusing of the camera to suit the reproduction is performed with the slide of the bellows in the usual manner. Lighting of the bulbs in the case is done with the switch H being in a handy location for the man to reach when making the picture. A reproduction of the tracing as shown in the frame is illustrated in Fig. 2 and shows how clearly the part is produced. We used the apparatus for quite a while on tracing work and thought this was the full extent of its usefulness, but a picture was also taken of a blue print, and the device can also be used for this purpose. Even on the blue print work the lines are more distinct than on the ori-

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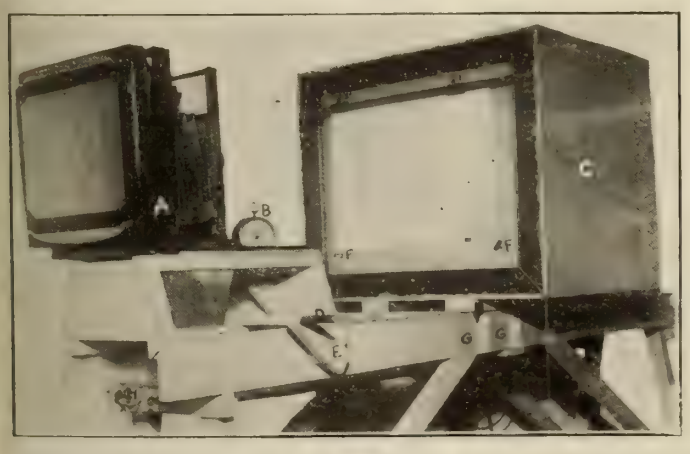


Fig. 1.—Camera outfits for photographing drawings.

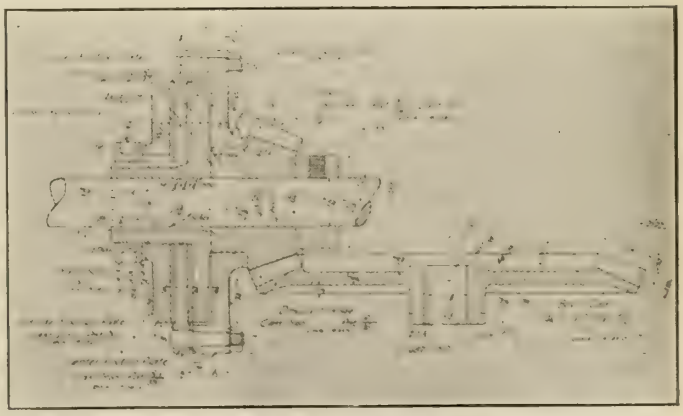


Fig. 2.—Photograph reproduced from tracing.

SLOTTING ATTACHMENT

An automatic slotting attachment which has been designed for use on a five spindle automatic screw machine has recently been perfected and is now on the market.

It consists primarily of a three-hole turret mounted on a suitable bracket which is attached to the machine by means of the bolts holding the stationary head caps in place. The saw head is mounted over the revolving head, and uses the same change gears as the machine, thus permitting any change of speed desired. The whole attachment is, of course, protected by guards.

In the turret are three sliding plungers carrying in their front ends, bushings fitting the screws, produced by the machine to be slotted, and having on their rear ends a T head. Three sliding spindles are yoked together by a spider and given a sliding motion by menas of a regular cam lever. Two of the spindles have a head with a T slot which engages with the T head of the turret plunger. The third, or front spindle, carries the ejector which slides through the plunger. The turret is revolved one third of a turn at the same time the crank shaft, which indexes the machine, revolves one. The cycle of operation is as follows: Just as the screw is cut off, the plunger carrying the bushing pushes up over the screw which, after being cut off, remains in the bushing.

The plungers are drawn back by the spindle to a stop and the head indexes, the small turret at the same time revolving one third of a turn, in which time the T head of the plunger slides out of the T slot of one spindle and into the next. At the next forward movement of the spindles, the screw is carried forward, slotted, and returned as before, while at the same time another screw is being picked up by the following spindle. At the third forward movement, the slotted screw is in the ejecting position, but instead of the plunger sliding forward, it is held back and the ejector pin passes through the plunger and bushing and ejects the screw. The cycle is then repeated. At each forward movement one screw is picked up, another slotted and another ejected. The attachment is made by the Davenport Machine Tool Co. of Rochester, N. Y., and is easily attached to all Davenport machines. When not in use it can be removed by taking out two bolts. All parts that are subject to wear, are hardened and ground. While intended primarily for slotting, the attachment by slight modifications can be used for other secondary operation work such as milling, cross drilling, burring, etc.

NEW CATALOGUE

The Diamond State Fibre Company of Canada have issued a new catalogue, No. 20, on Condensite Celoron which fully describes its properties, gives technical data, etc., and is illustrated.

Introducing



TRUMAN M. NORTON

This is a non-professional photograph of Mr. Norton, who is manager of the Canadian plant of the Wallace Barnes Co., Hamilton, Ontario, and is a busy man with no time for fancy postures.

Mr. Norton was born in Guildford, Conn., in 1879, and after completing his schooling, went on the farm. Later on he managed a farm for several years, but in 1905 became interested in manufacturing, going to the American plant of the firm he is now associated with. In fact since joining their staff at Bristol, Conn., he has never left them.

For some time previous to his coming to Hamilton, his firm had been considering Canada as a new field for their products, and in Sept., 1921, Mr. Norton came over to Hamilton to start the new factory.

Since that time he has been constantly improving conditions, production methods, and making friends. Mr. Norton is feeling particularly good these days for business is picking up, and he is also getting out a new catalogue which is going to be well worth while. We saw the advance proofs and can speak with authority.

TIME STUDY WATCH

No plant is immune from the disease of non-productive effort, wasted time and lost motion and the losses incident to them would equal enormous sums if reckoned and totaled in terms of dollars. A new decimal duration time study watch has recently been placed on the market which incorporates some interesting features. The graduated dial is so designed that it eliminates all need for calculations, the reading being direct from figures thereon. The dial contains a portion incompassing three minutes of observation, that indicates at any point of elapsed time exactly what the corresponding output per hour is. A small circle in the upper central portion contains a small hand which records the revolutions of the large hand up to and including thirty minutes. This time study watch is especially designed to facilitate the deduction of the time wasted and automatically reduces the net time to output per hour. The watch is manufactured by the Mortimer J. Silberberg Co. of Chicago, Ill.

REAMER DRIVES

"Reamer-Drives" operated by small electric motors placed near the assembling benches are doing away with the antiquated "strong arm" or manual methods of hand reaming. By expediting the reaming of finished holes where sizing is essential, they improve the quality of the work, reduce the handling charges, save time and tedious, slow, intermittent work of turning reamers by hand is eliminated. The reamed hole produced by a steady power drive is smoother and better finished, of greater accuracy and consequently longer life. Only 1/16 h. p. is consumed when the machine is used. The gearing of the head is so composed that this force is amply sufficient to handle reamers as large as 1½in. It is a sturdy, well built machine. All parts are thoroughly safe-guarded, readily accessible, enclosed to retain oil for lubrication and it is entirely self-contained. A pedestal of the vertical type carries the driving motor which is belted through a three speed cone to a self-locking worm gear reduction which rotates the chuck carrying the reamer. The operator stands directly in front of the reamer and holding the work free-hand (floating holder) feeds it on the slow turning reamer (which centralizes itself) with the fastest possible speed producing better results than with rigid fixtures. These machines are built and marketed by Geo. H. Blettner Co., 1841 W. Jackson Blvd., Chicago, Ill.

The elements that give brittleness to copper have little effect on the conductivity of the metal.

Ample space should be provided at the extreme ends of reciprocating parts of machines, such as planer tables, shaper rams, etc., so that there is plenty of room for a person to pass when machine is in motion.

News From the Welding Field

Overcoming Defects and Failures in Welding

Allowance Must be Made for Expansion and Contraction—Methods of Eliminating Distortion of Welded Parts—Causes and Remedies—Making Calculations in Advance

By M. PIETTE

THERE are many ways of taking care of expansion and contraction, but the four principal methods are as follows:

(1) Arrange the lines of welding and weld in such a manner that the effects of contraction are distributed and divided up so as to neutralize their effects.

(2) Distorting before welding the piece, in an opposite sense to that which contraction effect would produce.

(3) Producing, in certain cases, a sudden contraction of a portion of the piece by local cooling of a heated zone.

(4) Preheating the piece to be welded.

Sheet Welding

In welding two pieces of sheet metal together, suppose they are placed edge to edge as shown by dotted lines in Fig. 5 and a blowpipe is applied at A it will be found that the plates diverge as shown by full lines and form an angle. This is the result of the expansion of the zones Z which consist of sectors of radius R, for example.

The length 1. of each edge increases and the plates separate a certain amount at B.. When the weld has progressed a certain length two other phenomena come into play. The zones Z now commence to cool and tend to close the angle at B; the plates should therefore return edge to edge but the transverse contraction of the molten bath becomes prominent and these two phenomena lead to the overlapping of the plates at their extremity B. It is for this reason, therefore, necessary before commencing to weld to set the plates so that the edges are not parallel but set at a slight angle.

These contraction effects cannot be determined in advance for the reasons previously explained, but it is generally agreed that the separation or correct amount of divergence which should be given at B should be from 3 to 5 per cent. of the length of the weld.

In thin plates, say below ⅛ inch, tacks or short welds at intervals of about 2 inches are frequently made previous to welding. These should be made with a welding rod. In welding material about ¼ thick expanding the line of welding, previous to welding, by an amount that will practically equal the contraction effect, gives very good results and we shall examine a practical application of this method later.

Cylinder, Pipe and Tube Welding

The welding of pipes, tubes and sheet metal rolled into cylindrical form is extensively applied in the sheet metal industry, in many cases the applications to this class of work exceed those of ordinary plate welding. It is worth noting in passing that manufacturing sheet metal products by the welding process

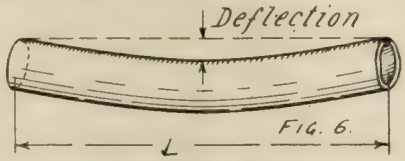


Fig. 6.—Longitudinal distortion.

produces far more satisfactory results than are possible by riveting or other means, as the finished product is not only stronger and more uniform, but the joints are air and fluid tight.

In welding cylinders, pipes and tubes the distortion produced during welding can be placed in two classes, viz.:—Longitudinal distortion and circumferential distortion. The longitudinal distortion, shown in Fig. 6, is due to the

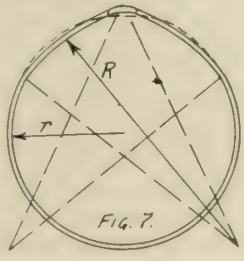


Fig. 7.—Circumferential distortion.

diminution in length of the line of welding. The circumferential distortion shown in Fig. 7, is due to the transverse contraction of the molten bath tending to straighten the plates in the vicinity of the weld.

This circumferential distortion becomes prominent when the material is thin, because the size of the molten bath is, in this case, comparatively greater than in the case of much thicker plates; the contraction effects are therefore greater and further the resistance of distortion in the neighborhood of the weld is relatively weaker. The circular section thus becomes oval, due to the pull of the contraction forces, and the radius of curvature is increased to R, as shown in the diagram. It is possible to overcome this oval distortion by making allowances in the preparation of the edges, in other words, by hammering the edges of the plates so that after welding the contraction stresses practically produce a circular shape. The phenomenon of oval distortion diminishes in proportion as the thickness of the pl: and the diameter of the cylinder increases because the molten bath is proportionately less and the contraction effects are distributed over a larger surface.

The longitudinal distortion, which is in the form of a deflection, is from th to four thousandths when the diameter of the cylinder or pipe does not exceed 100 to 150 times the thickness of the plate; above this value it diminishes. If the preparation for welding is unsatisfactory or unsuitable jigs are used, the amount of the deflection may vary considerably. This is illustrated by the preparation shown in Fig. 8, in which the ends of the cylinder are drilled and the two chamfered edges of the plate are held solidly in position by plates bolted to the ends of the cylinder. This method is defective and brings about continuous curving or deflection of the edges which is usually corrected by hammering, thus making the welding operation more troublesome and requiring more time. It is, therefore, not advisable to adopt this kind of preparation when welding sheet metal in cylindrical form because the resultant effect is to concentrate the total contraction stresses along the line of welding, as is shown by the increased deflection.

Welding of Tubes

In the welding the longitudinal seams of cylinders or tubes, in which the thickness of the material is relatively thin, the preparation generally consists in tacking the two edges. Tacks, or short welds, at intervals of from 2 to 6 inches according to the thickness of the sheet are made the entire length of the seam, to hold the edges in position. This tacking can be carried out in two ways

Conclusion of a paper prepared for Acetylene Journal by the author, who is engineer to the Chamber Syndicate de la Soudure Autogene. The material has been translated and added to by Capt. D. Richardson, R.A.F.

chine, otherwise the sheets must be drawn with a hammer.

In welding the longitudinal seams of cylinders in which the material is comparatively thick above 3/16 inch, for example, tacking is seldom resorted to, the usual method being to set the plates at an angle as previously explained for sheet welding. When the length of the

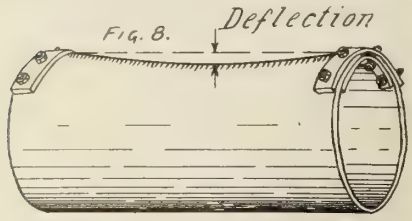


Fig. 8.—Deflection of tank.

weld exceeds 3 feet, it is advisable to start welding at the center of the seam either by commencing at a short distance from the ends of the plates and tacking at regular intervals the full length of the seam, or by commencing to tack at the middle of the seam and then tacking alternately on each side of the first tack.

The latter method, shown in Fig. 9, is the best and avoids loss of time. The

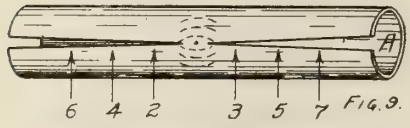


Fig. 9.—Allowing for contraction.

effect of tacking in the center is to make the plates take a V form, as shown. The effect of tacking at 2 is to cause the edges at 3 to approach each other, and thus make the tacking at 3 a simple matter. In the meanwhile the contraction effects at 2 draw the edges at 4 together, and so on, the expansion and contraction effects thus assisting the operation.

Tacking should be well done and preferably without using a welding wire,

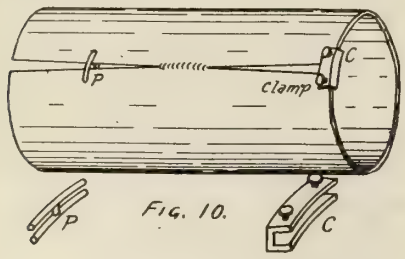


Fig. 10.—Providing for contraction of sheets

thus leaving the hand free to guide the plates. It is not sufficient to just melt the metal together at the tacked points, as the heat effects easily break one of more of the tacks. The effects of tacking thin sheets and the subsequent welding is to produce distortion or buckling of the welded sheet. A practical method of rapidly and effectively remedying this is to make use of a rolling machine, otherwise the sheets must be drawn with a hammer.

In wielding the longitudinal seams of cylinders in which the material is comparatively thick above 3/16 inch, for example tacking is seldom resorted to, the usual method being to set the plates at an angle as previously explained for sheet wielding. When the length of the weld exceeds 3 feet, it is advisable to start welding at the center of the same and weld in opposite directions toward the ends of the cylinder. By adopting this method, shown in Fig. 10, the amount of divergence is less than that necessary when welding from end to end and the longitudinal distortion or deflection is diminished. This is an application of the method of dividing the expansion and contraction effects.

On heating the center of the plates at the commencement of welding the edges separate and a suitable wedge, for preventing the plates getting out of line, can be inserted. The small device shown at P, Fig. 11, proves excellent for this purpose. It consists of two round rods or tubes 4 to 5 inches long welded to a vertical piece of iron rod, the length of which is made to suit the thickness of the plates. Displacement of the plates being welded in a vertical sense is entirely eliminated and the welder can move it along the seam as the weld advances. This device can be supplemented by the U clamp, shown at C, which is fixed at the extremity of the plates and may be used by itself when welding cylinders of short length. The screws simply keep the device in position and should not interfere with the free expansion and contraction of the plates.

GEOMETRIC CONTROL OF GEAR TEETH SHAPES

(Continued from Page 41)

the bevel gear, and of course, of equal pitch. Thus the pitch angle becomes the determining factor.

Odontograph Method

There are several variations of the generating principles of producing the tooth curve. The first, the Odontograph method, is not strictly within the classification, for the curve produced is only a compromise. In this method, which is most applicable to shaping machines, the point of the tool which describes the tooth curve, is constrained to move in an arc of a circle which approximates the curve of the involute tooth which is to be imitated. Remembering the way the true involute is described—by unwrapping a tangent from the base circle—it will be seen that it continually becomes of greater radius as it swings outward. Also the correction applied to the true full depth involute (as by Brown & Sharpe) to prevent interference consists in a narrowing of the tooth tip. Therefore if an arc of a circle be chosen for the Odontograph such that it is practically correct at the pitch line, it will be found that the tooth produced is increasingly scant all the way to the tip, and increasingly full inwards towards the root.

Generating Principle

This method is not nearly as much used as the true generating processes of which there are two, viz., the Describing Generating and the Moulding Generating. Both apply almost exclusively to the involute curve, or its variant the octoid in the case of moulding generating bevels. The describing generating process, which is a shaper process in application, is the less important of the two commercially but is theoretically correct, producing perfect involute teeth. In this process the shaper tool is made as previously described for templet planing, that is, with a curved end to form the fillet at the root of the tooth, but in this case it is ground to form also the part below the base line. The remainder of the tool is a straight shank and the point where this straight portion joins the formed end is the describing point of the tool, corresponding to the describing point of the unwrapped tangent. In addition by the reciprocating cutting motion of the tool along the tooth, means is provided to feed the tool sideways so that the describing point traverses a path tangent to the base circle of the gear, while the gear is synchronously rotated. This gives the exact motion of the tangent being wrapped up on the base circle and compels the describing point to travel a true involute curve till it reaches the base circle. The flank of the tooth below the base circle and fillet in the clearance have at the same time been formed by the end of the tool projecting beyond the describing point. This is for one side of the tooth only but the principle is the same for both. This finds application in a number of British and Continental gear planers.

USING THE CAMERA

(Continued from Page 45)

ginal, in other words the object stands out in bolder contrasts; as regards the tracing example there is no doubt of the superiority of the reproduction over the original. After the negative has been taken by the camera it is developed and prints made in the usual manner followed in photography.

We use these photos by fixing them onto paste board and sending them into the shop similar to the using of blue prints and as they are all one size, are easily kept in boxes in the tool-crib to be called out on check as required. Further, a complete set of assemblies and details are pasted in a folder and kept in the superintendent's office so that he can readily refer to them when necessary without going through a cumbersome folder as is the practice in most shops. When another copy of any print is required the boy simply gets out the original negative and the supplying of the drawing or reproduction is a matter of only a few minutes, just making a print from this negative.

Practical Ideas From Practical Men

TOOLING FOR SIMPLE JOB

By H. Alton

Some of the simplest jobs that are taken care of in the machine shop often develop some interesting fixtures when it becomes necessary to take care of such work on a production basis. A good example of one of these jobs is that of turning the groove in a large number of small cast iron sheaves for use on overhead rail carriers in the new cold storage warehouse recently erected by the Harbour Commissioners of Montreal.

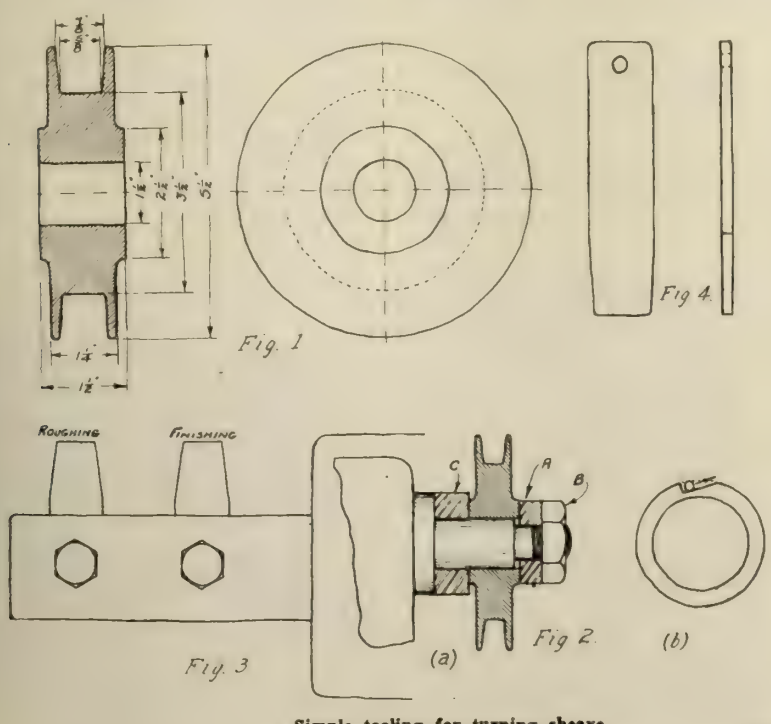
This sheave is shown in Fig. 1 and is approximately five and one half inches in diameter. The groove is one inch deep and is seven-eights and five-eights of an inch wide at the top and bottom respectively. The groove is not turned from the solid, there being a groove in the casting.

Previous to the turning of the groove, the sheaves are bored and the hubs faced on both sides. The turning operation is done on a Jones and Lamson flat turret lathe. An expanding mandrel of the single roller design is used as shown in Fig. 2. In this figure there is also shown the general method of gripping the sheave. The combination of clamping the sheave between two collars by means of the nut and at the same time using an expanding mandrel, is one that provides, to all intents and purposes, a drive that is well nigh positive. The construction of the expanding mandrel is very simple. One groove is machined in the mandrel as shown at b in Fig. 2. The mandrel is case hardened before being placed in service. In the groove is placed a piece of hardened drill rod that is retained in place when assembled by the collar C. When the roller is located in the deepest part of the groove, as shown in the illustration, the diameter of the mandrel over the roller is the same as it is, if calipered at the full diameter, namely 1½ in. The sheaves are a sliding fit on the mandrel. After the sheave is placed on the mandrel the collar A is slid on and then the nut put in place. This nut is brought up fairly snugly by means of a spanner wrench. If the friction between the sheave and the two collars is not enough to keep the sheave from moving on the mandrel when turning operations commence, the slightest movement of the sheave causes the roller to move in the direction of the arrow which in turn causes the mandrel to grip the sheave positively. The collar C is used to keep the roller in position when changing sheaves. However, it was noted that the operator had the mandrel marked and always stopped it with the roller on top.

After placing the sheave on the mandrel, turning is commenced. Two solid tools, one for roughing and one for finishing are mounted on a special bar, as shown in Fig. 3. The outer tool is used for roughing and the inner one for finishing. Both tools are slightly narrower than the finished width of the groove. The roughing tool is fed into the groove, and the scale on both sides and the bottom is removed. The turret is moved slightly, longitudinally, in order to widen the groove. Thus the groove is prepared for the finishing cut. No gauging as to diameter of the bottom of the groove, nor of the width of it, is made in the roughing operation. Because of the narrow tool both sides and the bottom are not being machined at the same time and possibly heavy cutting is avoided. Thus tendency to chatter or to dig in is also made practically impossible.

The finishing tool is fed into the groove in much the same manner as the rougher. The bottom of the groove is cleaned up and then the sides are machined. The gauge shown in Fig. 4 is used to check the width of the groove in the finishing operation. No direct reference to the diameter of the bottom of the groove is made at any stage of the operation. The wire edges of the top of the groove are removed with a file. On the design of turret lathe used in this operation the turret is equipped with only longitudinal feeds. The cross feeding is accomplished by means of travelling the head transversely. The removing of the sheave is also simple. The nut is started by the wrench. Then the operator reverses the spindle and grasps the nut in his hand. The collar A is then removed and a slight blow loosens the sheave on the mandrel. A production of from twenty to twenty-five sheaves per hour can be maintained.

Some of the methods employed in this operation may not appear to be along the lines of the best mechanical practices, but this fact cannot be disputed, and that is the sheaves practically all pass a final inspection and the cost is well within the estimates of the firm. Under present conditions, any method that produces the work so that better than ninety-five per cent. of it passes inspection, and at the same time is within the estimated cost, ought not to be too severely criticized.

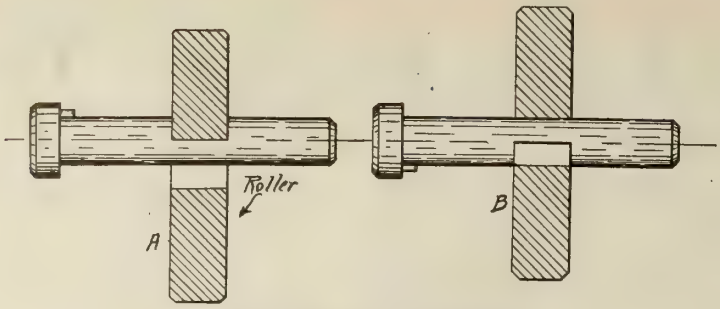


Simple tooling for turning sheave.

WHY THE EXHAUST VALVE DID NOT WORK

By G. Blake

The writer, whilst working in a general repair shop some years ago, was one day sent out by the foreman to examine a gas engine in a bakery, the complaint was that is pulled up when the load was on. The engine was of a very old type, but it seemed to be in good working order as far as the writer could ascertain, the pulling up with the load on indicating that some part was not functioning properly. When the engine was running it was noted that the small cam roller, which actuated the exhaust valve mechanism, appeared to have a very small amount of lift, the engine was accordingly shut down and



Why the exhaust valve did not work.

the roller examined and it was discovered that the pin on which the roller worked had become worn on the top side, that is the side on which the thrust took place when raising the valve to exhaust the exploded gases. This pin was worn practically half way through, see sketch A, consequently the valve did not open sufficiently to allow the gases to escape, which would account for the pulling up when the load was on. The old pin was turned half way round so as to present the unworn part to the bore of the roller, see sketch B, thus giving the valve nearly the proper amount of lift. This of course was only a temporary adjustment until a new pin could be made. The engine pulled all right on lead after this simple alteration.

THREE SIMPLE SCALE HOLDERS

By Harry Moore

Quite apart from the combination sets and other standard scale holders now on the market, there are many simple devices for holding a scale that any mechanic can make in a few moments. For example; nothing elaborate is required to hold a scale securely in a true vertical position, as will be seen by a glance at the first Fig. accompanying this article. In this case a piece of 1¼ inch cold rolled steel has been turned parallel and one end slightly concaved. To hold the scale a piece of common elastic B is used, the only requirement being that it shall be tight enough on the steel piece to hold the scale securely. If the scale is pushed through the elastic until the end rests squarely on the surface plate, a true vertical position is assured.

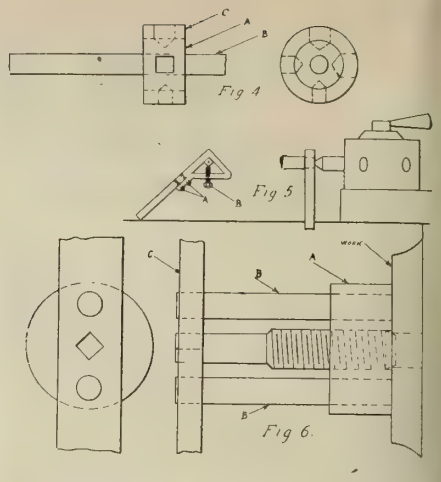
Very often two scales held in this position are handy in laying out work; one graduated in fractions, the other in decimal parts of an inch, or millimetres. The writer first came across this idea during the war when several jobs were being put through to the French measurement. To make assurance doubly sure some of the men fell into the habit of transferring all dimensions into inches, as 75 m.m. for instance, means absolutely nothing to a man unaccustomed to such, but a table of equivalents clears things up somewhat. As mentioned before, it was the custom to make sure before final marking, to try the surface gage on an ordinary scale. Two washers A about ¼ inch thick are used to hold the scales vertical, the hole in the center of one being slightly larger than the screw B to accommodate any little difference in the thickness of scales by allowing the washer to rock. The diameter of both washers is of course equal, the scales are tightened in place by the button head screw B and a nut on the back.

In the last figure two scales are held at right angles by two triangular pieces of ⅛ flat steel A, drilled and tapped for a collar head tightening screw B and a square head adjusting screw C. This simple device holds two scales together rigidly, and if the ends of the scales are in good condition they form a very good square; handy in many cases where an ordinary square could not be used.

MACHINE TAP WRENCHES

By Harry Moore

Several pieces like A can be made up to take different size taps, or if preferred the wrench can be made as shown in Fig. 4 which takes care of four different sizes of squares. The hole for B is drilled through the centers, and on the outside, equi-distant apart, are countersink holes, the top diameter of each being a little larger than

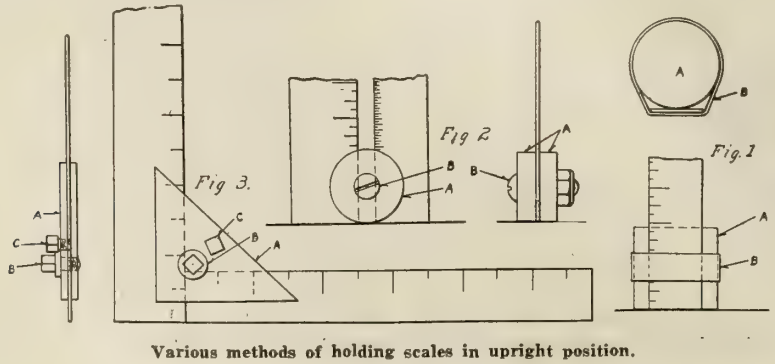


the distance across the corners of taps. Next a ring C is made, drilled the same with four equi-spaced holes and filed out to take the squares of taps. This ring is then either driven tight or shrunk into A as desired, the whole making a very neat wrench when finished.

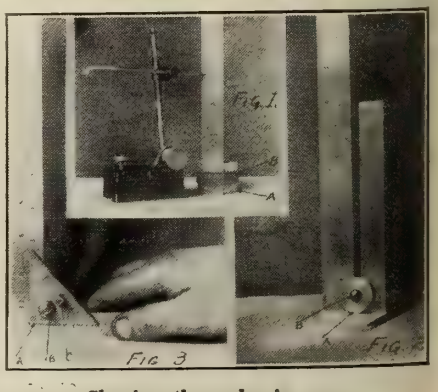
Fig. 4 shows a wrench which has proved useful in connection with a small turret lathe, rather badly worn. Many shops make use of these old timers and find them very handy for doing odd jobs. This is particularly true of tapping operations, for if a cutter of suitable size can be found the tap is soon taken care of by using a center in one of the turret holes and holding a monkey wrench on the square to keep it from turning. This is however rather dangerous, for the moment the tap gets through the nut, or whatever is being tapped, it is likely to jump away from the wrench—which of course has no actual grip on it—and drop into the chuck jaws. With the wrench shown the operator has control of the tap all the time, and when it is through the work it can be held safely back on the center until the machine is stopped. Made of rectangular stock it is best as shown to form a triangular holder, two screws A securing the ends together, and a cap screw B being used to tighten the taps in place; various sizes can be held.

In the last example, Fig. 6, a special guide and wrench are shown, designed for tapping a number of holes in a horizontal direction, this being necessary because they were drilled that way and

(Continued on Page 57)



Various methods of holding scales in upright position.



Showing the scales in use.

New Things in Shop Equipment

AUTOMOTIVE PARTS GRINDING MACHINE

There has recently been placed on the market a grinding machine particularly designed for operation on crankshaft bearings, valve seats, valve stems, piston rings, pins and push rods. The machine is made in two styles one for power feed and the other for hand feed. The power feed machine provides power traverses and automatic reverse for the table and an automatic in-feed for the grinding wheel. Two back rests with wooden shoes and two crankheads are furnished while adapters are provided for holding flanged end cranks. The machine is manufactured by the Cincinnati Grinder Co. of Cincinnati, Ohio.

NECKING ATTACHMENT FOR FULL AUTOMATIC LATHES

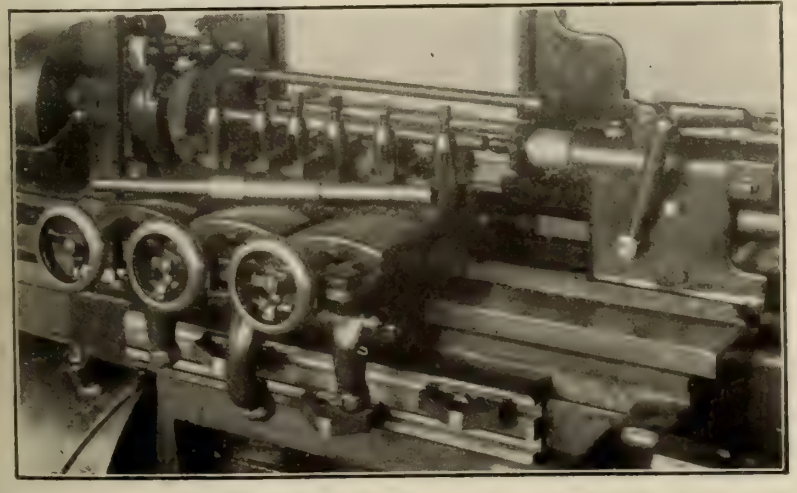
An attachment provided for the purpose of squaring shoulders or necking below the turned surfaces of work for grinding, or for any other operation where a cross feed can be utilized, has just been placed on the market. The attachment consists of multiple carriages to replace the regular carriage of the lathe. One, two or three (as shown) of these carriages may be adjustably clamped to the front way of the bed. They carry regular tool slides and provision is made for multiple tool posts. Adjustment for depth of cut is made by the handwheels shown mounted on screws with graduated dials reading in thousandths of an inch. The cross slides are actuated, through the medium of roll carrying arms, by the adjustable cams mounted on a cam carrier which is reciprocated longitudinally by the main feed cam of the machine. These cams can be adjusted to provide any sequence of the cross movements or all slides may be moved in unison depending on the nature of the work. Suitable oil distribution is provided and all of the automatic functions of the lathe are retained. This attachment may be readily removed and the regular carriage with its actuating parts applied. The device is being manufactured and placed on the market by the Pratt and Whitney Co.

COMBINATION BENCH MACHINE

A rather unusual bench machine has recently been placed on the market. This machine is a combination tool intended for use in the garage or service station. By employing various attachments that are supplied, the machine can be used for drilling in wood or metal, for surfacing or sanding, disc grinding, polishing, buffing, rough or tool grinding, or for rip-sawing wood. The table through which the rip-saw protrudes can be removed in order to allow the various attachments to be adjusted, or the table can be tilted, for sawing at an angle. A horizontal disc placed at the upper end of the vertical spindle, is intended to be used for disc grinding or surfacing. The frame of the machine is cast iron and the two spindles of high grade carbon steel. Both spindles run in bronze bearings. The vertical spindle has a range of movements of 3½ in. without adjustments, and is supplied with a Jacobs chuck which will take drills up to ⅝ in. in dia. The drilling table is adjustable when in position. This machine is manufactured by the Ster-O-Lock Mfg. Co., of Chicago, Ill.

14-INCH TOOL-ROOM LATHE

There has recently beeen placed on the market a motor driven tool-room lathe that embodies some noteworthy features. The motor is mounted on a shelf beneath the oil pan where it cannot obstruct light or interfere with the operator. The drive is through a feed box and an Oldham coupling having no screws or bolts and the motor may therefore be removed or replaced without any other preliminaries than withdrawing the holding down bolt and disconnecting the wires. The motor pinion, being supported by independent bearings remains in place in mesh with the second gear An oil-tight change-gear box is mounted so as to swing about the centre of the second shaft, and from a pulley on the exterior of this box a belt goes directly to the single drive pulley on the spindle. The weight of the gear box maintains a constant tension on the belt, thus eliminating trouble from the stretching of the belt and dangers of breaking from possible snagging of the tool in the cut. Nine changes of feed are available by means of a gear box, and are controlled by the position of the two levers on the front of the pedestal. A positive interlock prevents interference of the gears. The usual form of back gearing, mounted on a quill running on a stationary eccentric shaft, is provided. The ratio of the back gearing is such that nine additional speeds are available, making 18 in all. A complete range of threads and feeds is provided by the two gear boxes controlled by the two upper levers. Improvement in the design of the carriage and cross-slide add rigidity and convenience. The ratio between the cross-feed and carriage traverse is carefully calculated and intended to give accurate tapers when the two are used together. An extremely wide range of tapers is available through the taper attachment. The tail spindle is graduated and the foot stop is provided with an improved form of locking device. Every moving part except the spindle nose and the lead screw is completely covered. The motor is stopped by means of conveniently located push buttons. The speed-change levers are interlocked with the electric control mechanism, so that the first movement in the act of changing the gear speeds, operates to slow down or stop the motor without the attention of the operator. The treadle extending along the front of the base is connected with the swinging gear box so that the operator can, by pressure of his foot, stop the lathe for the purpose of calipering or inspecting the work without stopping the motor. The pressing the treadle raises the gear box and releases the tension of the belt, the operator is thus enabled to stop the lathe from the extreme end without the necessity of reaching the control button. In its lower position the weight of the gear box rests partly on the belt and partly on an adjusting screw, so that the belt tension may be adjusted as the nature of the work may require. This lathe is manufactured by the Hendey Machine Company, of Torrington, Conn.



Necking attachment for full automatic lathes.

STAYBOLT MACHINES

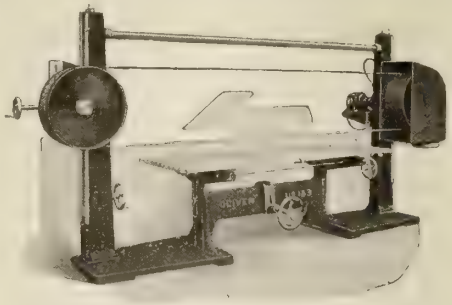
A staybot machine that has some really novel features has recently been placed on the market. The machine is used for turning simultaneously the taper and straight diameters on radial, button-head and crown staybolt forgings, and for threading both the straight and taper ends, also simultaneously, in uniform pitch and continuous lead. After the turning operation, the cutters in both heads are replaced by chasers. To enable the machine to be adjusted to any desired length within its range, the rear die-head carrier is adjustable on the slide by means of a fine-pitch screw. A permanent spacer bar, very accurately made, is furnished with each machine. This bar has twenty-three holes accurately bored and spaced one inch apart, to correspond with the various lengths of the bolts. The rear die-head carrier has a pin, which when inserted through any of the holes in the bar sets the die-heads in continuous lead without further adjustment. A cross-slide with hand cross-feed and hand longitudinal adjustment is provided for facing and undercutting the button-head bolts. The machine has a capacity for bolts from ¾in. to 1½in. in diameter and from 14 to 36in. long. The machine is supplied with a step cone or all geared head, the latter arranged for single pulley or motor drive. Seven hundred bolts 28in. long have been completed in one day of nine hours, by one operator. The machines are equipped with many of the common and well-tried devices and it is stated that these, along with the special features, put them in the class of big producers. The manufacturers are the Millholland Machine Co., of Indianapolis, Ind. They are marketed under the trade name of "Lassiter-Millholland" by the Dale Machinery Co., Inc., of New York City.

HAND PLANER AND JOINTER

A portable, motor-driven planer and jointer has recently been offered to the trade. The machine is intended for mounting on a bench and is made in 4 and 6 in. sizes. The larger size planes widths of 6¼ in. while the smaller size takes care of widths of 4¼ in. Both sizes rabbett up to one-half inch. All parts of the machine are carried on the one base which is a one-piece casting so that the entire unit can be easily moved from one location to another. Hand wheels and screws are provided for raising and lowering of the tables. Provision is made for quick adjustment of the fence to any desired position on the table. When not required it can be moved out of the way. An aluminum safety-guard is provided for covering the knives, yet these do not interfere with the operation of the machine. Three tungsten-chromium steel knives are fitted to the cutter head. The head runs on self-aligning, closed-in ball-bearings, and is driven by means of an electric motor directly connected by means of a universal flexible coupling. The cutter operates at a speed of 3,600 r.p.m. on either alternating or direct current of 110 or 220 volts. A special attachment for sharpening the knives may be furnished when desired. The larger machine occupies a bench space of 32 by 18 in. These machines are manufactured by the Oliver Machinery Company, Grand Rapids, Mich.

SELF CONTAINED BELT SANDER

A machine intended for rapid sanding and polishing of cabinet work and large patterns, and also metal surfaces, has been placed on the market recently. The machine has an exceptionally wide range, and it will take care of work 42 in. high on table and 66 in. with table



Self-contained belt sander.

removed. Table has a travel horizontally of 36 in. and a vertical adjustment of 14 in. Belts are 10 in. and about 31 ft. long. The three principal parts of the machine are the power stand, idler stand and the table. The table is 96 by 32 in. and rolls on ball bearings. It is fastened to the base plates of the stands as shown, all the members being carefully machined and mounted in alignment. The two stands are connected with a rigid top stay, as shown.

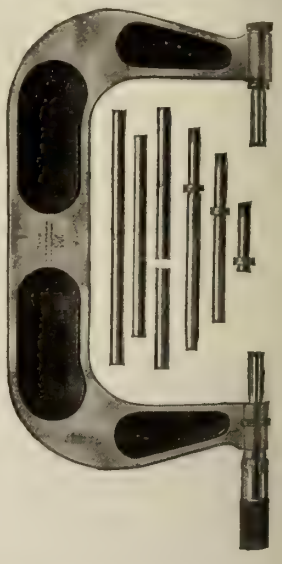
For motor drive a slow speed motor is direct connected to the driving pulley, but high speed motors may be geared to the pulley also, the latter arrangement being shown in the illustration. The pulleys are 24 by 10 in., the large diameter being to assure long life to the belts, sand breaking off less than when traveling around small pulleys. The pulleys are rubber faced and run 600 r.p.m. A reversible switch permits running the bolt in either direction. The machine is made by the Oliver Machinery Co., Grand Rapids, Mich.

NEW LINE OF SMALL LATHES

A line of screw cutting engines ranging in size from 9 to 13 in. swing with the usual lengths of bed have been recently placed on the market. The machines are sold under the trade name of "Handy." They are general purpose machines designed especially for the radio industry, and for started and magneto service stations. The machines may be arranged for either motor or belt drive. The bed is of heavy ribbed construction and can be equipped with either bench or floor legs. The headstock has back gears and a large hollow spindle adapted to draw-in collet chucks. Provided with the machine are power longitudinal and cross feeds, graduated cross feed screw, and a set-over tail-stock. A plain or compound rest and a double friction countershaft having a cone belt shifter and self oiling bearings can be supplied. With this line of lathes the manufacturers are also marketing a plain turning lathe having a 10⅛ in. swing and a three foot bed, taking 12in. between centres. The machine is equipped with a plain rest, feeds from 0.002 to 0.040in. per revolution of the spindle, set-over tail-stock, three step cone, and self-oiling spindle. The countershaft is of tight and loose pulley type with roller bearings in the loose pulley. This machine is intended for plain turning where screw cutting is not necessary, and it is especially adapted for use in making small parts for electrical apparatus. The manufacturers of both these lines of machines are the Seneca Falls Manufacturing Co., Inc., of Seneca Falls, N. Y.

WIDE RANGE MICROMETER CALIPER

A very useful micrometer caliper of unusually wide range has recently been placed on the market. By means of the four detachable anvils, the tool can be adapted to measure from two to six inches instead of from three to six which was the range of the original design. The anvils can be quickly changed and are held securely in place by a knurled nut. One anvil is for measurement from two to three inches, another from three to four inches and so on throughout the range. The tool is especially adapted for use in garages and service stations where small pistons, many under three inches in diameter, and also large pistons for trucks and tractors require accurate measurements.



Wide range micrometer caliper.

It can measure all ordinary sizes of pistons and cover the same range of work as three or four ordinary micrometers. The micrometer is being manufactured by the Brown & Sharpe Mfg. Co. and in general construction it is similar to other micrometers of this make.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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The Outlook is Brighter

THE AGRICULTURAL field in Canada has shown slow but gradual improvement during the spring season. Rural buying is on the upgrade, and while there is still considerable room for improvement, the results so far have been encouraging. Ontario and Eastern Canada are the localities which show to best advantage at present, especially for agricultural implements, while the West is as yet an unknown quantity. Until the outcome of the next harvest is definitely known, we can hardly look for much improvement in that section.

Given a good harvest, there is no doubt but that Western optimism would again prevail. There is a wonderful market for not only agricultural supplies in that part of Canada, but for other lines as well, such as hardware, dry goods, etc., so that the possibility of increased activity in the West, once the harvest is over, must not be overlooked. Now is the time to create good will, so that later, when orders are being placed, the manufacturer who remembered his prospects, even in dull times, will not be forgotten.

Lower Freight Rates Necessary

ON JULY 1, railroad freight rates in the United States will be reduced approximately 10 per cent. Practically all classes and commodities of traffic are affected by this decision.

The move has not been made any too soon. The reduction should have taken place long ago, and Canadian roads should immediately follow suit. There is considerable talk about lower rates in Canada, but little action. In the meantime manufacturers wait and grumble.

Under present conditions machines can be shipped from England by boat to Vancouver, then by rail to the Trail mines, B.C., cheaper than by boat to St. John, N.B., and from there dircet by rail to the mines. To get the significance of this statement look up the map.

The same machines can be shipped from England by boat and rail route to the Trail mines at approximately the same figure at which American firms in Denver, Colorado, can forward their equipment by rail.

A certain brand of spring wire can be purchased by a moderate user in Canada in completed condition cheaper than he can bring in the raw material from the States. Further examples of the hindering influence of high railroad freight rates are unnecessary, for we all realize the necessity of a revision downward.

The decision of the United States labor board to reduce the wages of railroad employees is also a move in the right direction. There may be some trouble about enforcing the reduction, but a firm stand must be taken. Since 1898 operating costs on the railroad have increased tremendously. Passenger engineers who used to receive $3.29 per ten hour day in 1898, now receive $6.08 for an eight hour day. This is an increase of 131 per cent. General wages have increased all the way from 131 to 414.3 per cent. for this period.

A reduction in freight rates here would allow Canadian manufacturers to reduce their prices on goods both for domestic and foreign consumption, and would stimulate production and increase buying in many ways.

Are All Inventors Lucky?

ARE ALL OUR present day inventions the result of painstaking study on the part of the inventors, or is accident, rather than necessity, the mother of many inventions?

According to some authorities, accident forms the chief pivot point in new discoveries, and to try and prove their theory they offer some interesting stories.

Careless workmen in a paper mill some years ago omitted to add any size to the pulp. The paper was thrown aside as waste, but some one accidentally used a scrap of this waste, discovered its absorbent character, and thus blotting paper was invented.

A glass cutter at Nuremberg accidentally let some aquafortis drop on his spectacles, and discovered a means of etching glass.

It was not from any set purpose of forwarding his own scientific experiments that Montgolfier one day undertook the responsibility of airing his wife's gowns, when she was called to leave the house. He observed, while engaged in this task, that the gowns became inflated and tended to rise when filled with heated air; and Madame Montgolfier, on her return, found her husband sending up little paper balloons, thus originating his famous invention.

Some years ago, an Ohio business man had a shop in a good situation, and many customers, but somehow his business was not profitable. There was evidently something lacking in his methods, and he worried so much on the subject that he found it necessary to take a rest. While on his way to Europe, he was standing one day in the ship's engine-room, when his attention was attracted by the automatic indicator of the propeller shaft's revolutions. The question suddenly occurred to him: "Why not devise a machine for recording sales in a shop." Hence the invention of the cash register.

At the hearing of a Dunlop appeal case in the House of Lords in December, 1920, it was mentioned that the idea of a pneumatic tire was suggested by the tying of a piece of water-piping around the wheel of a wheelbarrow.

At least one valuable invention was the offspring of sheer laziness. In 1846 a railway pointsman, who had to attend to two station signals some distance apart, decided to save himself the trouble of walking to and fro between them by fastening the two levers together with a long piece of wire. A broken iron chair served as a counterweight. The wire ran on into his hut, where he sat nightly by his fireside and worked the two signals without setting foot outside. Presently the railroad officials found it out, reprimanded the lazy man for his indolence, promoted and rewarded him for his ingenuity, and adopted the invention.

After these stories what decision can we arrive at? To our mind, although accident may have had a great deal to do with the inventions mentioned, there was more than pure luck connected with the development of the ideas. Vision was necessary, the power to follow out a lucky coincidence, and the will to carry on in spite of disappointments. The stories told barely scratch the surface, for underneath these so called lucky incidents we find the inventive mind and the will to persevere.

Several Advances In Quotations Have Occurred

Products Advance Slightly, Also Iron and Steel Bars In Some Localities—Wipers Drop In Price—Small Tool Market Fairly Active—Non-Ferrous Metals and Scrap Are Quiet

SHEET DELIVERIES ARE MUCH SLOWER

A FEW PRICE reductions and advances have occurred on Canadian markets during the week. None of these however are of great importance, simply reflecting the strength or weakness of the section in which the change occurs.

Iron and steel bars have advanced to $2.90 in the Montreal field, but $2.75 still holds good around Toronto. Competition is too keen in the latter mentioned locality to permit an advance, although it may occur any time now that Montreal has taken the initiative.

Copper products also advanced in price, copper bars being now $28; brass sheets, $22; copper tubing, $29; and brass tubing $25. These new prices became effective May 29.

Fuel oil went up four tenths of a cent, the net price per barrel being $10.80 in place of $10.40.

Wool packing has dropped in price, the amount varying between 4 to 6 cents per pound.

Machine tools are the same as last week, but small tools and supplies have improved slightly. The iron and steel market is firm, and May will show up as the best month this year.

Pig iron demand is lighter, but the market is firm. Non-ferrous metals and scrap are both quiet, but there has been no change in price, except in Montreal locality, where the revision is upward. These advanced figures mean little or nothing as the volume of business moving is not worth commenting upon.

The bolt and nut factories are busy and expect to continue active for some time to come.

The steel market in the United States has lost no strength so far as prices are concerned, but the demand is lighter. Producers are well sold up, and have orders on hand for at least two months. In fact several mills have not opened their order books for third quarter business. The coal strike is responsible for this cautious move, for should the strike continue longer than the next two or three months, the mills might not be able to produce.

The general freight reduction taking effect July 1, will reduce the average cost of making steel about $1.25 to $1.50 a ton. This will of course help the consumer.

Steel ingot production is running at about 38,000,000 gross tons a year, this being 3,000,000 advance over the figure for April. The present rate is practically double actual production in 1921.

Bars, shapes and plates are now quotable 1.69c minimum, while some early delivery business is being closed at premium prices. Nails range between $2.40 and $2.50. Tubular goods are very firm, the shading that was so pronounced two months ago having disappeared.

Connellsville coal has declined to between $3.00 and $3.25. Hoover's determination to bring about reasonable prices for non-union coal is largely responsible for the reduction. Small lots of Bessemer pig iron have been sold at $25, valley. Basic and foundry are quoted at $25 and $24 respectively. The market, however, is stagnant.

Toronto

June 1.

A FEW price changes have occurred during the week but nothing of outstanding importance. Wool packing has dropped slightly, while some copper products have advanced. The iron and steel market is firm, and it is quite possible that Toronto will soon advance their price on iron and steel bars to the same level as Montreal. In fact they would have done so before had competition not been so keen.

Iron and Steel.—Every week sees a little added strength in these two lines. The demand is general and covers a large field. Sheets are decidedly active, and deliveries from the mills are getting longer all the time. Four to six weeks from date of order is the best you can get, and in the majority of cases August delivery is now being quoted by Canadian mills. This does not infer however that the mills are working right up to capacity, for they are not. The reason is this:—They are operating at what they consider a safe margin, keeping in mind the possibility of a coal shortage. In fact some American sheet mills are not accepting orders from local jobbers because of present booking, and uncertain coal supply.

The past month has shown up to good advantage on the merchants' books, and an increase of at least 15 per cent. is expected when the figures of May have been totalled up. Building keeps very active, this also being responsible for added business in iron and steel lines. Following are local quotations:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Non-Ferrous Metals.—There has been very little change in this section. A slightly stiffer tone exists, but the volume of trade moving has not increased to any extent. As a detailed account of the non-ferrous market appears on another page of this issue, we will simply print quotations to guide readers in their purchases:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	6 75
Aluminum	26 00

Scrap Metals.—This is another quiet market. Compared with two months ago, it has improved, but placed alongside last week's report, conditions are identical. Following are prices quoted:

Copper, light, per 100 lbs.	8 00
Copper, crucible	10 50
Copper, heavy	10 50
Copper wire	10 50
No. 1 composition	8 50
New brass cuttings	6 00
Red brass turnings	6 00
Yellow brass turnings	4 75
Light brass	3 50
Medium brass	4 50
Scrap zinc	3 25
Heavy lead	4 00
Tea lead	3 00
Aluminum	10 00
Boiler plate, per gross ton	9 00
Heavy melting steel	10 00
Axles (wrought iron)	16 00
Rails (scrap)	10 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools.—This section is merely holding its own. Enquiries are better and are more direct in character, but outside of this, there is nothing new to report. What sales have been closed are for small amounts.

Small Tools and Supplies.—The demand for supplies has held up very nicely during May. Compared with April it will be about one third better, but to use this comparison is hardly fair, because April was a poorer month for some dealers than March. Looking on March figures, then totalling May sales, an improvement of between five to ten per cent. can be noted, the amount varying according to the dealer and his particular field. Some merchants feel that the new tax on the automobile industry will be sure to affect them indirectly, for a large percentage of the business closed recently has been for automotive factories.

Pig Iron.—Although the demand for pig iron is not exceptionally heavy, the market is firm. The mills are not running anywhere near full capacity, placing safe on a possible coal shortage, but a fair amount of orders are still being placed. The price is strong, being still $29.15. So far, Toronto has not felt the influx of British pig iron, but a few large users are completing enquiries.

Steel Pipe.—This market has a decidedly firm tone and the mills are quoting extended deliveries. Large users have already placed their orders so they are well protected. The small consumer simply has to take his turn, the mills doing the dictating.

Oils.—The demand for all sorts of oil continues to be fairly good. Fuel oil is up four tenths of a cent, the new price per barrel being $10.80. This is a very small increase, but shows the tendency. Following are present quotations:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	0 20
Palacine	0 23
Machine oil, per gal.	0 88
Black oil, per gal.	0 17½
Cylinder oil, Capital	0 61½
Petroleum fuel oil, bbls. net	10 80
Pure turp., single bbls. gal.	1 35
Linseed oil, raw, single bbls.	1 00
Castor oil, per lb.	34½
Royalite, per gal., bulk	21
Palacine	24
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	9 90
Pure turp., single bls. gal.	1 35
Linseed oil, raw, single bbls.	1 15

Waste and Wool Packing.—Several reductions in wool packing have taken place, and the new list shown below gives existing quotations. The previous prices were 30, 25, and 20 respectively.

WOOL PACKING

Arrow	24		
Axle	20	Anvil	16

Other lines of waste have not changed, but the demand has increased. The added activity in several branches of industry is reflected in these lines, the printing trade ordering a large percentage of the washed wiper business. Following are quotations:

WASTE

XXX Extra	16	Atlas	13
Peerless	11	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

Copper Products.—Several lines have advanced slightly, copper bars being $28.00 against $27.00, and copper tubing 29c. against 27c. Other new prices are, brass sheets, 22c, and brass tubing 25c. All these changes became effective May 29. Following is complete quotation list, showing new figures:

COPPER PRODUCTS

Copper Bars, ½ to 2 in.	$28 00
Cooper wire, list plus 10	
Plain sheets, 14 oz., 14x60 in.	28 00
Copper sheet, 14x60, 14 oz.	35 00
Copper sheet, planished, 16 oz., base	40 00
Braziers', in sheets, 6x4 base	28 00
Copper tubing, seamless	29
Brass Sheets	22 00
Brass Tubing	25

Montreal

June 1.

THE FEATURE of the local metal market is the stiffening of quotations in many lines. The strength in base price of steel at Pittsburg is reflected locally, and the new import tax is responsible for firmness in some quarters. Machine tools are quiet, and supplies are moving fairly well. Pig iron is quiet but the price is firm. Nonferrous metals are stiffer and business is improving The scrap market is dull.

Iron and Steel.—Jobbers and consumers allowed their stocks to get low during the very dull period of fall and winter, and being also influenced by the falling market, they kept out of actual purchasing, except for small lots intended for immediate use. In March when the bottom prices were reached, and the upward revision of prices was announced, it resulted in considerable business being placed with mills in the U. S. For some time past these mills have been receiving an increasing volume of business. Pittsburg base prices have risen from $1.30 to the present quotation of $1.60 in the past two months. In fact quite a tonnage has been recently placed in Pittsburg for early delivery at $1.75 base. Local mills are feeling this increase in business, and improvement is shown in many lines.

Jobbers increased their quotations during the week from $2.75 to $2.90 base. The mills are quoting jobbers in car load lots at $2.50 base, and on larger lots, representing the most attractive business, a price of $2.30 is named. Speaking generally, local jobbers state that the sales of iron and steel have improved with each succeeding month since the New Year, with the exception of April, which showed no improvement over March. Figures for May indicate that sales for the month will be about twenty per cent. ahead of April.

Building operations are still calling for a large volume of nails, spikes, reinforcing bars, and heavy hardware as well as some tonnage in structural sections. Merchant bars are moving fairly well, but rail orders are not yet in evidence. Sheets are active. Galvanized sheets in standard sizes and gauges cannot be obtained from British mills in quantities required to take care of the immediate demand. Blue annealed and black sheets are also moving well. Small steel lines are in fair demand but the business is somewhat spotty. Boiler tube quotations are very firm. Other lines are moving satisfactorily. For some time past a small weekly improvement has been consistently shown. Jobbers quote the following prices:

Iron bars	2 90
Steel bars	2 90
Reinforcing bars	2 90
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—Since the last two-dollar a ton increase in price brought many firms into the local market, sales have been dropping off until conditions are again very quiet. In normal pre-war times, the Province of Quebec and the Maritimes, used about ten thousand tons of pig per month, but sales for the past year have been at about the rate of one thousand tons per month. Recent purchases following the jump in price were far in excess of consumption, hence the present dullness. Some sales of British Summerlee iron are still being made, and this is quoted at about one dollar per ton lower than Canadian iron. This condition is a serious one locally for Canadian mills and will exist as long as consumption in Britain is below normal. However, consumption in this vicinity is gradually increasing. No. 1 Canadian iron is quoted at $31.80.

Machine Tools and Supplies.—Little change in the machine tool situation is shown this week. The new import and sales taxes will increase prices of both wood and iron working tools. At present these figures have not been announced. Wood-working equipment is moving a little better than iron working tools, but the market is extremely quiet.

The supply business is fairly satisfactory as most of the jobbing shops are reasonably busy and are coming into the market more freely.

Non-Ferrous Metals.—An originally firm foreign market and the new import tax have caused the upward revision in nearly all non-ferrous metal quotations. Business is somewhat better than last week, although the demand is scattered and for small lots, the total volume is satisfactory, and an improvement over the figures for any single week for some time past. Local jobbers quote the following prices:

Lake Copper	17 25
Electric Copper	17 00
Castings, Copper	16 75
Tin	35 00
Lead	6 75
Spelter	7 75
Antimony	6 50
Aluminum	23 00

Scrap Metals.—The scrap market is very quiet. Prices are somewhat firm owing to an increasing number of inquiries, but the holdings are small in this locality. The following prices are quoted by dealers:

Copper, light per 100 lbs.	9 50
Copper, crucible	12 50
Copper, heavy	12 50
Copper wire	12 50
No. 1 composition	9 50
New brass cuttings	7 00
Red brass turnings	8 50
Yellow brass turnings	6 00
Light brass	4 00
Medium brass	5 00
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	12 50
Boiler plate, per gross ton	8 50
Heavy melting steel	10 00
Axles (wrought iron)	9 00
Rails (scrap)	10 00
Malleable	10 00
No. 1 machine cast iron	22 00
Pipe, wrought	7 00
Car wheel	17 00
Steel axes	16 00
Mach. shop turnings	4 00
Stove plate	18 00
Cast boring	3 00

Pittsburg

June 1.

THE STEEL market has grown still quieter in actual turnover, but has lost no strength, as producers are well sold up and are assured of as full oper-

ation as physical conditions will permit for a couple of months or longer.

Whether buyers would continue to purchase now, for later deliveries, if they had the opportunity, is an open question. The opportunity is lacking in most cases, for some mills have not opened their order books for third quarter business, having been deterred from doing so by uncertainties as to ability to produce if the coal strike continues beyond the next couple of months. They are also doubtful whether all the buying tendency at present rests upon the solid foundation of requirements. In other words, the mills are afraid of there being speculative buying, for consumers are now as anxious to buy as they were a few months ago to refrain from purchasing.

Of course some of the tonnage now on books will not be shipped until after July 1, through some mills being behind in deliveries, while several sales have beeen made for July delivery. Little regular third quarter business, however, has been entered. The American Sheet & Tin Plate Co. will in all probability have opened its books for third quarter sheets and tin plate before this report reaches the readers. In bars, shapes and plates there may be no formal book opening at all, on account of so much of the tonnage now entered lapping over into the new quarter.

Steel ingot production is now running at about 38,000,000 gross tons a year, against 35,000,000 tons April 1, and 20,000,000 tons last December. The present rate is practically double the actual production in 1921, and falls only a few per cent. short of the production in 1920, when there was a strenuous demand for the major part of the year.

An interesting thing about the steel position, is that there is a very strong market when production is at the rate of 38,000,000 tons of ingots a year, for this is only between 70 and 75 per cent. of capacity, which probably lies about half way between 50,000,000 and 55,000,000 tons. Before the war it was commonly held that a strong steel market, with prices stiffening, could not develop after a depression until production reached 85 or 90 per cent. at least. The difference between recent and pre-war conditions is that before the war the steel industry was always able to operate at capacity when it had the orders, while since 1916 which was a year of capacity production, there has been no time when there was a full demand that capacity operation was possible.

In 1917 and 1918 there was practically continuous shortage of coke, due to transportation difficulties, together with some shortage of labor. Late in 1919 there were in succession the iron and steel strike and the bituminous coal strike, and when the industry had gotten over these there came the outlaw railroad strike April 1, 1920. Now there is the bituminous coal strike.

Perhaps in a pinch the steel mills could produce considerably more than they are making, but evidently the buyers of steel do not think they could. They are acting as if there is a possibility of a shortage of steel, and there is practically no doubt that actual consumption at present is less than production and shipments. Consumption no doubt is increasing and may catch up, but to keep the steel market strong continuously in the future there must be considerably greater consumpt on or a continuous inability of the steel industry to function up to capacity. There must for instance, be a breakdown of the railroads after the coal strike has ceased limiting steel production, or some other trouble.

Bars, shapes and plates are now quotable at 1.60c as minimum, and it appears that there is some buying, for early deliveries, at premiums, probably involving no large tonnage. Nails continue to be quoted at $2.40 by the American Steel and Wire Co. and at $2.50 by the independents, but as the leading interest did not follow the advance made by the independents about the middle of April, it has been increasingly difficult for the independents to sell much tonnage at their higher price.

Hoops, bands and hot rolled strips are all quoted at 2.25c, chiefly, perhaps, because mills still have a considerable tonnage of old business on books, at less than 2.00c. Tubular goods are very firm at regular prices, the shading that was so pronounced a couple of months ago having disappeared.

There are no new developments in the union bituminous coal strike, which has now lasted two months, and may last two or three months longer. The various non-union strikes have held out very well thus far, but are hardly likely to last as long as the regular union strike. In the Connellsville region, which is of particular interest to the iron and steel industry, there have been reports for several weeks of men drifting back to work, and this drift is now causing a slight increase in production. The guess among operators is that within a few weeks there will be a stampede back to work.

Connellsville coal has declined in the past week as rapidly as it advanced in the previous week, and is now quotable at $3.00 to $3.25. The cause of the decline was withdrawal from the market of many buyers, who were influenced by Secretary of Commerce Hoover's determination to bring about reasonable prices, for non-union coal, on the other hand, has advanced sharply, chiefly on account of buying by one steel interest, which is about to put a blast furnace in operation. The market is now all of $7.00 for either furnace or foundry coke. The advance shows how limited the offerings previously were.

Several small lots of Bessemer pig iron have been sold at $25, valley, which is now the quotable market against the nominal figure of $26 given a week ago. Basic and foundry are quotable at $25 and $24 respectively. The market is quite stagnant.

The general freight rate reduction ordered by the Interstate Commerce Commission amounts to 10 per cent. in Eastern territory, i. e., rates after July 1 are to be only 26 per cent. above rates in force just before the general advance of August 26, 1920, instead of 40 per cent. above. Thus, in general, 35 per cent. of that advance is taken off. This, however, does not put the iron and steel industry back 35 per cent. of the amount by which its freight charges have increased since 1913, since there were various advances before that of August, 1920, and in particular there were some stiff advances in coal, coke and iron ore rates when there were not corresponding advances in the class rates. A rough guess would be that the present reduction will reduce the average cost of making steel $1.25 or $1.50 a ton.

Non-Ferrous Market Shows No Change

SPEAKING on conditions in the Canadian non-ferrous market, Ernest W. Knight, Frankel Bros., Toronto, says that there has been no material change in the copper situation. "The market has been a little erratic but no marked alteration in the quoted price has materialized," continues Mr. Knight "and at the commencement of the month of April, the New York market showed some signs of life, based on the fact that the English market suddenly grew stronger, whilst exchange rates remained in last month's position. With the decline in exchange, which has now taken place, the English market has dropped pro rata and English values are, therefore now on a par with American values. No. 1 Lake is quoted at 12 7-8, Electrolytic at 12 3-4 and casting at 12.50 and there is no scarcity of red metal at these figures.

"When the Genoa Conference first went in session, the producers withdrew a considerable amount of metal from the open market, but this has now been replaced, and the high hopes which were entertained at the outset of the conference have apparently given place to a feeling of resignation. No rise is anticipated, but on the other hand, there is little likelihood of any decline. Consumers, therefore, cannot be far wrong in buying futures at current values.

Caution Necessary

"Tin is again fluctuating in an erratic manner and purchasers are just as likely to be right by buying on any one particular day as on any other. Tin, at the present quotation of 31c., appears to be cheap, but this is largely owing to the fact that the present value is much below that to which we have become accustomed during the past few years. It is not so very many years ago since tin was purchased freely at from 12-5-8 to 13c. per pound, and when one considers that this price ruled for a period of about 5 years, from 1894 to 1898, inclusive, it is pretty hard to decide exactly what is likely

to happen in the immediate future. There is not however, likely to be any marked reduction in price but the advance in sterling exchange should make a difference of 1c. to 2c. Caution should, therefore, be exercised in the purchase of this commodity for futures.

"The market for aluminum continues about the same. Ingot metal is quiet but sheet and wire are in fairly good demand. Prices remain at much the same level as last month but with a strong upward tendency, with the outside market quoting for 98-99, 17¼ to 17¾, 99, and over at 18.50. The Trust, however, are quoting for 99 p.c., 20c. in 50 ton lots, and an upward turn is likely to take place any time.

"The nickel market is still lifeless, and very little buying is taking place.

Advances Looked For

"Inquiries for spelter are more numerous than has been the case for some little time, and May, June and July shipment is selling freely. Producers are cautious in making future commitments at present levels, and further advances are likely at any moment. The East St. Louis market closes at 5.05, with both New York and London firm and steady, with an upward tendency. Unquestionably, spelter will be higher before very long.

"Lead is also firm and spot East St. Louis closes at 5¼. The A. S. & R. price for East St. Louis is firm at 5.05 but no large parcels of metal are available at this figure. Lead is not likely to advance much beyond the present price but the producers have the market well in hand and no reduction is looked for in the immediate future."

BUSINESS CONDITIONS SHOW IMPROVEMENT

"WERE I to attempt to describe the conditions now existing, I would to a large extent repeat what I said last year," remarked President Howland of the Imperial Bank a few days ago. Several other statements made were exceedingly interesting, and following are a few excerpts which will interest our readers.

"There are some changes for the better. The cost of manufacturing and the cost of distributing goods has been somewhat modified, but they are still out of line with the purchasing power of the country, and I fear business must still be done without an adequate return. The farmer, too, I am glad to say, has better prospects than a year ago.

"His seeding has been done under fair conditions; he is economizing, getting his labor cheaper, doing his work cheaper, and producing cheaper in practically all respects than last year, and notwithstanding the restrictions on his markets is getting remunerative prices for hogs, in some cases for cattle, and the promise of reasonable returns for grain; he would seem then to have a good chance of coming out with his accounts on the right side; if he does, it will help us all mightily.

"Some branches of mining are yielding returns; the results from woods operations and from lumbering should be better than last year; some of the textile industries are doing better; the trapper, too, I think is getting profit from his furs; automobiles are still selling freely, and in the United States the demand for iron and steel has improved with advances in prices in some cases, which must be reflected here; whether the change is the result of the coal strike or has a more stable foundation it is hard to say. Building is going on briskly, particularly that of dwellings in this city.

"Altogether, although there have been improvements in some directions, I am of the opinion that, while we are getting nearer a stable level, the processes of readjustment must continue for some time before we will be relieved of our anxieties and another lengthened period of what is called 'Good Times' sets in."

MACHINE TAP WRENCHES

(Continued from page 50)

the work required considerable manouvering to secure a proper clamping. Anyone who has done any tapping this way knows how difficult it is to start the tap in straight, it seems to prefer any angle but a right one. The guide A is drilled to slide over the threads of the tap nicely, and has two holes, one at each side into which are driven two drill rod pins B. The wrench C is a solid one with two holes to accommodate the pins in the guide. This idea works better if the wrench is a little easy on the tap square, for this reason; as it is impossible to exert an even pressure with either hand this wrench is always more or less binding a little on one of the pins, thereby keeping the guide close up to the face of the work. The guide remains on throughout the operation there being ample allowance for the tap to travel before the wrench strikes A.

A ONE-MAN MACHINE GUN

The British War Office have recently been testing a remarkable machine gun which is so light that it can easily be carried by one man slung over his shoulder in much the same way as an ordinary rifle. This weapon is capable of firing from 400 to 700 rounds per minute according to the strength of the spring used. The weight, complete with mounting, is only 15½ lbs., and the inventor claims that there is no possibility of the cartridge becoming jammed in the gun. Lubrication of the mechanism is not necessary and the heat of the barrel does not affect the working in any way; in fact the gun will continue firing even though the barrel gets red hot. When the cartridge is fired gas passes through an aperture in the barrel into a cylinder and forces a piston backwards, thus operating a spring which brings another cartridge from the magazine into place.

LARGE CONTRACT TO BE LET SHORTLY

THE Department of Railways and Canals are receiving tenders for the completion of sections 3 and 4 of the new Welland Ship Canal. These are to be closed June 9. The two sections mentioned comprise the heaviest part of the work yet to be done, as they run through rock, and include the erection of several locks. The estimated value of the contract is around thirty millions, and the work must be completed by the end of March, 1926. The locks on this section are the largest in the world, equalling an ascent of 139½ ft. Each lock is 800 feet long, with 28 feet of water on sills. It is estimated that there are about four million cubic yards of rock and twenty-six million yards of earth to be excavated on this section, and about one million five hundred thousand cubic yards of concrete to be laid.

The specifications call for the successful tenderers to purchase all the plant and equipment now owned by the government on the sections valued at $2,500,000 thus making the contract the largest ever awarded in Canada for the expenditure of 30 million dollars for work to be done and for the contractor to pay two and a half million dollars for the purchase of the plant.

These two sections run through the town of Thorold. Since 1919 they have been working on the cost plus system of contract, Doheny Quinlan and Robertson being the contractors, but the government now desire to revert to the unit price contract.

Alex. J. Grant is the engineer in charge of the whole canal, while F. S. Lazier is the divisional engineer for sections 3 and 4. As soon as the contract is let it is said that about 2,000 men will be employed.

A HUGE TYRE MILL

ONE of the most powerful machines in the world for making steel tyres of locomotive wheels has just been installed in a British locomotive works. It is capable of rolling the largest locomotive tyres and it can also produce broad rings up to twelve inches in width. Several novelties have been introduced into the design. One outstanding feature is that the top roll spindle is made to rise and fall, whereas in the ordinary type it is the bottom roll which is movable. Huge as the machine is, both the top and bottom rolls can be changed in a few minutes without dismantling any part of the mill. The mill is driven by special electrical gear which gives every speed from a slow creep up to the fastest possible. The top roll is driven by a four hundred horse power motor and the bottom roll by a six hundred horse power motor, and the driving gear is capable of carrying double load for a considerable time.

About eighty per cent. of the nickel produced is used for the manufacture of nickel steel.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 90
Steel bars, base, Montreal	2 90
Reinforcing bars, base	2 90
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate ¼" and heavier	5 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.50
Tank plates, Pittsburgh mill price	1 50
Structural shapes, Pittsburgh mill prices	1 50
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 53
Structural shapes	2 63
Plates	2 63
Small shapes under 3-in.	2 53

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge, 2 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 25	$17 00
Electric copper	17 00	17 00
Castings, copper	16 75	17 00
Tin	35 00	34 50
Spelter	7 75	7 25
Lead	6 75	6 75
Antimony	6 50	6 75
Aluminum	23 00	25 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Battweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.85	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.33	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 9 50	$ 8 00
Copper, crucible	12 50	10 50
Copper, heavy	12 50	10 50
Copper, wire	12 50	10 50
No. 1 machine composition	9 50	8 50
New brass cuttings	7 00	6 00
Red brass turnings	8 50	6 00
Yellow brass turnings	5 00	4 75
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 00
Tea lead	3 00	3 00
Aluminum	12 50	10 00

	Per Ton	Gross
Boiler plate	$ 8 50	$ 7 00
Heavy melting steel	10 00	10 00
Axles (wrought iron)	19 00	16 00
Rails (scrap)	10 00	10 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	22 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	16 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	18 00	14 00
Cast boring	3 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto ..... Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	60
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

IRON PIPE FITTINGS

	Black	Galv.
Class A	54	67
Class B	20	28
Class C	13	20

Cast iron fittings, 30%; malleable bushings, 32%; cast bushings, 32%; unions, 47%; plugs, 30% off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 40	$4.40
Sheets, blue ann., No. 10	3 80	3,75
Canada plates, dull, 52 sheets	5 75	6 00
Can. p'ates all bright	8 25	...
Galvanized sheets, No. 28		5 60
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis. 28 B.W.G.	7 00	
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	....
Premier, No. 28, U. S.	6 45	5 35
Premier 10¾ oz	6 00	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	21.00	$
1¼ in.	21.50	
1½ in.	22.00	
1¾ in.	23.00	
2 in.	22.00	17.00
2¼ in.	26.00	18.00
2½ in.	30.00	20.00
3 in.	34.00	25.00
3¼ in.	43.00	27.00
3½ in.	47.00	28.00
4 in.	58.00	35.50

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	20
Palacine	23
Machine oil, per gal.	33
Black oil, per gal.	17½
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	1.40
Pure turp., single bbls. gal	10.80
Linseed oil, raw, single bbls.	1 15

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets. 24 gauge and heavier, base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White 18 Dark colored.13

Mixed colored.14

This list subject to trade discount

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Copper Bars, ½ to 2 in	$29 00	$28 00
Copper wire, list plus 10		
Plain sheets, 14 oz., 14x60 in.	30 00	28 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	35 00
Copper sheet, planished, 16 oz. base	42 00	40 00
Braziers', in sheets, 6 x 4 base	30 00	28 00
Copper tubing, seamless		29

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute).	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Several contracts have been awarded for additional work to the Cambridge St. school, Ottawa, totalling $55,000.

Montreal, P.Q.—The Foundation Co. have taken new offices at 552 Drummond Building.

Tenders up to June 8, will be received by Amable Mercier, secretary of town council, Berthier, Que., for the construction of a concrete bridge.

Fredericton, N.B.—The Imperial Oil Co., Barrack Point, St. John, is considering the erection of an office and warehouse.

Toronto, Ont.—A. J. Latornell, engineer in charge of sewer section, dept. of works, has resigned. George McCarthy who has been engineer in charge of railways and bridges takes his place.

Lethbridge, Alta.—A school to cost $50,000 for Saskatchewan S.D. No. 1,036, and Albert S.D. No. 1,753, will soon be erected if present plans go through. A. M. Jeffers, architect, 210 McLeod Bldg., Edmonton, is preparing the layout.

Aurora, Ont.—Tenders will be received up to June 6, for the erection of addition to school to cost $60,000. The plans are with D. R. Franklin, 2 College St., Toronto, and A. Love, of Aurora will receive the tenders.

R. J. Fuller, chief engineer for J. V. Gray Construction Co., Toronto, has assumed managership of the New London, Ont., office of this concern. Mr. Fuller will however continue to be chief engineer.

Windsor, Ont.—The city clerk will soon advertise for debenture bids for $1,250,000. This is for the erection of the following buildings. Technical school, $666,666, public schools, $65,738.30, street flusher, $12,000, street lighting, $10,535.76, hydro-electric extension, $300,000, and $20,000 for municipal housing.

Tobias Dantzig, Ph. D., formerly instructor of mathematics at Columbia and John Hopkins Universities, and recently research engineer of S. K. F. Industries, Inc., has resigned the latter work to engage in scientific and technical consulting work, specializing in bearing problems and mathematical research of an engineering character. Mr. Dantzig is located in New York at Room 1109 Canadian Pacific Building.

Toronto, Ont.—W. H. Martin & Co., 28 Harcourt Ave., have been incorporated. The name of firm is now the United Building Corporation, and W. H. Martin is president and general manager. Mr. Pillsworth, formerly with Pillsworth & Daly, contractors of Cobourg, Ont., Chas. E. Jex, and Fred Halloway are also included in the new organization. The capitalization is $60,000.

WILL ESTABLISH SALES OFFICE IN TORONTO

THE JOHN MORROW Screw & Nut Co., Ingersoll, Ont., have announced an important policy of expansion. Starting June 1st this company will establish executive and sales offices in Toronto. J. F. MacKay, vice-president and general manager of the company will be in charge, and while he will have his headquarters in Toronto, he will continue to have a general oversight of the company's affairs, spending some time each week at the factory.



J. F. MACKAY

Other changes are as follows:—Lt.-Col. Edmonds, director and secretary, has been made secretary-treasurer, and will reside in Ingersoll. J. E. Hargan, in addition to his duties as works manager, will act as assistant-treasurer. J. C. Adams, the company's Toronto salesman, has been made assistant sales manager.

Two additional travellers have been added to the selling force, Wilbur Detweiler and Lewis Hague, the former covering Western Ontario and the latter being attached to the Toronto office.

Increased demand is evident in all lines manufactured by this firm, and practically the entire force is working on a fifty-hour per week basis, and additional men are being taken on daily. The Ingersoll File Company, a subsidiary of the Morrow Company, has also been enjoying a period of great activity since the first of the year, at present over seventy hands being employed full time with occasional overtime. At present a complete sprinkler system with elevated tank is being erected at the screw and drill plants.

Allison Ridden, Kentville, N.S., is contemplating the erection of a mill.

Field & Patterson, Sawridge, Alta., will erect a saw mill in the near future.

A community hall costing $10,000 is at present being erected at Newcastle, Ont., by the Massey Estate.

Plans will soon be prepared for an addition to Laval Hospital, Quebec. The estimated cost is $150,000.

The Gloves Tanning and Knitting Co., Rigaud, Que., is contemplating the erection of a factory.

A hospital and nurses' home to cost $79,000 will be erected at Pembroke, Ont. Wm. Markus, Pembroke, has been awarded the contract.

The Pacific Meat Co., 268 Columbia St., Vancouver, B.C., is considering the erection of abattoir and cold storage plant which will cost around $100,000.

The general contract for erection of factory to cost $40,000 for Dominion Dress Co. has been awarded to A. J. Cromer, 448 Colborne St., Brantford.

Hon. P. J. Veniot, Minister of Public Works, New Brunswick, says that about $500,000 will be spent on bridge construction throughout his province during the present year.

The Dominion Textile Co., Montreal, is having repairs made to its office amounting to $5,000. J. MacGregor, 44 Close Ave., has been awarded the contract.

Jas. Gordon, 885 Broadview Ave, Toronto, has been awarded general contract for erection of oil distributing station and storage tanks at London, Ont. These tanks will cost $60,000 and will be erected for the Pure Gasoline Co., Toronto.

"We have felt a decided improvement in our business," said Mr. Truman Norton, manager of the Canadian plant of the Wallace Barnes & Co., Hamilton, to Canadian Machinery the other day. "This fact shows," continued Mr. Norton, "that general conditions must be improving, for we handle such a diversified line, catering to all classes of industry, and our books show that these orders are coming in from general sources."

Vancouver, B.C.—A paper mill, to cost $100,000 is to be erected on the north arm of the Fraser river within the boundaries of the city of New Westminster, according to an announcement made by the Westminster Paper Co. This is a new organization backed by United States capital, most of the individuals interested being Wisconsin men. About one hundred men will be engaged, and it is the intention to manufacture tissue and other thin papers from British Columbia pulp for the Canadian and Oriental markets.

The London Life Insurance Co., 424 Wellington St., London, Ont., is considering the erection of an office building to cost around $100,000.

The Western Clock Co. is going to erect a factory at Peterboro, Ont., which will cost approximately $180,000. Sullivan & Fried, 81 Victoria St., have been awarded the general contract.

The steel contract for a time furnace to cost $23,000 for the St. Maurice Lime Co., Three Rivers, has been awarded to the Phoenix Bridge & Iron Works, 83 Colborne St., Montreal.

Victoria, B.C.—The Western Abrasive Paper Co. has been incorporated with headquarters here for the purpose of manufacturing sandpaper. The company is using as abrasive material a hard crystalline quartz from the Prince Rupert district, which has proven to be of hard quality.

Canada may have a new industry here soon. Col. John Jardine, manufacturer of lace making machinery has been visiting Toronto, in fact is making a survey of Canada, with a view of submitting his recommendations to his firm on return to England.

Toronto, Ont.—From 1911 to 1921, a total of $7,702,000 has been voted and $5,777,779 expended on capital account on Toronto harbor, according to a statement made in the House of Commons. On Toronto Island breakwater $400,000 has been voted and $37,441 expended. During the year 1920-21 there were 1,909 steamers with freight entered at customs, and in 1921-22 a total of 1,821 steamers.

Calgary, Alta.—The Rocky Mountain Paint Co., recently incorporated, which has located in this city, controls vast deposits of color-bearing material in the western area of the province and is utilizing these western resources in the manufacture of paints and colors. Arrangements have been made for placing the local product on the western markets.

The Canadian Vickers Ltd., Montreal, has become fairly active since the opening of navigation. The part of yard devoted to repairs is very busy. There is always one boat in the dry dock and it is not unusual to see several waiting their turn tied up in the basin. In fact there is so much repair work offering that the firm is having difficulty in taking care of it fast enough to suit the steamship companies.

Frank Williams, who is now at the Alfred Herbert Ltd. offices at Toronto, Canada, Canadian agents for Holman Bros., rock drill and mining machinery specialists of England, says that his recent trip to Northern Ontario fully convinced him that there is a great future for that section of the country. He says that the results of his visit came up fully to his expectations, and that he was successful in interesting several mining companies in his line. There is considerable activity in Northern Ontario, according to Mr. Williams, and he feels better things are still to come.

Kingston, Ont.—The Canadian Pacific Railway Co. will build a spur line into the feldspar mining district located near Thirteen Island lake, according to latest information received.

The British Metal Corporation has been incorporated with headquarters at Montreal. $100,000 is the authorized capital. C. G. Howard is one of the directors.

Toronto, Ont.—The city council have awarded contract to the American La France Fire Engine Co. of Canada, for varied fire apparatus amounting to $58,-750.

C. P. Thompson, chief engineer of the Koppers Co. is in Hamilton, Ont., conferring with the Hamilton Harbor Commission. Mr. Thompson will erect the new coke oven plant for the United Gas & Fuel Co. also lay out the grounds for the plant.

Montreal, P.Q.—According to reports from the Espanola plant for the Spanish River Pulp and Paper Company, the mill has attained an output of 307 tons per day which is 50 tons per day greater than was originally planned. The entire output of the Spanish mills is working steadily towards the 700 ton per day standing which is expected eventually to be reached.

Grand Prairie, Alta.—Business men who have been identified with brick interests in Edmonton for the past twelve years have completed arrangements for the installation of a brick plant at Grande Prairie to supply the markets of the Peace River country. Suitable clay deposits have been secured and the first machinery has arrived. It is hoped to be producing early enough to supply material for some of the larger structures planned for this year.

The Premier Silk Mills have located at Cowansville, P. Q. This company have incorporated under Dominion charter with a capital of $250,000 preferred stock, and 2,500 shares common stock of no par value. The interests which control the Regal Silk Company of Paterson, N.J., will control the Premier Silk Mills, and a factory has been purchased which is now being remodelled previous to the installation of machinery. This plant is a 3-storey, mill constructed, 100 ft. x 50 ft. The company has also purchased five acres of land adjoining this property to take care of future developments. It is expected that the first unit of 60 looms, out of a contemplated installation of 150 looms, to manufacture broad silks, crepe de chene, etc., and similar goods, will be installed shortly and will employ 100 hands to start with. The company will manufacture both skein dyed goods and piece dyed goods. This is said to be the first establishment in Canada to manufacture this class of material. In this connection it is interesting to note that at Drummondville the Dominion Silk Dyeing and Finishing Company are erecting a plant covering two acres for the purpose of dyeing and finishing silks, either in the skein or in the piece.

The Lackawanna Tubes Ltd., Welland, Ont., have placed an order with the Dominion Bridge Co., Montreal, for the installation of a 7½-ton overhead electric crane in their new plant.

An actual proof of what can be accomplished in the way of building with cement and with other products entirely Canadian is afforded by the completion of the Canada Cement Co.'s new 10-storey up-to-date office building in Montreal, in which cement has been used wherever possible. The project was undertaken partly to gratify a desire of the company to have office premises of their own and also to demonstrate the uses to which their product could be put. The investment has been a large one and, though not made primarily with the object of making money, is likely to prove not unremunerative.

FORT WILLIAM NEWS

The keel of the new freighter Mattewson which is being built by the Port Arthur Shipbuilding Company, has been laid and night and day shifts are engaged upon her construction.

The pouring of concrete into the forms for the storage tanks at the new two million bushel annex to the Northwestern Elevator Company commenced Monday. It is expected the new house will be entirely completed by the end of August. Harnett and McQueen company are the contractors.

Damage estimated at $15,000 was done to the four storey brick warehouse building and contents owned by the Northern Engineering and Supply Company last week, when fire gutted the structure. Repairs will be made immediately. Sufficient insurance to cover the damage was carried.

Fort William, Ont.—The York Wrench Corporation is the name of a new industry that is to be located in Fort William. It will be housed in the Kelly warehouse, Hardisty Street, and the factory will be devoted to the manufacture of a wrench, the invention of Percy York, a local resident. The head factory of the organization is in Duluth where during the past eight months 16,-000 of the wrenches have been manufactured. T. P. Kelly and H. Frawley, of Fort William, have secured the Canadian manufacturing rights. This tool is fitted with a sixteen inch handle and is so constructed that it can be used quickly and efficiently in cramped quarters. It works on the universal joint system.

Considerable activity still exists along the waterfront of the two cities. Grain shipments by boat continue large and large quantities of package freight are being received from eastern ports. Extensive repairs are being completed to the Canadian Pacific railway wharf adjoining the railway steel dock. The dock is being lowered to the level of the city wharf, immediately up river. Several cargoes of pig iron have been received and two cargoes of binder twine since the opening of navigation. Most

package freighters are arriving loaded but owing to the continuation of the coal strike in the Pennsylvania fields, bulk freighters are arriving light for grain. Only one cargo of coal has arrived here this year. It was loaded in a chartered bottom before the strike. Three ships carried the first cargoes of pulpwood from the head of the lakes last week. Two were bound for Muskegon, and one for Erie, Pa.

Chattels and goods owned by the Palatine Iron and Steel Company, of Chicago, at the old Atikokan blast furnace, Port Arthur, have been seized by bailiff and will be sold at public auction to meet the claims of two former employees for wages due totalling $400. This company's ambassadors arrived in Port Arthur last year and great promises were made. Their ambitions included the putting in first class shape of the old Port Arthur and Duluth railroad running from Port Arthur to the international border at Gunflint Lake, the active development of the Paulson iron mine in Minnesota, the leasing and operation of the old blast furnaces at Port Arthur, and the purchase of 200 acres of land from the city of Port Arthur upon which was to be erected three huge ore docks with a future prospect of electric furnaces, rolling mills and all that goes to make up a huge steel and iron manufacturing centre. Prominent Polish capitalists were supposed to be behind the proposition and there were banquets at which the company officials and the officials of Port Arthur were in turn guests and hosts. Flowery speeches were made and great things promised. Now the bubble has burst. The Palatine Company is said to be defunct. The ancient outlines of the sleeping giant in Thunder Bay are as yet undimmed by the smoke from busy furnaces, and the only commodity around the head of the lakes that ever saw a mine is coal from Pennsylvania.

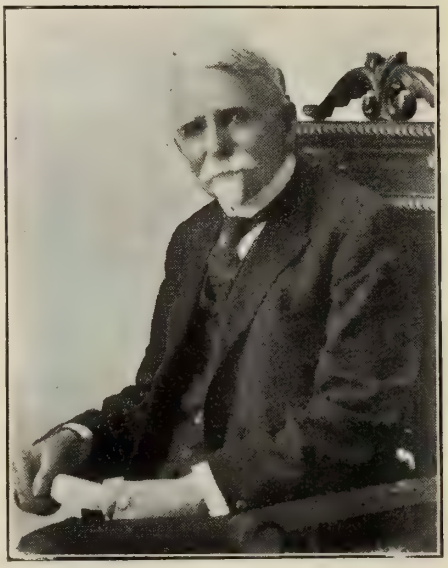
A movement has been started in the city of Hamilton by Controller Tope to appoint a purchasing agent to supervise the buying of all sundries, the cost of which does not exceed $500. This department would be under the direct supervision of the Board of Control. It is stated that other cities that have organized purchasing departments have effected great savings in the buying of city supplies.

The International Business Machines Co., Toronto, have opened a new showroom at 32 King St. West, in which the three divisions of their business will have ample room for demonstration and service. International time recorders, Dayton computing scales, and Hollerith tabulating machines will be the lines displayed. Speaking to Mr. Morris, sales manager of the firm, he said that they had felt for some considerable time a downtown centrally located demonstration room was essential, and that now they had secured this place, they wished everyone interested to drop in and see them. They will also keep their other store on Yonge St. open.

PIONEER MACHINE TOOL BUILDER DIES IN LONDON, ONTARIO

WILLIAM YEATES, for many years one of London's leading manufacturers, died on May 16th, at the age of 75. He was born in Liverpool and came to Canada when a young boy, settling with his parents in the city of London. He received his early education in the old Union School and afterwards started his apprenticeship with David Bruce to learn the machinists' trade.

Before reaching the stage of a journeyman he enlisted with the seventh battalion of London and fought in the Fenian Raid. After returning to industrial life he served for a time with the



William Yeates

firm of Macpherson, Glasgow & Company of Fingal. He subsequently left this position to form a partnership in the machine business of White & Yeates and White, Yeates and Jolliffe. In 1881 Mr. Yeates founded the London Machine Tool Company. This business was successfully carried on for nearly a quarter of a century at the London plant. The activities of the firm were then transferred to Hamilton where, in addition to the production of machine tools they manufactured many lines of railroad machinery and other equipment. In 1922 the London Machine Tool Company was absorbed by the Canada Machinery Corporation of Galt, the latter concern even removing the greater part of the Hamilton building to Galt. At this time Mr. Yeates retired from active interest in industrial enterprise.

However, the war came along and the need of equipment for the manufacture of munitions was so urgent that Mr. Yeates was induced to accept an order for fifty special lathes. He was then close on to 70 years of age, but undertook this obligation as he had undertaken many others; in the spirit of true patriotism and the love of accomplishing something worth while. At that time he had no shop of his own but renting one, installed the necessary equipment for the manufacture of the shell lathes, which were turned out in record time, several hundred being made altogether. Mr. Yeates was greatly interested in many other activities, having served several times on the Western Fair Board, on the local school board, and took a keen personal interest in the development of technical schools, being one of the pioneers in this movement in the Province of Ontario. The passing of Mr. Yeates removes one of the pioneers of machine tool building in Canada. The city of London is still using a six million gallon cross compound steam driven pump constructed under his supervision back in the early nineties.

In his treatment of employees the late Mr. Yeates might be termed an employer of the old school. While exacting in his requirements all the men who worked with him were his friends. To the apprentices — for apprenticeship under him was a privilege very much sought after—he was both mentor and father—and they lay the groundwork of their mechanical experience to the very thorough training received in his shop. Many of these men are now owners of their own plants or occupy important posts in large industrial enterprises in the States.

DEATH OF ERNEST SOLVAY

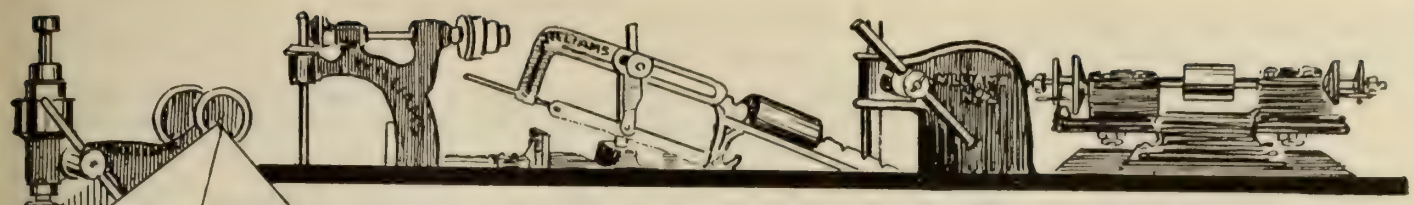
Ernest Solvay, the inventor, reputed to be the wealthiest man in Belgium, died suddenly at his home in Brussels on Friday morning, May 26th. Mr. Solvay will be remembered as one of those who were seized as hostages by the Germans on their entry into Brussels during the early stages of the war. As an inventor he was chiefly interested in chemical research and as such he became world famous in the metal industry field as the inventor of the "Solvay Process" of making low-sulphur foundry coke from ordinary soft coal which had formerly been unsuited. Had he accomplished nothing but this his name would be worthy of a prominent place in history.

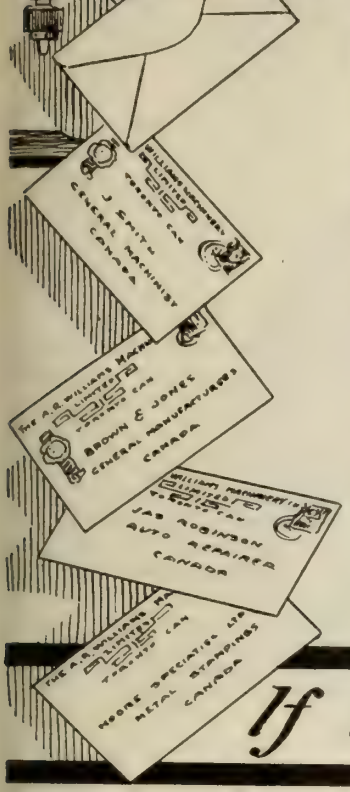
PASSING OF WILLIAM SHEARER

Wm. Shearer, who served for a number of years as superintendent of the James Smart Mfg. Co., died a few days ago, at his home in Brockville, Ont. Mr. Shearer has held various positions since his retirement from the James Smart Co., and in addition to being engaged in the real estate business has been secretary-treasurer of the board of trade, and held other local positions.

Canadian Electric Castings Co. of Orillia, are constructing a new building. They make electric furnace products, largely for mining and cement industries; also bronze, brass, iron and steel castings.

Approximately eighty per cent. of cobalt is used in the making of stellite.





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YOU are invited to call on us for any sort of service in connection with machinery of any kind. The staff of experts comprising our Service Department are specially trained to serve you and can be relied upon.

We can also fill any requirement for machinery (new and reconstructed) from our immense stock of nationally known products. You will find our prices right and that we live up to our reputation for fair dealing.

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If its Machinery—Write "Williams"

Procunier Safety Tapping Attachment



THE ONLY DEVICE ON THE MARKET HAVING A BALANCED REVERSING MECHANISM, thus eliminating all side pull or torsion. Its reverse speed is twice that of the forward speed. It has other features too we would like to bring to your attention. *Send for illustrated circular showing the*

PROCUNIER LINE

to



WILLIAM L. PROCUNIER, 18 South Clinton Street, Chicago, Ill.

Ontario Distributor: **H. A. Harrison, 220 King Street West, Toronto, Ontario**

Fisher Motor Co., of Orillia, manufacturers of die castings and metal stampings are taking over new premises to take care of their increasing business.

J. Walter and Sons, manufacturers of wood fibre products will erect a new factory at Kitchener. The new plant will treble the output and take care of the rapidly growing export trade of this firm.

The Canadian Wire and Cable Co. will establish a plant in Vancouver, B. C. This plant will take care of the company's market in the west. It is stated that about 400 men will be employed at the Vancouver factory.

The H. H. Robertson Co., Sarnia, Ont., report an improved demand for their roofing and siding products used largely for manufacturing plants. Among recent contracts are squares for Page Hersey Co., Welland, and the new building of the Lackawanna Tube Co., Welland.

"Business is improving," according to Mr. Morris, sales manager for the International Business Machines Co., Toronto. Computing scales are the feature at present, but as several factories have recently engaged more help, they are securing some time recorder business as well. "The situation is much easier, and the added interest in recorders can be accepted very much as a thermometer of business improvement," concluded Mr. Morris.

Announcement is made that the McClary Manufacturing Co. of London, has commenced operating again with a full staff of men and on full time. J. J. Foote, who made the announcement, states that times are slowly but steadily improving, and he looks for general prosperity in the not far distant future. McClary's has always been the barometer of conditions in London, and the announcement of the return of the plant to normal conditions of business is good news to the citizens.

TWO IMPORTANT FIRMS HAVE JOINED FORCES

The National Electro-Products, Ltd., and the Dominion Oxygen Co., have amalgamated. This consolidation becomes effective immediately. The Dominion Oxygen Co., takes over the plants, patents, goodwill and contracts of the National Electro-Products, both companies operating under the name of the Dominion Oxygen Co. By combining forces, they intend to add still further improvements to their service, stabilize the products, thus making possible a steady supply.

E. G. MacKay, lately superintendent of the steel plant of the Scotia Steel and Coal Co., at Sydney Mines, is retiring and was presented recently with a gold watch and address by the office staff. Mr. MacKay leaves shortly for Pittsburg, where he is expected to take an important position with the Lackawanna Corporation. A. C. Fraser, of the Scotia staff at Sydney Mines, leaves shortly on a two months' vacation trip to the west.

BRITISH MOTOR LINERS

Excellent results continue to be obtained by the oil-driven ships constructed in Great Britain. Recently a large passenger liner equipped with oil engines completed a round voyage from the United Kingdom to India and back; and the commander of the ship reported that the engines "ran like a sewing machine." Even at the present heavy price of oil the voyage showed a considerable economy in the cost of fuel in comparison with coal. The passengers benefited from the absence of coaling on the voyage and by the minimising of vibration. The daily consumption of oil at 14 knots was less than 18 tons. Another British oil-driven ship proved on her trials that she could run at 13 knots on 16 tons of oil per day. The oil is carried in the double bottom of the vessel and there is sufficient capacity for a voyage of 30,000 miles.

A NEW BATTERY LOCOMOTIVE

The use of locomotives driven by electric batteries is rapidly developing in mines and in connection with civil engineering, as well as in factories and on railsidings. In fact the popularity of this type of locomotive for special purposes has led a leading British locomotive firm to devote the attention of experts to the problem of improving the efficiency of the machine. A new type of mechanism was accordingly devised and recently tested with remarkable results. It was found that for a certain amount of actual hauling work done by the locomotive only half the usual battery capacity was required. The control arrangements are extremely simple and do not involve the complicated resistances generally required. Only one motor is used. One very useful feature of this novel design is that the locomotive automatically "regenerates" with a high degree of efficiency. That is to say, when the locomotive is running down hill or being brought to a standstill the motor produces electric power which goes to re-charge the battery. Another point of importance is that ball bearings are used throughout as an additional means of saving power. Hitherto locomotive engineers have looked askance at ball bearings for heavy machines, but the pioneer courage of this British firm seems to be fully justified by results.

HORSE POWER ELECTRIC BOILER

To many people it will seem absurd to use electricity for making steam; but this is actually being done—and for a very good reason—on British railways. The railway systems in Great Britain are gradually being electrified where the conditions are favorable; and the result is that in certain routes steam haulage will be at work on one portion and electric haulage on another. The usual practice is to heat steam trains with the steam from the locomotive, and obviously this method cannot be continued when the steam locomotives are replaced by electric locomotives. Ex-



Rockwell Rotary Automatic Furnaces in series for a three-operation heat-treatment

NO MANUAL LABOR
is required with these
ROCKWELL ROTARY AUTOMATICS

during the continuous travel of the pieces from the charging end of the normalizing furnace on the left to the discharging end of the drawing furnace on the right.

In each of the three furnaces—for normalizing, hardening and drawing, respectively—*each piece is exposed to the heat in the same manner, for the same time and at the proper temperature.* This, with continuous operation and economy of fuel and labor, insures

QUANTITY PRODUCTION OF HIGH QUALITY PRODUCT AT LOW COST

Bulletins 39-T and 232-T are of interest to manufacturers intent on improving quality and lowering production costs.

British Representatives:

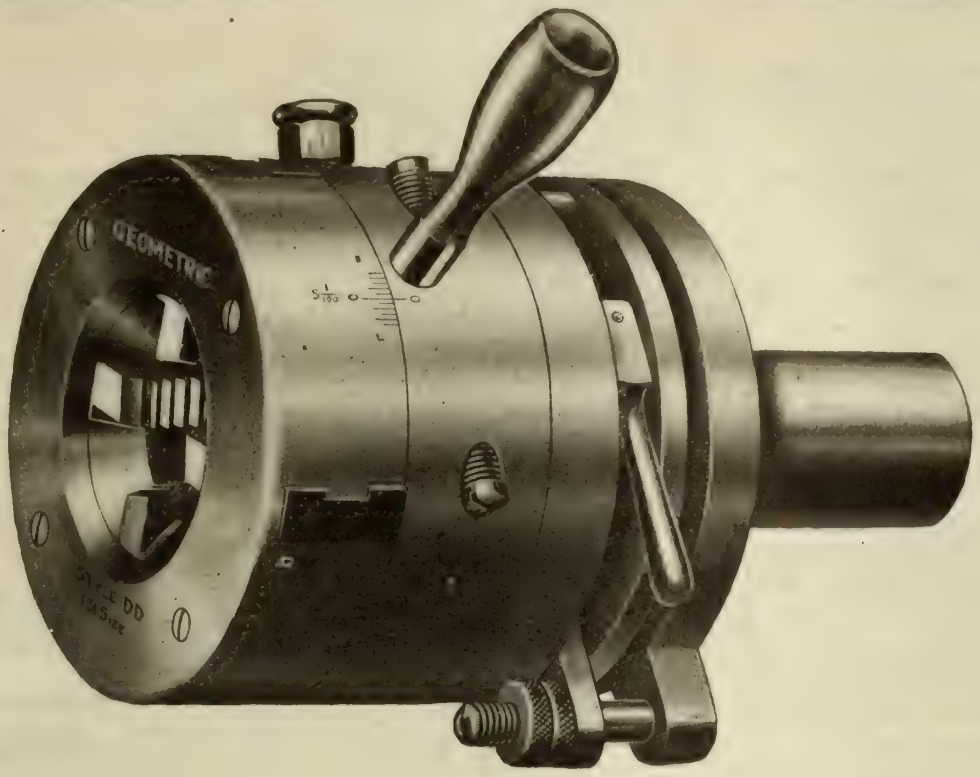
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BETTER HEATING
W. S. ROCKWELL CO.
INDUSTRIAL FURNACES
ESTABLISHED 1888
50 CHURCH ST. NEW YORK
LOWER COST

A WELL-BALANCED DIE HEAD

Geometric Style DD
For Hand Operated Turrets

Yields to Adjustment
Resists Inaccuracy



Faulty Turret adjustment is common and causes serious trouble in cutting Screw Threads. The Geometric Style DD Die Head for Hand-operated Turrets, with its compensating spring mechanism, not only functions perfectly itself, but overcomes any inaccuracies of adjustment of the Turret. The Die Head yields as it comes in contact with the work, allowing the Chasers to start the thread properly.

In perfecting a Die Head for certain Automatic Screw Machines, features were developed that made the Die Head quite as desirable for Hand-Operated Turrets, and as a result the Style DD for Hand Operated Turrets has been added to the Geometric Die Heads that have just the right features for the varied requirements of machine and work.

Latest improved equipment is telling the story of production in busy shops.

Geometric Screw Cutting Tools Have a Story to Tell You .
Have You Heard It ?

THE GEOMETRIC TOOL COMPANY
NEW HAVEN **CONNECTICUT**

Canadian Agents :

Williams & Wilson, Ltd., Montreal. **The A. R. Williams Machinery Co., Ltd., Toronto.**
St. John, N.B. **Halifax, N.S.** **Vancouver, B.C.**

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TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
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At Low Price

FORTY TONS BAYONET STEEL 1⅛ x 5-16

Will sell whole or part, write for samples

The
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FOR SALE

"RICARDO" ENGINES, PETROL OR PARAFfin, excellent for marine, commercial or stationary use. Brand new. 100 h.p. 4-cylinder, 150 h.p. and 255 h.p. 6-cylinder, 300 h.p. 12-cylinder. Thirty shillings per horse-power sterling London. Sykes, Patching, Sussex, England.

FOR SALE:—COMPLETE EQUIPMENT FOR small machine shop, consisting of 16" Davis screw-cutting lathe, hack saw, shaper, drill, buffer, grinder, and forge. Will sell reasonably and terms to responsible party. This is a snap for someone starting in business. Would sell separately. Apply Box 811, Canadian Machinery. (C23M.)

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1 only 15" x 34" Wheelock Engine 125 H.P. also 5'6" x 15' H.R.T. Boiler—both in good condition for immediate delivery. Apply:
THE STEEL COMPANY OF CAN. Ltd.
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REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
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Phones: Adelaide 2841 and 1524
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HIGH PRESSURE PUMP, 250 IMPERIAL gallons per minute, at 35 r.p.m., 700 lbs. pressure; also 150 h.p. 500 r.p.m., 220 or 2200 volt, 3 phase, 25 cycle, Squirrel Cage Induction Motor, for direct connection to pump. Page-Hersey Tubes, Limited, Toronto, Ont.

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MECHANICAL DRAFTSMAN AND DEsigner desires position, preferably firm where advancement and responsibility is given. Competent chief draftsman with machine shop experience, well educated. Box 810, Canadian Machinery, Toronto. (C.18M.)

MECHANICAL ENGINEER IS OPEN TO consider partnership or interest with manufacturer with a view to producing new high grade lines of engineering equipment. Must have good reputation and manufacturing facilities. Box 808, Canadian Machinery. (C.16M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience, 10 years general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

$67.60 Per Year



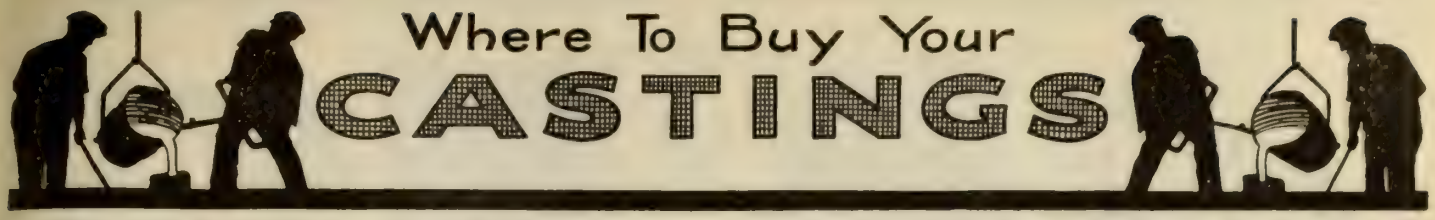
How much time in a year do you spend soliciting business for your shop? Half an hour a day? All right! Half an hour at a 6-day week comes to 3 hours a week. 3 hours a week at 52 weeks in a year amounts to 156 hours a year.

How much is your time worth—$2.00 an hour? To make sure we'll say $1.00.

That means you spend $156.00 worth of your time each year looking for business. This page is read and considered valuable by the majority of plant superintendents, purchasing agents and managers, both large and small, all over this Dominion. A one-inch card every week with a REAL message in it will do more for you than you can do for yourself. We only charge one-half of what it would cost your business if you were to use your own time.

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Grey Iron.

John T. Hepburn, Limited
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Grey Iron.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets, TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

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HAMILTON, CANADA.
Steel Castings all sizes.

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Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

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GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

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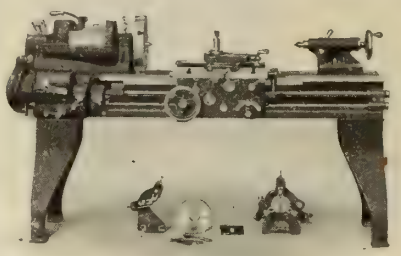
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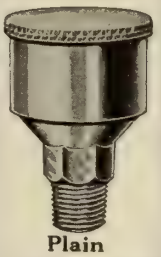


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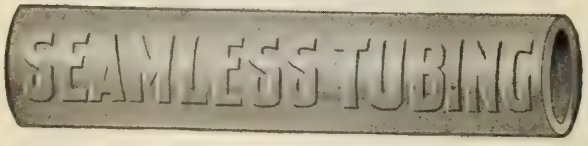
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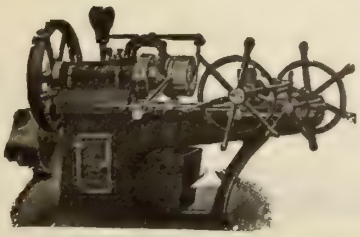
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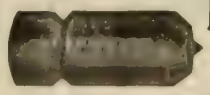
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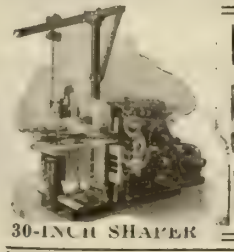
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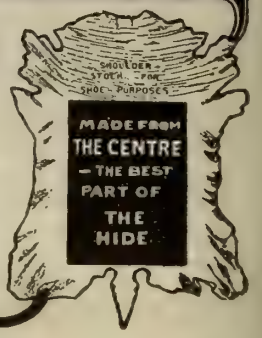
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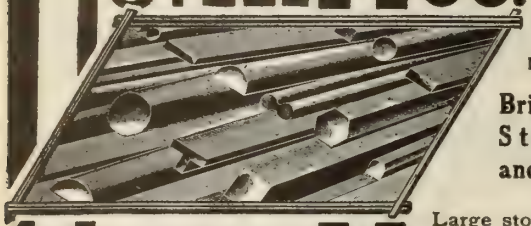
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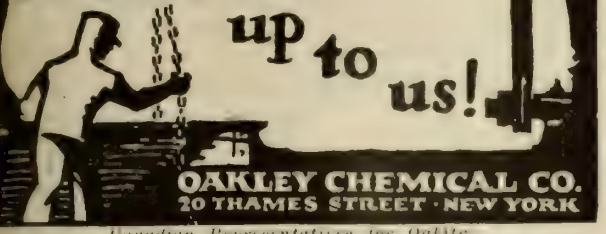
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Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.

Smooth Mfg., Co., Jersey City, N.J...

CEMENTS, IRON
CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, Ohi
Brown & Sharpe Mfg. Co., Providence R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Steinle Turret Machine Co., Madison Wisconsin.

CHUCKS, DRILL AND TAP
Aikenhead-Hardware Ltd., Toronto, On
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Skinner Chuck Co., New Britain, Conn
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn
Geometric Tool Co., New Haven, Conn
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERA
Oakley Chemical Co., New York, N.

CLOCKS
Chicago Watchman's Clock Co., Chicag Ill.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicag Ill.

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can. Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can.-Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., land, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS, CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can.-Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

CRANES, TRAVELING
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCHLIGHT SECTION).
Petrie, Ltd., H. W., Toronto, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio
Hendley Machine Co., Torrington Conn.
Kearney & Treacker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Tool Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., td., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W. Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, COMBINATION CENTRE
Preston & Schwartz, Galt, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can Fairbanks-Morse Co, Ltd., Montreal, Que.
Cleveland Twist Drill Co, Cleveland, O
Greenfield Tap & Die Corp, Galt, Ont
Morse Twist Drill & Machine Co., New Bedford
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co, Chicago, Ill.
Butterfield & Co., Inc., Rock Island Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton,

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis,
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc. E.C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W. Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.
National Electro Products Co., Ltd.,

FORGING MACHINERY
Acme Machinery Co, Cleveland, Ohio
Bertram & Son Co, Ltd, The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co of Canada, Ltd, Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES, LAPWELDED
Beardmore & Co., Ltd., Wm., Montreal, Que.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto, Ont.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. P., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

HYDROGEN
National Electro Products, Ltd., Toronto, Ont.

HYDROGENATING PLANTS
National Electro Products, Ltd., Toronto, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O.

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATES, BOILER AND SHEET
Beardmore & Co., Ltd., Wm., Montreal, Que.

PNEUMATIC TOOLS
Beardmore & Co., Ltd., Wm. Montreal.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R. Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilon.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hmilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound Ont.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, CENTRIFUGAL
Beardmore & Co., Ltd., Wm., Montreal

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, SEMI-ROTARY WING
Beardmore & Co., Ltd., Wm., Montreal.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Pertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N.Y.

RECORDERS, TIME
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Fittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Mchinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Pulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co. New York, N.Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Manteral, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E.C., Indianapolis.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Manteral, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, MILLING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Isinad, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Isinad, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, One.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Moutreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SECTIONS, SHIP AND BOILER
Beardmore & Co., Ltd., Wm., Montreal, Que.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS, HAND
Can. Blower & Forge Co., Ltd., Kitchener.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Pertrams, Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

SHEETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B.A. AND BLUE ANNEALED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Prown Engineering Corp., Ltd., Toronto.
Bisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Pryibil Machine Co., P., New York City.

SPRINGS, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
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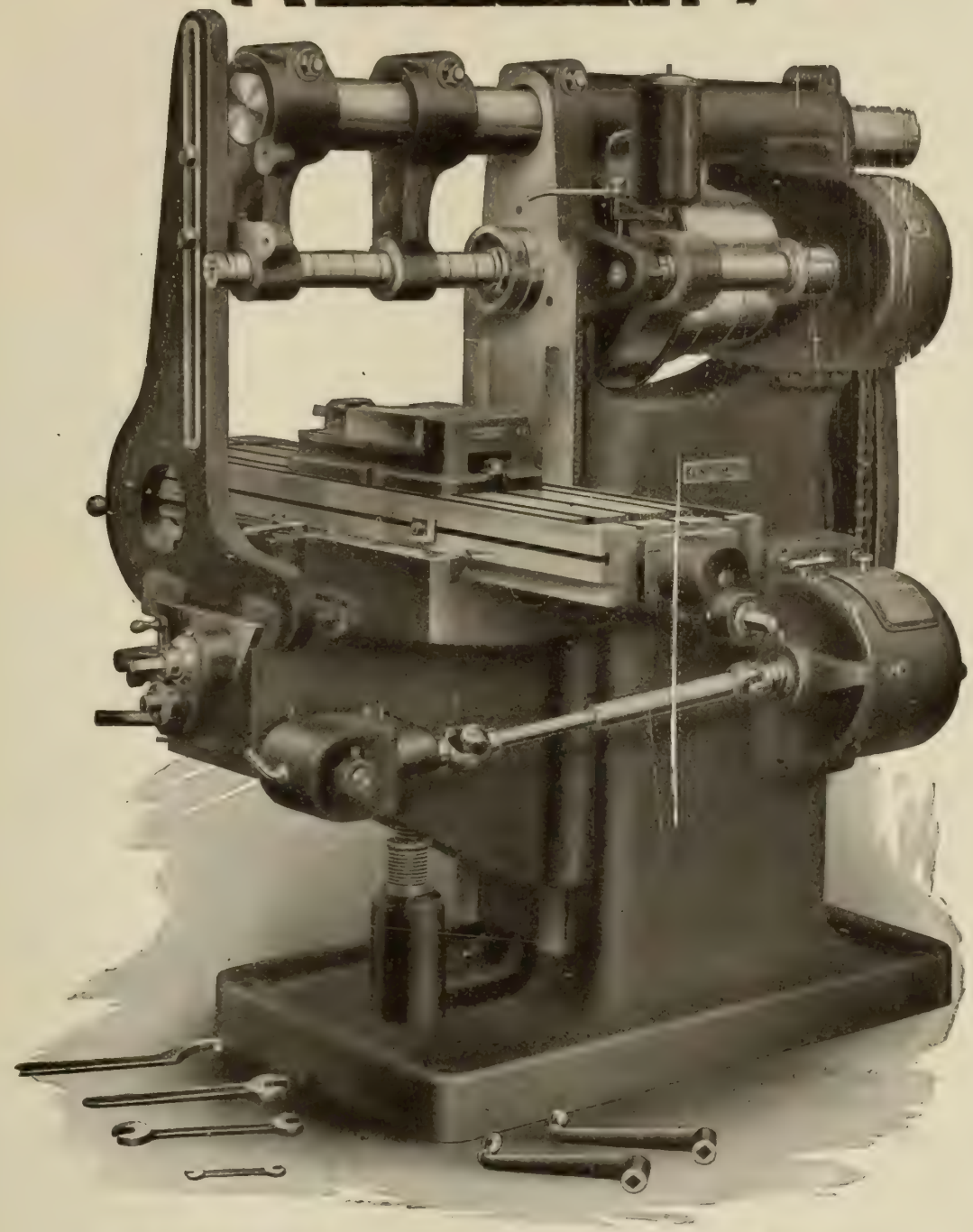
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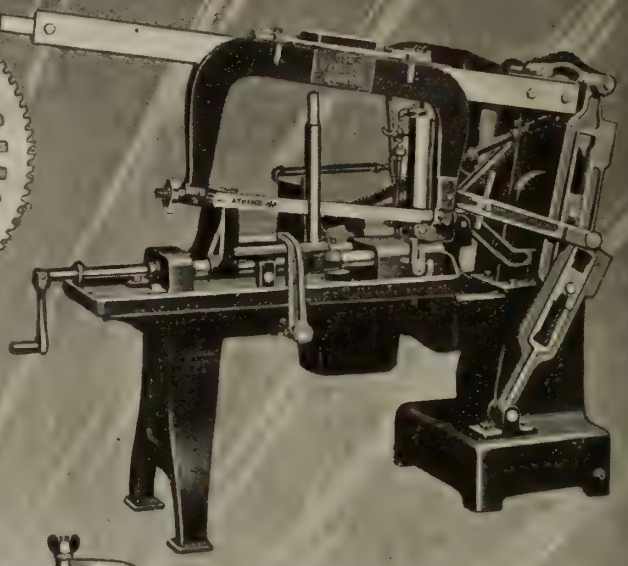
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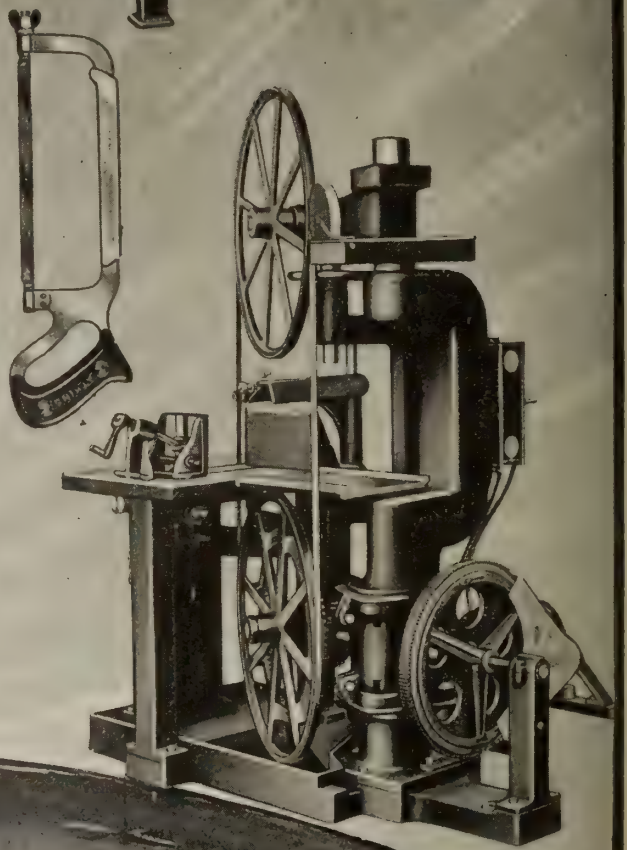
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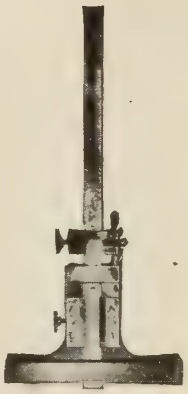
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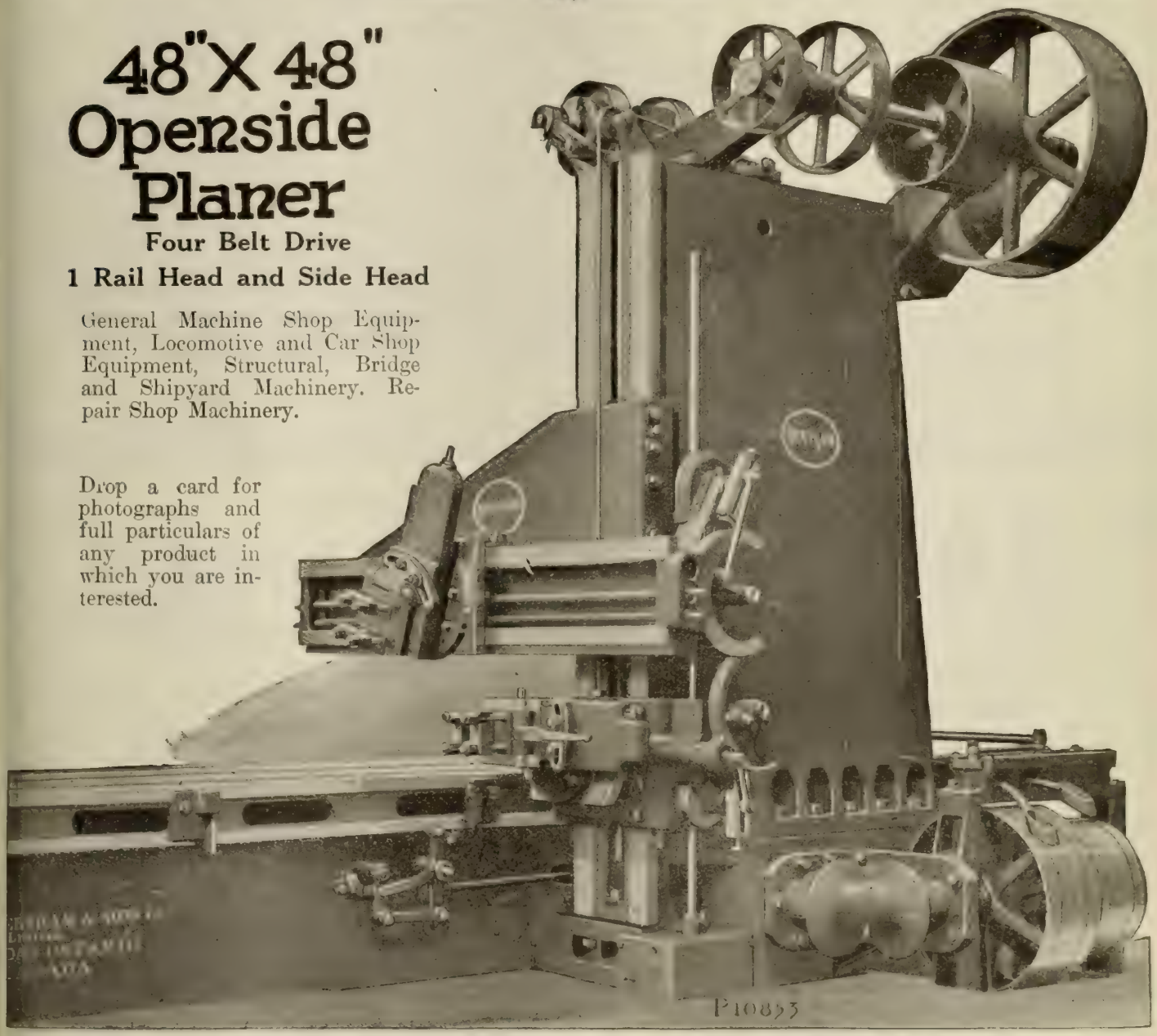
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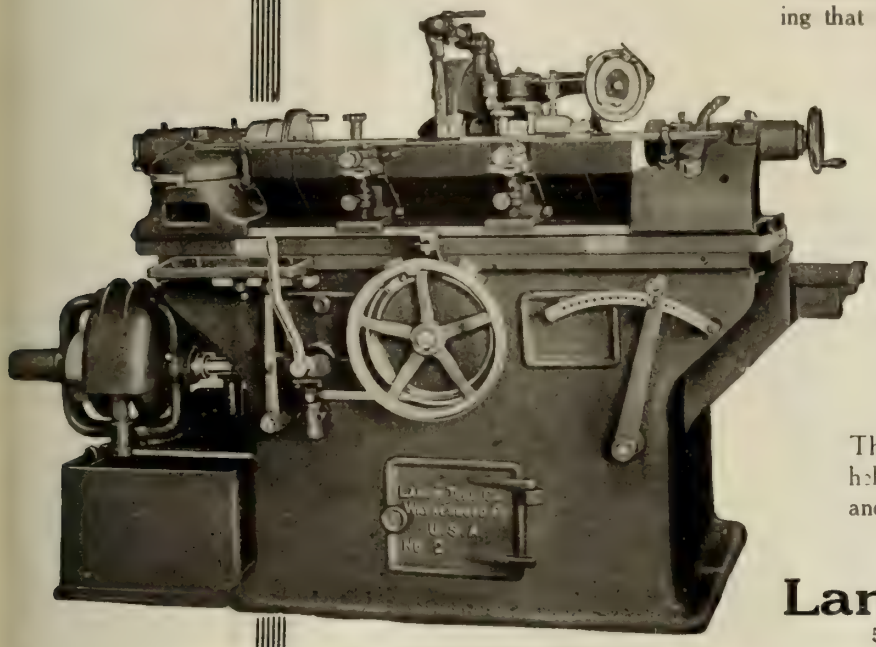
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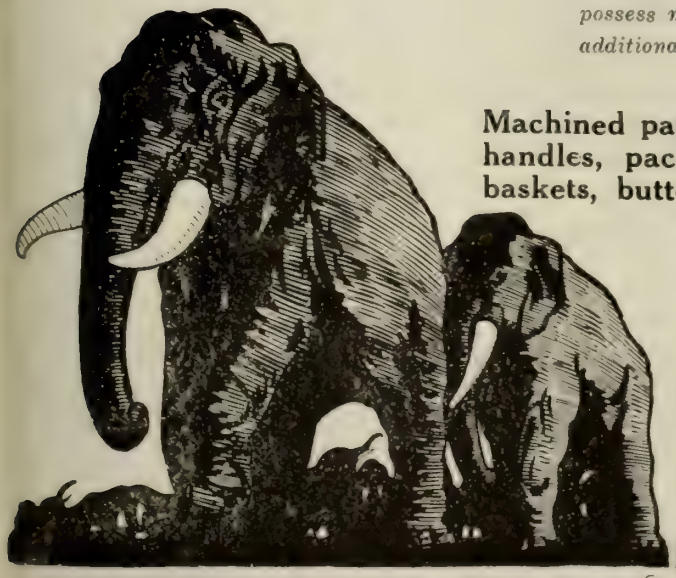
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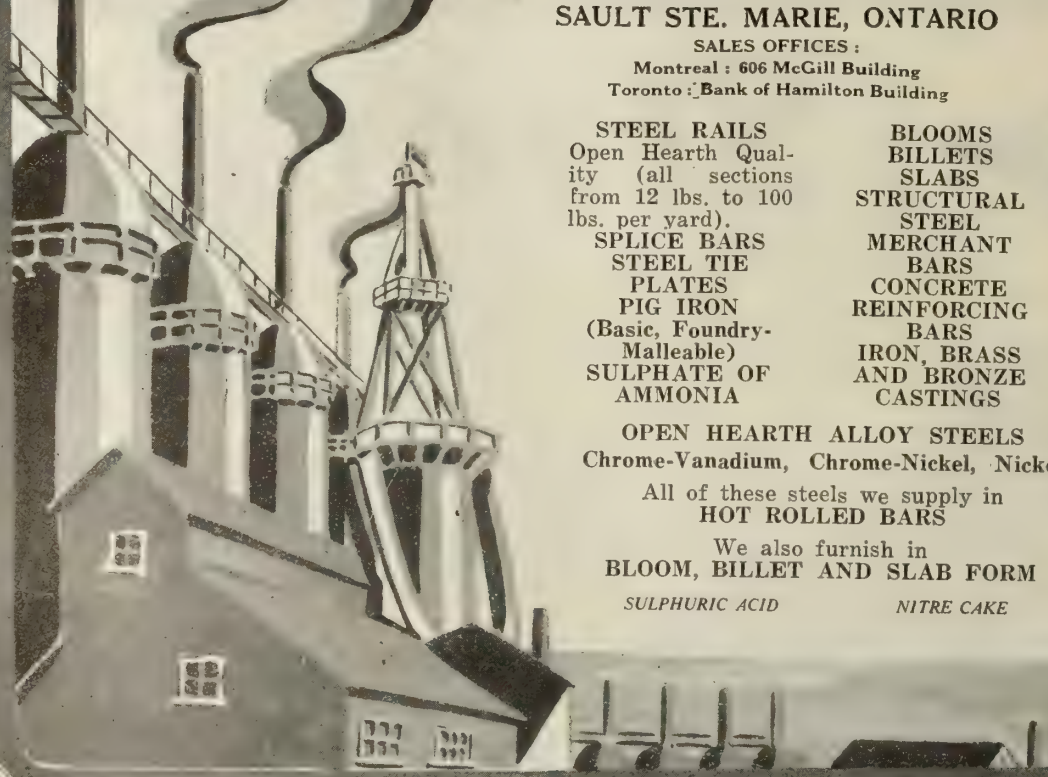
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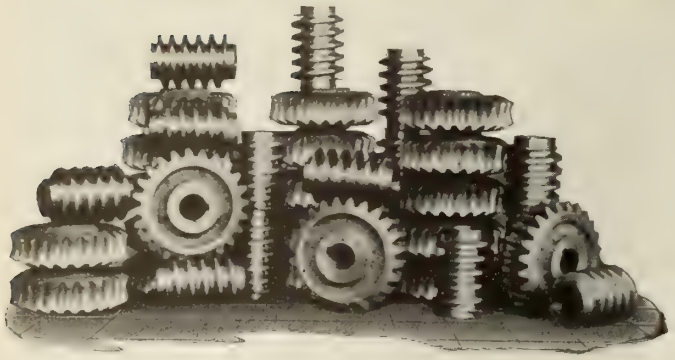
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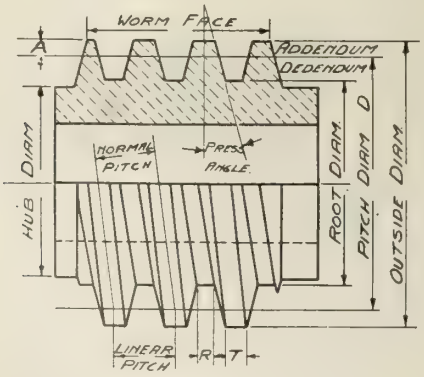


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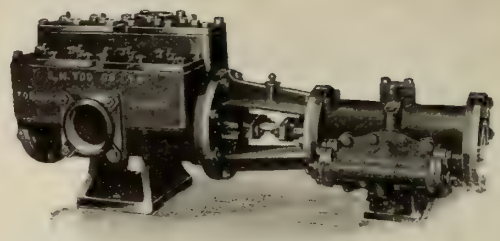


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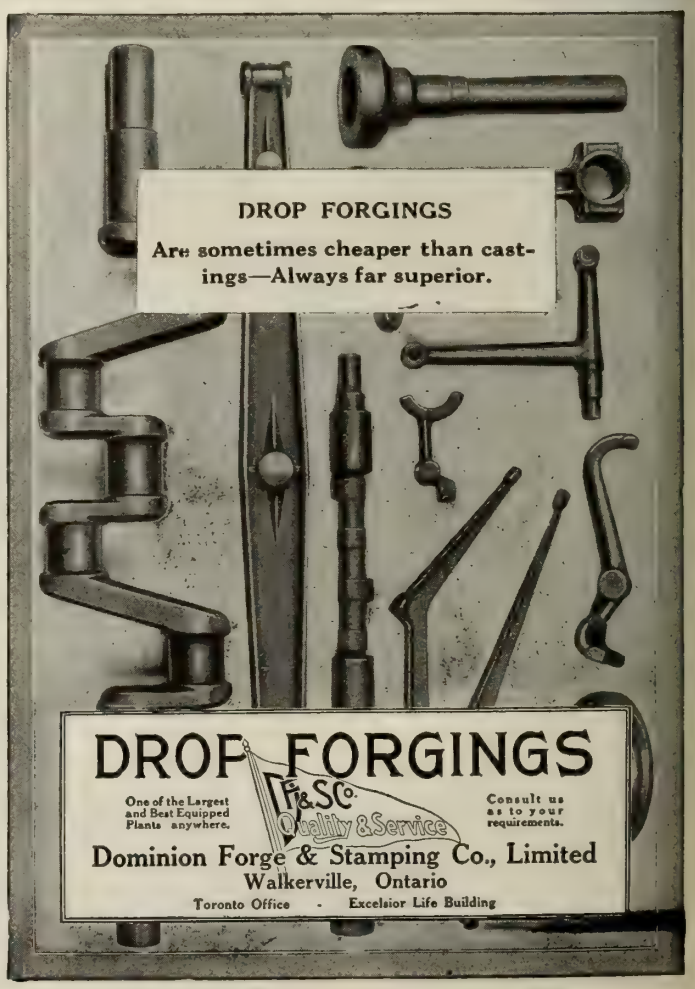
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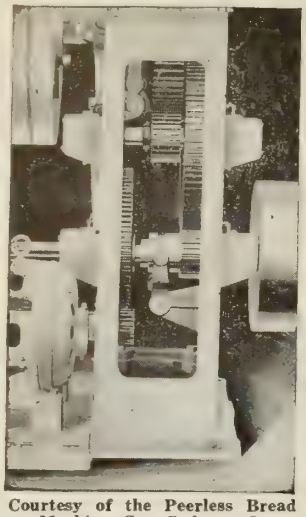
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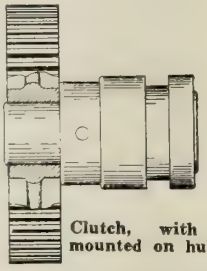


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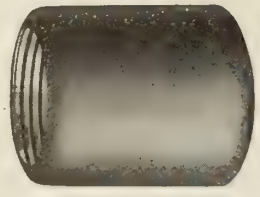
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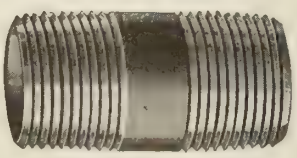
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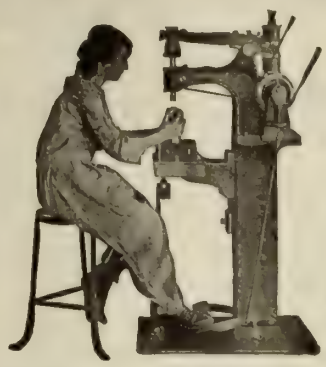
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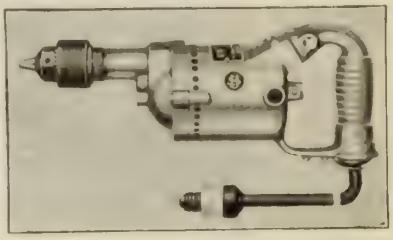
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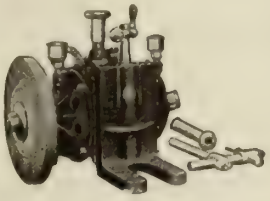
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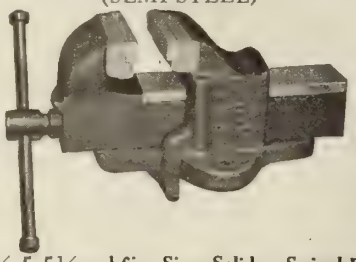
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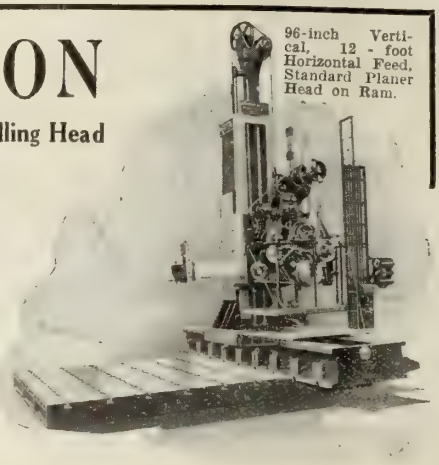
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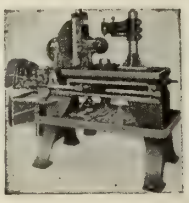
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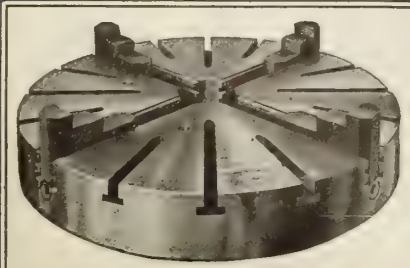
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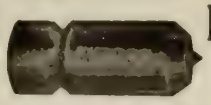
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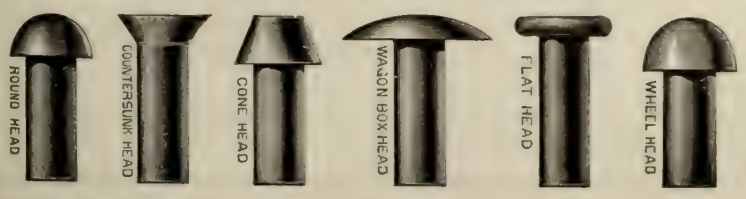


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WELDING AND CUTTING
and also many articles of an interesting production character, as well as the regular features such as the review of inventions, foreign trade notes and metal markets, etc.

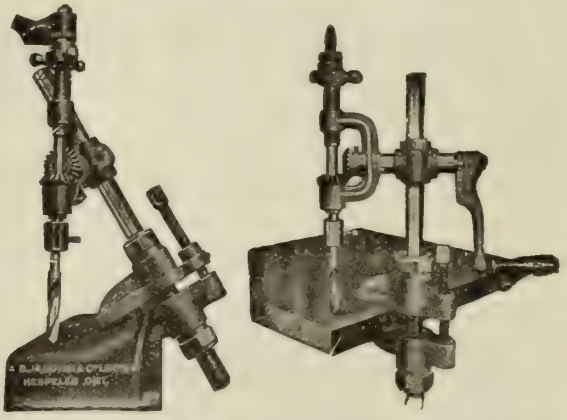
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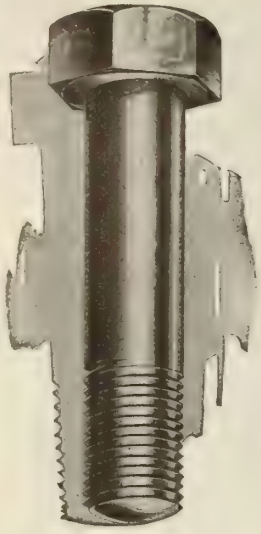
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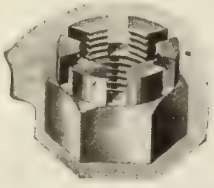
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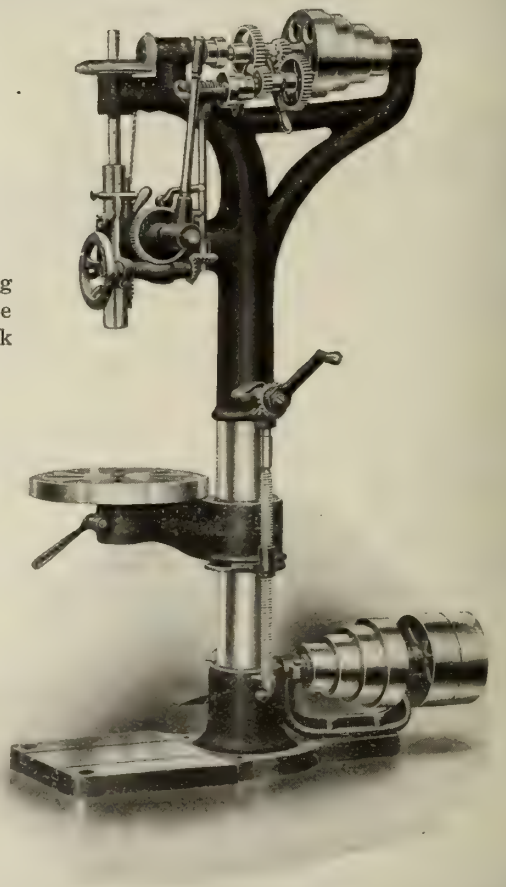
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This machine will drill 1¼-inch holes in steel and 1½-inch holes in cast iron from solid metal and will bore up to several inches in cored holes.

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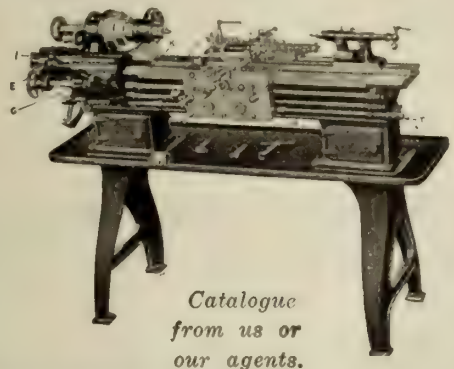
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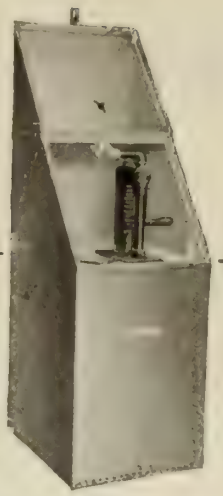
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When Bill meets Jim at the oil barrel, they are sure to gossip—for Bill has to wait while Jim fills his oil can. That's six minutes of your time wasted—three by Bill and three by Jim.

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ACCURATE MEASURING PUMPS

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Filling Station Pumps and Tanks for Gasoline.
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

VOL. XXVII. No. 23 June 8, 1922

Interesting Examples of Multiple Fixture Work

Minimizing Non-Productive Time—Conserving the Energy of the Operator—Making of Parts in Large Quantities Demands Adequate Machining Facilities—Magnetic Chuck Permits of Rapid Setting

By J. H. RODGERS.

MODERN manufacturing methods to-day are tending more and more to the elimination of unproductive time, and the utilization of processes and machine equipment that will relieve the operator of the physical effort required in performing unnecessary manual labor, as related to the work upon which he is engaged. The chief aim of machine tool builders is to incorporate improvements in their product that will spell economy. The human element is the one outstanding factor that makes the solution of the industrial problem so difficult, and yet it is a portion of this very element that is making it possible to overcome many of the intricate phases of manufacturing that are confronting us at the present time.

Multiple Fixtures

One of the most interesting developments of recent years is the rapid progress made in the design of tools for multiple machining, both in the way of fixtures and tool cutting heads. The continuous method of cutting is the feature most desired in the machining of metal parts, and in plants where large quantities of any particular piece is produced, the question of multiple or uninterrupted operation is of prime importance and should receive the careful consideration of executives before deciding on the methods to be adopted for performing the different detail operation. Very frequently the jigs and erations. Very frequently the jigs and keep down the initial cost of manufacture. Where the output is comparatively small it is often well to go cautiously in the making of equipment for duplicate production as the first expense may smother the profits estimated on the work; but on the other hand, the making of parts in large lots demands adequate facilities for taking care of the output on economic lines.

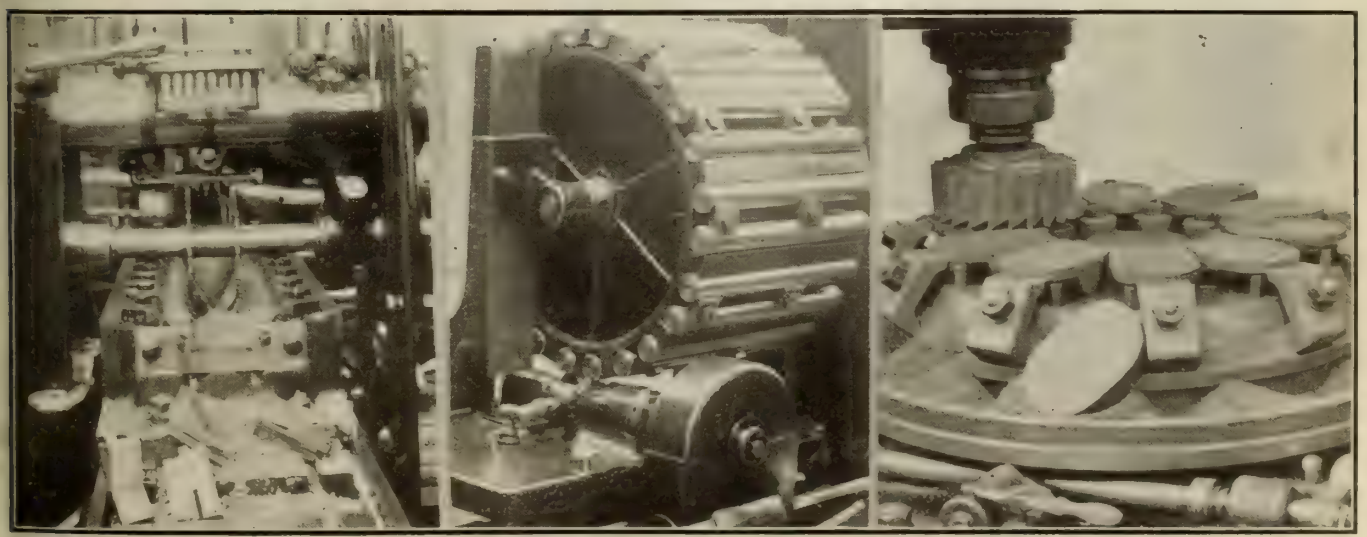
Non-Productive Time

It is difficult to calculate with any degree of certainty just what is non-productive time, as the value of this factor varies in relation to the problem. In the operation of metal cutting tools the productive period is frequently designated as that actually occupied in the cutting of the metal, but there are various details of manipulation of machine and tools that must be taken into account and which are essential to production. The chucking of the work, for instance, must be properly accomplished before cutting can be commenced. Tools must be ground, set and adjusted before starting the cut. Many other minor but none-the-less important factors must be considered in attempting to find a definite answer to the non-productive phase of manufacture.

Continuous Cutting Operations

What would appear to be the livest topic in advanced shop practice is the possibilities of the multiple fixture whereby continuous cutting can be carried on. What is most desired is that the machine should be kept at work all or most of the time. The cost of a multiple fixture may sometimes seem excessive but where the volume of machining is ample to cover the outlay the

Information and views in Fig. 1 by courtesy of Alfred Herbert Co. Those shown in Fig. 2 through the courtesy of the Heald Machine Co.



Left—Milling roller slides for roller steady turners on Herbert hexagon turret lathes. Centre—Continuous milling of splines on gear cutter. Right—Continuous milling of pump covers.

making of such equipment is the essence of economy.

Saving Time By Slitting

At the left of Fig. 1 is shown an interesting operation on the roller slides used in the roller steady turners on the Herbert hexagon turret lathes. The material for these slides is made of 5 carbon steel, heat treated. One of the finished slides is shown at the end of the table, and the operation here shown completes the removal of the wedge shaped piece shown on the table in the lower foreground. Instead of milling the metal completely away, it is removed by the intersection of two thin slots produced with side and face cutters, the second cut being the one illustrated. The fixture holds 40 pieces, and the side and face cutters are 8in. in dia. by ¼in. face. For this operation a feed of one inch per minute is employed, the limiting factor being the strength of the cutters.

Special Splining Fixture

The fixture shown in the centre of Fig. 1 is worthy of special notice. It is used for cutting the splines in shafts. The milling operation is continuous and performed on a gear cutting machine. The fixture is mounted on a work arbor, constructed for holding 24 shafts at the one time. Two splines are cut simultaneously with a pair of 3in. dia. slotting cutters, running at 80 r. p. m. The feed is 13/16in. per min., and the dimensions of the keyway ⅜in. wide, 3/16in. deep and 9⅜in. long. During the cutting operations the workman is loading and removing finished work, so that the machine operates continuously and several may be tended by the same operator. Fixtures of this character are a paying investment to any plant producing parts in large quantities.

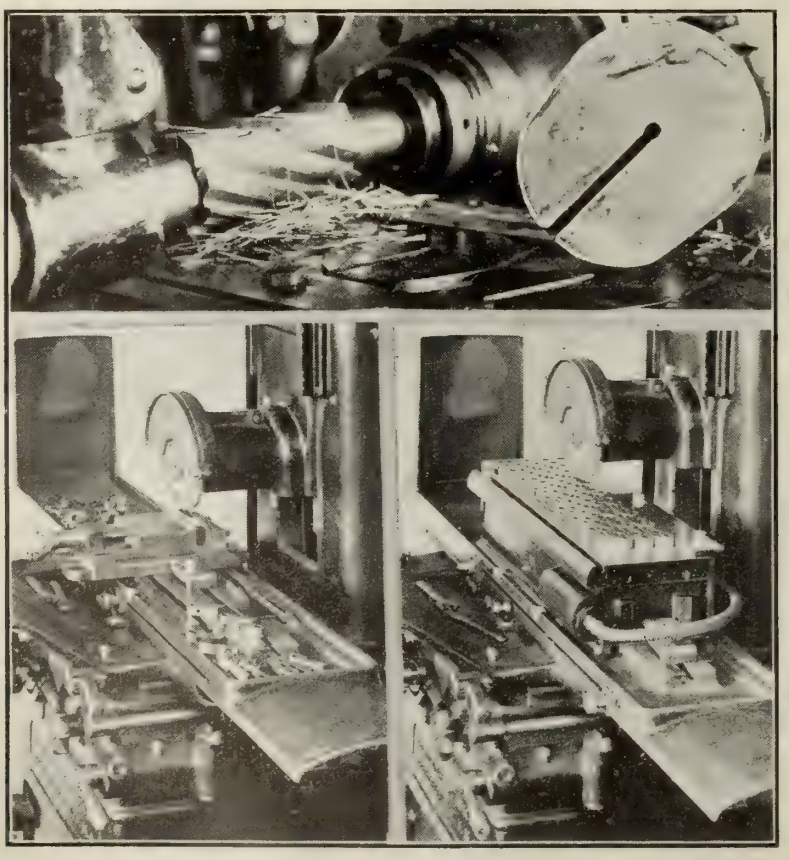
Continuous Verical Milling

Another milling fixture that permits of uninterrupted facing operations is shown at the right of Fig. 1. The work here is performed on a vertical milling machine and the fixture is secured to the revolving table. It will be noted that each cover is clamped by the operation of one nut, the clamp being so designed as to come below the level of the machined surface. The inner bearings against which the covers are clamped are threaded in such a manner as to pull the work down firmly on the locating pins. The cutter is 7in. dia., running at 30 r. p. m. and the output is 40 pieces per hour.

No Clamping Necessary

Another feature of interest in regard to modern methods is the increasing application of the magnetic chuck to the holding of work while the machine is being carried on. Primarily developed for holding work while grinding, the magnetic chuck is now receiving greater attention in connection with other phases of machine shop operations. At the top of Fig. 2 is shown a milling operation where the work is supported on a Heald magnetic chuck. No vise or straps are necessary. The plates, which are being milled, have previously been blanked out in a punch press from metal 165in. thick. They are held by the magnetic chuck and approximately .020in. is milled from each side, reducing the thickness to .125in. The five plates end to end make a milling surface 4in. wide by 21in. long. The cutter is 3½in. dia., and is run at 350 r. p. m. The error is limited to .005in.

The grinding machine is rapidly becoming an economic factor in the production of parts that until a short time ago were machined in an entirely different manner. The two lower views in Fig. 2 illustrate distinct methods in the facing of the sides of small pawls. As shown at the left this was formerly done by holding the work singly in an ordinary vise, one being ground at a time. As shown at the right the pawls are now placed on a magnetic chuck 56 being surfaced at the one setting.



Top—Milling thin sheet steel punchings held on magnetic chuck. Lower left—Grinding pawls held in vise. Lower right—Surfacing 56 pawls held on magnetic chuck.

A RUSTLESS IRON

An iron which not only possesses rustless properties but also can be worked cold without any trouble whatever are the characteristics of a rustless iron now being made on a commercial basis by J. J. Saville & Co., Ltd., Triumph Steel Works, Sheffield, samples of which we have recently examined. The Saville rustless iron can be bent cold through an angle of 180° without fracture, and the material is supplied in the soft condition, in which it is rust-resisting without any heat-treatment or hardening process after working, no matter to what purpose or in what shape it may be required. The only thing the user has to do is to treat the rustless iron in the same manner as he would brass and copper for the same purpose, that is to produce a bright surface and good polish on the article whatever it may be. This he can do by any method that may be convenient. It is claimed, says a writer in British Machine Tool Engineering, that the Saville rustless iron will take a polish equal to that obtained on electroplate and, in the soft condition, remains impervious to rust or tarnishing without any attention being given to it. The possibility of utilizing it for those machine-tool parts which, by reason of their contact with cutting compounds are subject to corrosion, will doubtless occupy the attention of machine-tool makers.

Another important property of the new material is that it can be manipulated into any shape or section by any process of cold working, such as cold stamping, cold pressing, cold rolling, cold drawing, or spinning, and, of course, by hot drop stamping or forging. The production of an iron capable of withstanding, without puckering or cracking, the most severe cold work and of being made by this work into intricate shapes, such as ornaments, beading, lamp bodies, and ship's fittings, is certainly a remarkable achievement. The physical properties of the material cover:—

Tensile strength (approx.) 40 tons per sq. in.
Elongation (approx.) 25% on 2 in.
Reduction of area (approx.) 60%.
Brinell 150.

How to Figure Successfully on Special Work

Simple Method of Keeping Track of Costs When Making Special Machinery and Estimating on Contract Work—Type of Forms Used—How Future Orders Are Dealt With

By J. H. MOORE.

Based on interview with P. Ford-Smith, general manager of the Ford-Smith Machine Co., Hamilton, Ont.

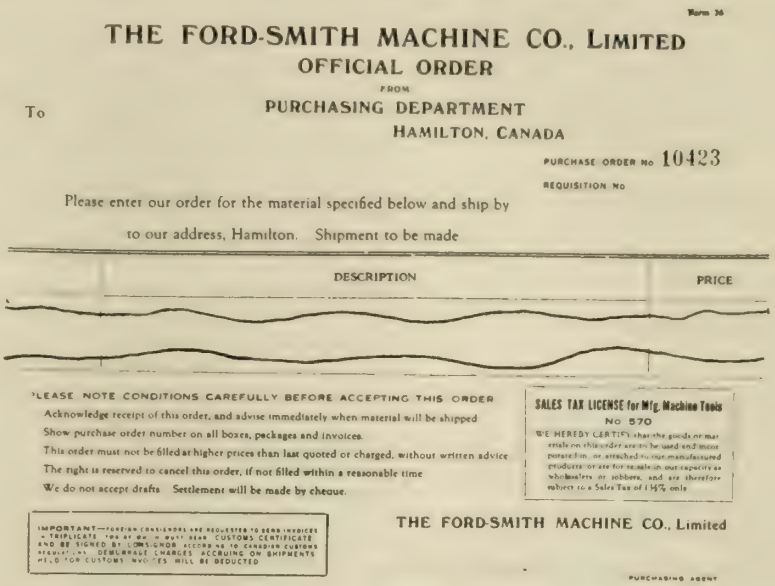
IN these days of keen competition it is the firm who tries in every way possible to reduce expenses and increase production that shows on the right side of the ledger at the end of the year. Owing to present conditions, several firms who previously handled only standard lines, are going out into the highways and byways in search of special work. Anything to keep the staff intact.

Often this change of policy causes confusion in cost keeping, with the result that the management is none too sure of the margin of profit. In fact they sometimes are doubtful if they even cleared expenses, especially on contract work. Keeping these points in mind, the following information should be extremely valuable, for the system described is one that the Ford-Smith Co. are at present using with splendid success. They know exactly where they stand. Guess work is eliminated, and not only do they benefit themselves, but the customer also feels that he is getting a square deal.

The type of work handled by this firm can be divided roughly into three different classes, viz., small jobbing work, repair work, etc.; special machinery tools and jigs, and standard grinders and millers.

In the case of small jobbing work, this is generally described on an order as shown at Fig. 1. This is issued from the main office on their regular shop order form and instructions are generally left in these cases, between the firm desiring the work, and the shop superintendent of the Ford-Smith plant.

Very often the drawing office, though receiving a copy of the order as usual, have nothing to do with it, simply getting the copy for record purposes.



THE FORD-SMITH MACHINE CO., LIMITED

OFFICIAL ORDER

FROM

To PURCHASING DEPARTMENT

HAMILTON, CANADA

PURCHASE ORDER No 10423

REQUISITION No

Please enter our order for the material specified below and ship by

to our address, Hamilton. Shipment to be made

DESCRIPTION PRICE

PLEASE NOTE CONDITIONS CAREFULLY BEFORE ACCEPTING THIS ORDER

Acknowledge receipt of this order, and advise immediately when material will be shipped

Show purchase order number on all boxes, packages and invoices.

This order must not be filled at higher prices than last quoted or charged, without written advice

The right is reserved to cancel this order, if not filled within a reasonable time

We do not accept drafts Settlement will be made by cheque.

SALES TAX LICENSE for Mfg. Machine Tools

No 570

THE FORD-SMITH MACHINE CO., Limited

PURCHASING AGENT

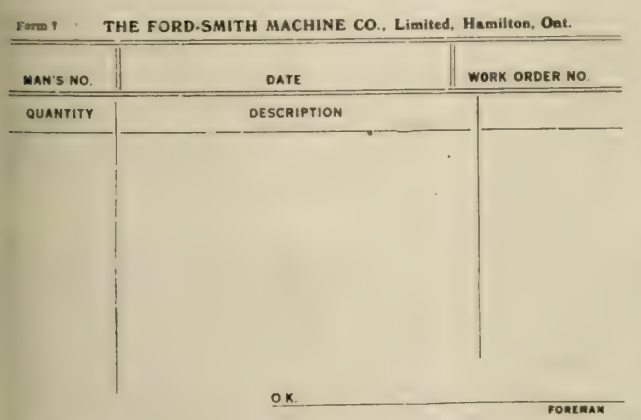
Fig. 2—Showing the style of official order used on special orders.

In the case of special machinery, tools, jigs, large dies, etc. the order goes through the office in the regular way. Each department, that is, the superintendent, chief engineer, shipping clerk and purchasing agent, all receive a copy. The material, except parts coming from the stock room are requisitioned in the drawing office, and go down to the purchasing agent. Prices are then enquired for, the material is ordered and brought into the factory as quickly as possible.

On the class of work manufactured by this firm, delivery is very important. If necesary, detail and working drawings are made in the drawing office which later go down into the shop after patterns are requisitioned. Copies of all requisitions made out by the drawing office go to the superintendent as well as to the purchasing agent, so that there shall be no overlapping, and also that the superintendent shall know exactly what is happening in regard to the matter for the job in hand.

The purchasing agent in writing out his official orders, makes copies as shown in Fig. 2, one of which goes to the superintendent so he is immediately informed that the material is ordered, and when he may expect it. This allows him to arrange his work. The original goes to the firm from which they purchase the material, and copies also go to the drawing office and shipping clerk. Thus we have an original, and three copies.

When special work, such as jigs, tools, dies, etc., are being made there is necessarily considerable intercourse and explanation between the drawing office



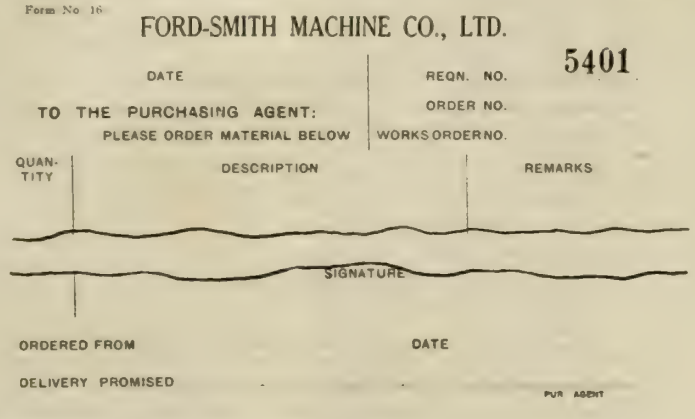
Form 1 THE FORD-SMITH MACHINE CO., Limited, Hamilton, Ont.

MAN'S NO. DATE WORK ORDER NO.

QUANTITY DESCRIPTION

O.K.

FOREMAN



Form No 16

FORD-SMITH MACHINE CO., LTD.

5401

DATE REQN. NO.

ORDER NO.

TO THE PURCHASING AGENT:

PLEASE ORDER MATERIAL BELOW WORKS ORDER NO.

QUAN-TITY DESCRIPTION REMARKS

SIGNATURE

ORDERED FROM DATE

DELIVERY PROMISED

PUR AGENT

Fig. 1—Showing form used for regular work. Fig. 3—Style of form sent by drawing office to purchasing agent.

and factory, but this is thoroughly understood, and no friction occurs. Everyone works in harmony, the idea being to produce at the lowest possible cost.

Standard Machines

When working on standard machines, the regular order form is made out in office, and copies distributed as usual. These machines come out of stock, so that really only the superintendent and shipping clerk are interested. If an order should clear out the stock, a new stock order is made out to the factory ordering them to make a certain number of machines for stock purposes. In this regard maximum and minimum quantities are provided.

ORDER ACKNOWLEDGED .....
HURRIED .....
SHIPMENT PROMISED .....
.....
.....
ORDER COMPLETED .....

When a job is completed, the shipping clerk makes his final remarks on the original order and returns it to the office. The drawing office and superintendent do the same with their copies. The purchasing agent attaches his vouchers of costs to his copy, then the sales manager gets a complete record of the costs and anything regarding each order. These are tabulated and the costs are always available. The invoices are then put through, if the work is on a time and material basis. Should the work be on a contract price, it is invoiced at this price, and a comparison made between the estimates and the actual costs. If there is any particular difference, the whole matter is very carefully sifted through to see where the estimate was inaccurate, or whether there were some special circumstances which made the costs vary from the estimate.

Fig. 3 shows the style of form used by drawing office when requesting material from the purchasing agent. A copy of this requisition is sent to the superintendent, and a copy also remains in the drawing office files.

This completes a simple but very efficient system, once an order has been completed on contract price, the firm knows definitely whether they lost or made money on the order. In the event of the profit margin being high, they give the customer the benefit of this on future orders of similar character, quoting a lower price. They also allow a reduction on future orders when the first contract price had to cover cost of patterns, etc. We know this fair dealing policy exists, for in discussing the matter with the manager, Mr. Ford-Smith, we touched upon several cases where this had been done.

After making repairs or adjustments to countershafts or hangers be sure and remove all tools. This will prevent the chance of accident.

It Does Not Pay to Mix Sport With Daily Work

YOUR article and editorial of noon-hour problem, which appeared April 27, fully coincides with my views," writes a well known manufacturer who prefers his name deleted. "I think the man who wrote this showed a great knowledge of the subject and a real understanding of same," he continues, but let this plant owner speak for himself from now on.

"I have talked with the managers of one or two large concerns on this subject, firms who have had their football teams and their baseball teams, whose successes have been written up in the newspapers, and they tell me that in very short order, the success of the baseball team or the success of the football team, is the sole topic of conversation and pretty nearly the sole thought going all through the plant, to the great detriment of the work.

"This applies particularly to sports. We have the same thing here in our Collegiate Institute. We have a track team which is probably second to none, taken all around, in the whole continent. The papers have had the boys' photographs in, and up to the advent of the new principal a few weeks ago, about the only thought of the students was about the track team.

"I do not think that a firm in business should take any active interest, as a firm, in sports. If they like to subscribe to the various teams in the city and generally encourage sports, that is alright, but as a company, I think that they should not encourage sports amongst their employees.

"I think the proper thing for the noon hour is to have a real good rest room with a man in charge who can see that the furniture is not abused, with plenty of books and periodicals around for reading, and also to see that the place is kept quiet for the men who want to read, and also to see that there is no discussion of matters detrimental to the interests of the company. If men want to discuss such matters, they should at least have the decency to do it off the company's premises. Other than this, I do not think that the company should take an active part in filling up the men's spare time with their own ideas.

"As a general thing we have found that men who are actively interested in sports, even heads of departments, are not generally sufficiently engrossed in the firm's business, and while we thoroughly understand that men must have recreation, and that it is very good for them, outside interests, particularly sports, are altogether too engrossing for a man to make advancement in his work. The only welfare work we do is our group life insurance by which every person in our employ is covered, and we have found this a great advantage to the men."

Another gentleman who has charge of several hundred men remarks that his firm does not know the meaning of welfare work. He says that all things done for the men come under the name of service, and in explanation remarks as follows:—

"When a man is going along nicely, all happy and in no trouble of any kind, there isn't anything we can do for him, but the moment he bumps into trouble we are right there to do all we can to help him out. And we help him no matter what the trouble is. After he is clear and back onto his feet we may have a severe reckoning with him and he may go to work somewhere else but only after he has been put on the right track. We do not believe in jumping on his neck when he is flat on his back.

"If we were a company making some product that needed some cheap advertising, we would probably have a ball team, and charge its expenses to the advertising department. However, we do not need to boost our goods publicly and are in the plant to produce material, not turn working hours into play time.

"We made one stab at sport, but it wasn't a success. As soon as our help showed signs of wear and tear, we cut out the game. No one was peeved, because down in their hearts they knew they had been overdoing it. In the winter months we have a bowling league, but after hours. We go down town in the evening, and it does not interfere with the work.

"Every year we have a picnic, and occasionally a dance, but all outside of working hours. We believe the men are at our plant for a definite purpose to get the work out, and are happy when they can accomplish that purpose. Welfare work may be all wrong, service work is good stuff, at least that is how we look at it."

"We do considerable welfare work here but have never considered any particular arrangement for the noon hour entertainment of employees," says W. C. Franz, president of the Algoma Steel Corporation, Sault Ste Marie, "and I entirely agree with the writer of the article in your April 27 issue, that it is of very little importance. Some of our employees are on continuous operation and those who are not occasionally find some kind of entertainment, but so far as the company is concerned we have never felt there would be any particular benefits in arranging any entertainment at that time."

As the wrong application of brakes has the effect of greatly increasing the power consumption of electric cranes, the motors should not operate against brake friction, but should be released from it when the controller handle is moved to the first notch of the starting position.

Give Consideration to Small Shop Layout

Advantages Often Derived by Rearrangement of Equipment—Keep Product Moving in One Direction—Proper Location of Different Departments a Factor of Economy—Keeping Tab on Work

By G. BLAKE.

WHILE most engineering works (large and medium size) are laid out for systematic production, it is often the case that in the small shop the layout of the plant, stores, (inspection department, if there is one) does not get the attention it should, probably on account of the expense involved in re-organization and the lack of appreciation of the advantages to be derived from a re-arrangement. The author proposes to deal with the shop with a payroll of say between 50 and 100, and assuming that some speciality is being turned out, taking for example the manufacture of small power driven type pumps for automobiles, usually driven by gearing from the gear box.

Routing of Work

In most large shops it is so arranged that the raw material comes in at one end of the works and goes out at the other end finished, the work always travelling in one direction, this is of course the ideal condition, and while it is generally in evidence in the larger shops, it is seldom or ever encountered in the small ones, as generally the latter is built in or surrounded by other buildings, etc., so that there is little possibility of there being separate goods entrances and exits. The sketch shows the general layout of the small shop engaged on the manufacture of the type pumps as already mentioned, and it will be noted that there is a combined goods entrance and exit. When entering the shop from the goods entrance, the rough material store is on the right. A machine hack saw is placed inside the stores for cutting up all bar material, this saves a great deal of time, as in some shops the hack saw is placed in the machine shop, thus involving extra labor carrying or wheeling the material to the saw and back again to the stores to be issued to the machine shop or assembly department as required.

The storekeeper takes charge of all incoming and out-going goods, but in connection with the inspection of all incoming goods and materials, the inspector would be responsible.

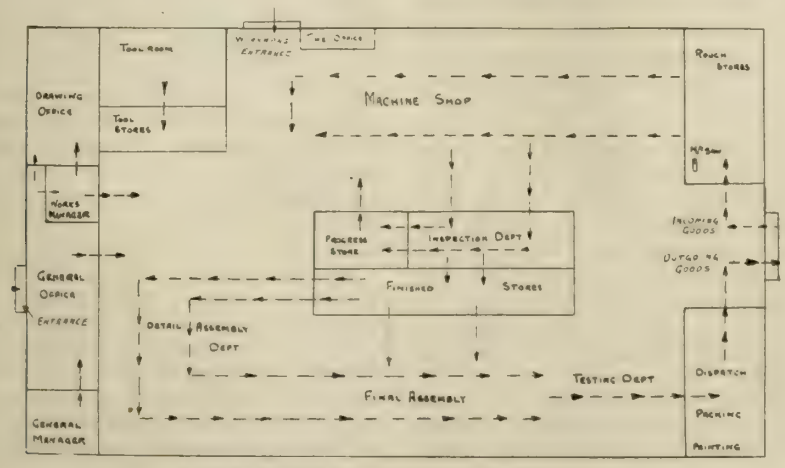
Sequence of Operations

The direction of the flow of work is indicated by the dotted lines and arrow heads, it will be noted that the work after being issued by the stores, goes to the machine shop and from there to the inspection department, but most of the small details are inspected in the machine shop as they come from the machines, it being so arranged that by having an inspector patrolling the machine shop, gauging the work on site, a deal of handling and time can be saved. Another point is that the floor inspector can prevent in a great measure the accumulation of defective or spoiled work, as he can at once notify the charge hand and have the machine put right. The work after being gauged in this manner can be simply transferred to another machine for the next operation without having to go to the progress store.

When an operation, on a batch of work, has been completed the inspector would put a small tag on the work and on this tag would be shown the quantity machined, the operation, the operator's number, the date, together with the inspector's O. K. and initials. It would also show the next operation so that the parts could be taken right away to the machine for the following operation. Of course, where it was necessary to inspect the work on the surface table, it would be transferred to the inspection department, accompanied by the work ticket which is somewhat similar to the inspection tag, the work would then be inspected and, if correct, transferred to the progress store, adjoining and communicating with the inspection department, awaiting re-issue to the machine shop. The inspector's tag would again be used to denote the next operation.

The writer's intention is not to illustrate the various tags, tickets, or cards used in connection with the work, but to indicate the lines generally upon which all unnecessary handling of the work can be cut out, thereby increasing the productive capacity of the shop. It will be noted that the finished part stores adjoins and communicates with the inspection department, the other side and ends face the fitting and assembly department. The dotted lines and arrow heads here again indicate the flow of work, so that after passing the final inspection the parts are transferred to the finished stores, to be issued to the fitters and assemblers when required. Following the dotted lines and arrow heads, it will again be noted that the materials now made up into detail assemblies, are following in the one direction towards final assembly, testing, and thence to the painting, packing and despatch department, which is opposite to the rough material stores. The finished goods have now arrived at practically the same position as when brought in as raw material. The goods again at this point come under the control of the storekeeper who is responsible for the packing and despatch.

A word now about the tool room and tool store; these two departments adjoin and communicate with each other. Again referring to the sketch, it will be seen that the tool room is placed at one end of the machine shop. As most of the tool room's products are in connection with the machine shop, it is therefore in the best possible position; the tool store by being attached to the tool room, provides the necessary link in the chain (as it were) as the tool store attendant can have all jigs, tools, gauges, etc., tested and corrected when required, with the minimum amount of handling. The position of the tool store is conveniently placed for machine shop inspection and assembly departments The "tool room foreman" should have charge of the "tool store." By this arrangement the upkeep of jigs, tools, gauges, etc., would receive the proper amount of attention, as the tool room foreman would in this case be responsible.



Layout of small shop to promote efficiency.

The general manager's office communicates with the general office, which, in turn communicates with the works manager's office and drawing office. The works manager's office is in direct communication with the works and also the drawing office, the floor level of all the offices being about 2 feet higher than the floor level of the works, by this means the works manager can have a good view of practically the whole of the shop from his office window. Regarding the procedure adopted when an order is issued, first of all the sanction is given by the general manager or managing director, as the case happens, for the manufacture of say 10,000 tyre pumps, the order is made out in the general office and signed by the managing director, instructing the works manager to proceed with the manufacture of the specified quantity.

Purchasing Department

In large and medium sized works there is generally a buying department and the individual in charge is responsible for the ordering and purchasing of all materials, etc. This duty in the small shops falls on the works manager. The first thing the works manager sees to is the materials in stock in the rough stores. Supposing that there are enough materials to make 1,000 sets to commence on right away, he would issue a works order to all the foremen or charge hands in the works. All these orders are in varying colors, each color representing a department; one order is sent to the storekeeper, another to the tool room foreman, another to the machine shop foreman, another to the inspector, and one to the assembly department foreman. After this is done the works manager would get quotations for the supply of materials sufficient to complete the order, with enough to replace the material taken from stock, as it is policy to always have in hand sufficient material so that small rush orders may be dealt with promptly. The tool room foreman immediately on receipt of the order would see that all jigs, fixtures, tools, gauges, etc., were in readiness to be issued to the machine shop when required. The progress clerk, who is responsible to the works manager would have the making out of the orders to the various departments, and his next duty would be to see that the stores delivered the requisite material to the machine shop to commence the production of the pumps.

Progress System

There are many other details in connection with the small shop, for instance a progress system would be necessary so that production could be recorded, and again some form of payment by results would also be essential, but to specify any particular method or methods is not the author's intention. For example, what may suit one shop, may not be at all practicable in another, as it depends in a measure on the products of the firm. There is one point in passing, however, which may be mentioned, a manufacturing system if adopted must be adhered to. Its ultimate success does not so much depend on the individual who introduces it, as it does on the whole-hearted co-operation of all in the works, from the shop boy to works manager and even managing director. Some workmen are opposed to any new idea and it is those who are the brake on the wheels of advancement; foremen are not exempt either in this respect, as the author has not infrequently noted that they do not take kindly to the new introduction, consequently they do not concentrate on getting the system going properly. There is nothing so detrimental to a new scheme as lack of interest, or unwillingness on the part of an executive. Getting the foremen and charge hands to take up the new scheme in an enthusiastic manner and to insist on it being carried out, goes a long way towards its ultimate success.

THE USE AND ABUSE OF A VISE

Probably there is no tool in the shop which is subjected to so much unintelligent use as a vise. Most machine tools are put exclusively into the hands of trained men whose education and experience have taught them to know the strength of materials and to closely estimate the strain which may be safely put upon a piece of machinery; and, furthermore, not to exceed that strain unless the exigencies of the occasion demand it, in which case the possibly resulting breakage may be pardonable on the ground of temporary necessity. But a vise is generally at the service of any one who may temporarily have use for it. It has no protection against use which may be so devoid of intelligence as to constitute gross abuse. Unfortunately its functions and design are such as to provide within itself the means for its own destruction, and it is frequently forced into service for which it was not designed or intended. Oftentimes we see it used as a screwpress, which use is quite legitimate so long as the operator is one who knows the maximum pressure it can safely withstand, and who doesn't allow that pressure to be exceeded. But in the hands of the average helper or laborer, such use is generally disastrous. When he reaches the limit of pressure which can be exerted by the lever with which the screw is provided, a piece of gas pipe slipped onto the lever provides the convenient means by which the leverage may be increased almost indefinitely, and a break is pretty likely to follow. One very provoking outcome, if the perpetrator happens to be unobserved, is his releasing the pressure when he feels the vise "give," and thus knows that a fracture has been started, taking his work somewhere else and leaving his damage to be uncovered by the next user of the tool, who truthfully reports that the vise broke under very little strain. Another fruitful cause of breakage is the clamping near one end of a long piece of work which may thus have considerable overhang. Many times the operator, instead of hunting up a stick or other support to keep the free end from dropping, will attempt to hold it by excessive pressure between the vise jaws; and if in that condition the operation may involve any considerable hammering, the service exacted of that vise is most severe. One cause of a minor breakage is the clamping of a hard piece of metal so that the pressure is concentrated upon a small area near the margins or corners of the hardened jaw face; and if the jaw is hardened enough to resist battering or indentation, a piece is almost sure to be broken out, leaving an unsightly notch.

A very common fault with vise users is the failure to keep the screw lubricated. We have seen many vise nuts in which the thread had practically disappeared. The front jaw should be occasionally detached from the vise, turned over, and the screw lubricated its entire working length. When this is done at reasonable intervals, the screw and nut will wear indefinitely.

The use of vises having smooth faces for their gripping jaws is not nearly as extensive as it would be with a better comprehension of their capabilities. For most operations involving filing or light chipping only, smooth jaws will hold the work securely enough, and the necessity for using loose pieces of smooth metal between the jaws to prevent marring finished surfaces is obviated.

Treat your vises as you would treat any good tool in your shop, and your expense for replacements will be negligible.

From Prentiss booklet.

SPEED OF COMMUTATOR

The peripheral speed of a commutator or slip ring is the speed at which its surface is moving under the brush contact. It may be calculated by multiplying the diameter of the commutator or ring in feet by 3.1416 and by the number of revolutions per minute. Brush manufacturers rate their brushes for the maximum peripheral speed to which they are adapted. This rating applies to direct-current types of machines of average design, and may be increased from 20 to 50% for slip-ring service. Permissible peripheral speed is determined largely by the coefficient of friction of the brush, but there are other factors having an influence, and for this reason, says "Power," it is advisable to base the selection of a brush on the manufacturer's rating for permissible peripheral speed rather than on the coefficient of fiction.

A crane driven by a three-phase wound-rotor motor will handle loads quite as sensitively as a direct-current motor, but the latter is capable of performing more work in a given period, due to its higher speed of hoisting light loads and lowering, although the speed of hoisting maximum loads is the same for both types of cranes.

Vertical Turret Lathe as a Production Tool

Intensifying Actual Machining Time—Reducing Tool Setting Periods—Advantages of Multi-Cutting Process—Great Saving Effected in Machining Piston Heads

By E. P. BLANCHARD.

IN the development of machine tools for greater production at lower cost, it has been possible at times to combine the salient features of several types of machines into one unit, thus not only consolidating the gains in each type, but producing a machine of wider range, increased adaptability, and more economical operation. Materials are improved to meet the new conditions, control is studied for the convenience of operation and production proceeds on an advanced scale. The vertical turret lathe represents in combination an advanced development of the engine lathe, the horizontal turret lathe, and the vertical boring and turning mill. There are, of course, some conditions that are satisfactorily covered by the original types but the mass of work in this field is appreciably benefited by the machine here shown, a fact conveniently demonstrable.

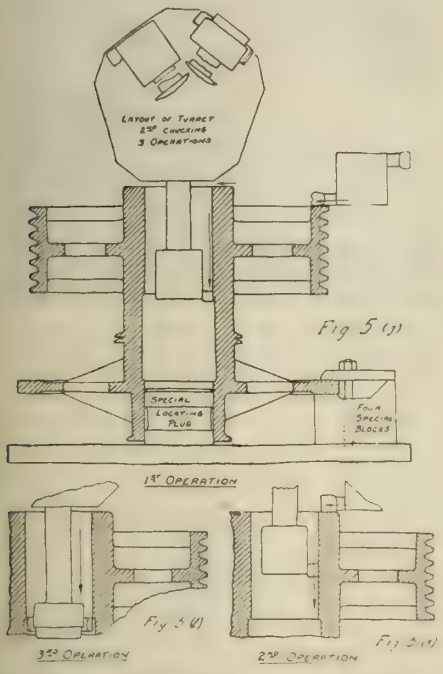


Fig. 5.—Sub-operations (j), (k), and (l).

Based on the proposition that all time is either used or not used for production, and that actual cutting time only, is productive, the problem with any machine is first to reduce the non-productive time with a corresponding increase in the productive, and second, to intensify the use of time in operation. The reduction of time between cuts is accomplished by convenience of control, elimination of unnecessary movement, and direct aid to the necessary. The use of productive time is intensified by the number of cuts that can be taken at once with proper feed and speed, the limiting factor in each being the ability of the cutting tool to stand up under these requirements.

The vertical turret lathe is an apt illustration of these principles, the inherent qualities being obvious in a study of its use. The performance of a battery of these machines at the Dayton Steel Foundry Co., demonstrated their ability to stand up to heavy work and places the responsibility of limiting production not on the machines but on the efficiency of cutting metal. Each machine was installed for a production of 18 truck wheels per day from cast manganese steel. The operations were rough turning, boring, facing and finishing. With tool steel, a speed of 40 feet per minute was used for roughing, and 65 feet per minute for finishing. By a change in cutting metal a roughing speed of 90 feet per minute and a finishing speed of 150 feet per minute was obtained. Production was doubled to 36 wheels per day from the same machines. The extra strain was not noticeable on the machines. A close up view of the tooling and the truck wheel chucked in the machine is shown in Fig. 2.

A complete study of the operations in the machining of a 26-inch diameter split gear of forged steel, Fig. 3, affords excellent opportunity of observing the machine under heavy work and clearly shows the value of turret tooling and multi-cutting. Line drawings of the piece and the tool layout are shown in Fig. 4. The successive operations are listed in the table showing clock times,

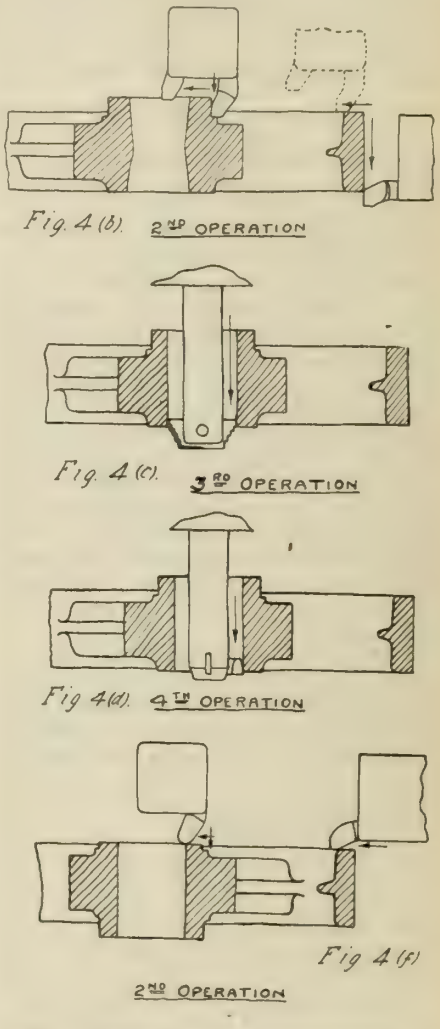


Fig. 4.—Showing various sub-operations on forged steel split gear.

The author is advertising manager of the Bullard Machine Tool Co., Bridgeport, Conn.

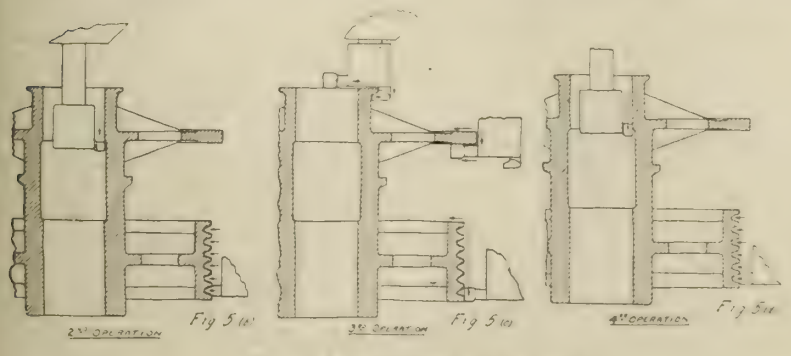


Fig. 5.—Sub-operations (b), (c) and (d).

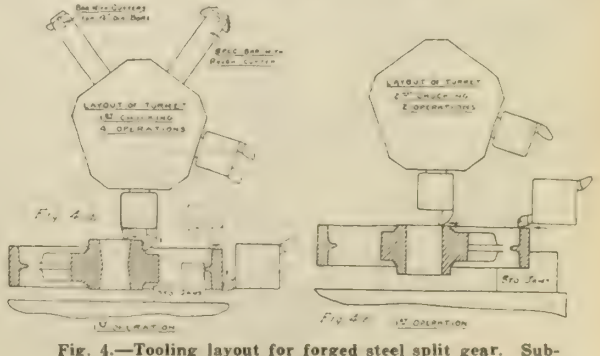


Fig. 4.—Tooling layout for forged steel split gear. Sub-operations (a) and (e.)

SPLIT GEAR BLANK—FORGED STEEL

Operation—	Clock	Time	Speed	Feed	Main Hd.	Side Hd.
First Chucking	2.14	2.17			3 min.	
Rough Turn O. S. Diam.	2.17	2.29	13 R.P.M.	.033		12 min.
Rough Face Rim	2.19	2.21½	" "	"	2½	
Rough Face Hub	2.21½	2.25	" "	"	3½	
Rough Turn	2.25	2.28½	" "	"	3½	
Finish Turn O. S. Diam.	2.29	2.30¾	" "	.245		1¾
Finish Face Rim	2.29¼	2.29¾	" "	"	½	
Finish Face Hub	2.29¾	2.30¼	" "	"	½	
Rough Bore (Spec. Bar)	2.30½	2.30½	56 "	.018	5	
Rough Bore Multi Bar	2.35½	2 39	" "	.033	3½	
True Multi Bar	2.39	2.41½	" "	.068	2½	
Size Multi Bar	2.41½	2.43	19 "	.131	1½	
Ream Multi Bar	2.43	2.44½	" "	.131	1½	
Take Off	2.44½	2.46½			2	
FIRST CHUCKING TOTAL TIME	32½ min.					
Second Chucking	9.51	9.52½			1½	
Rough Face Rim	9.52½	9.55	13 R.P.M.	.068	2½	
Finish Face Rim	9.55	9.56	" "	"		1
Rough Face & Turn Hub	9.56	9.58½	39 "	.033	2½	
Finish Face Hub	9.58½	9.59½	56 "	"	1	
Take Off	9.59½	10.01			1½	
SECOND CHUCKING TOTAL TIME	10 min.					

speed, feed and duration of each operation.

An analysis of the operations required in machining any given piece will indicate that with speeds and feeds equivalent to the capacity of the tool bits, or requirements of the work, the total cutting time per tool for any piece, will be the same regardless of the type of machine on which the work is done. On any machine, therefore, which is capable of work beyond the economical endurance of cutting metal, efforts for higher efficiency must be toward a reduction of non-productive time and a multiplied use of productive time. Such multi-cutting is the result of group tooling on one head, or of two heads cutting at once, or a combination of both methods.

The ability of a machine tool to thus concentrate extended single tool time into shorter simultaneous operation might be called "Simultation." Simultation varies with the requirements of the work in speed and feed, the adaptability of the machine, and the ingenuity of the operator. It might be expressed in the ratio of extended single tool time of 100 per cent. capacity to the actual operating time under simultaneous cutting.

Any machine tool capable of cutting continuously with a single tool at full capacity would finish a certain steam piston head in 116 minutes, plus such time as would be required to adjust that tool and make the changes in feed and speed. The vertical turret lathe furnishes the necessary power and rigid tool support for group tooling on each of two heads, and uses these heads simultaneously. Group tools are held in the turret and side head for successive operations, eliminating idle time between cuts. Control of all functions is centralized for further time saving and convenience of the operator. This is why the vertical turret lathe can reduce the extended single tool time for this piece to 48 minutes of intensive concentrated production, without straining the machine or the operator.

The vertical turret lathe can, by simultaneous cutting on several surfaces, give 60 minutes, 120 minutes, even 240 minutes of actual single tool productive

(Continued on page 44.)

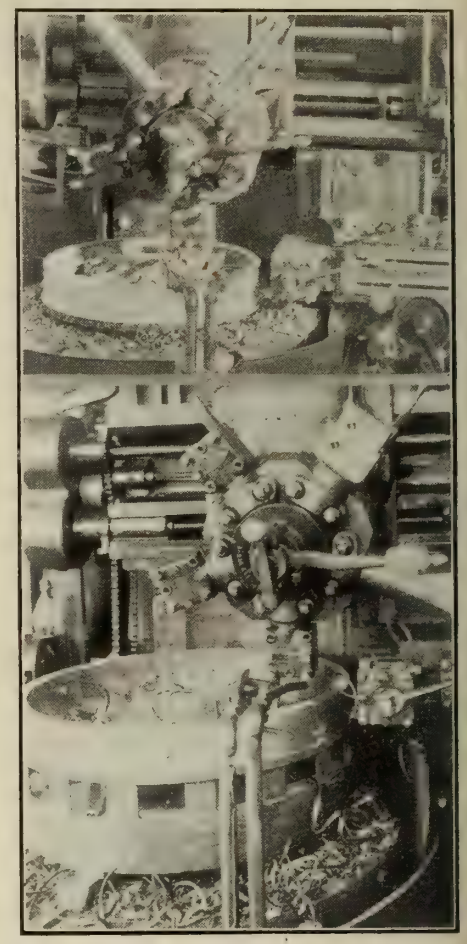


Fig. 1.—Tooling of a vertical turret lathe machining a manganese steel truck wheel.
Fig. 2.—Vertical turret lathe machining a forged steel split gear.

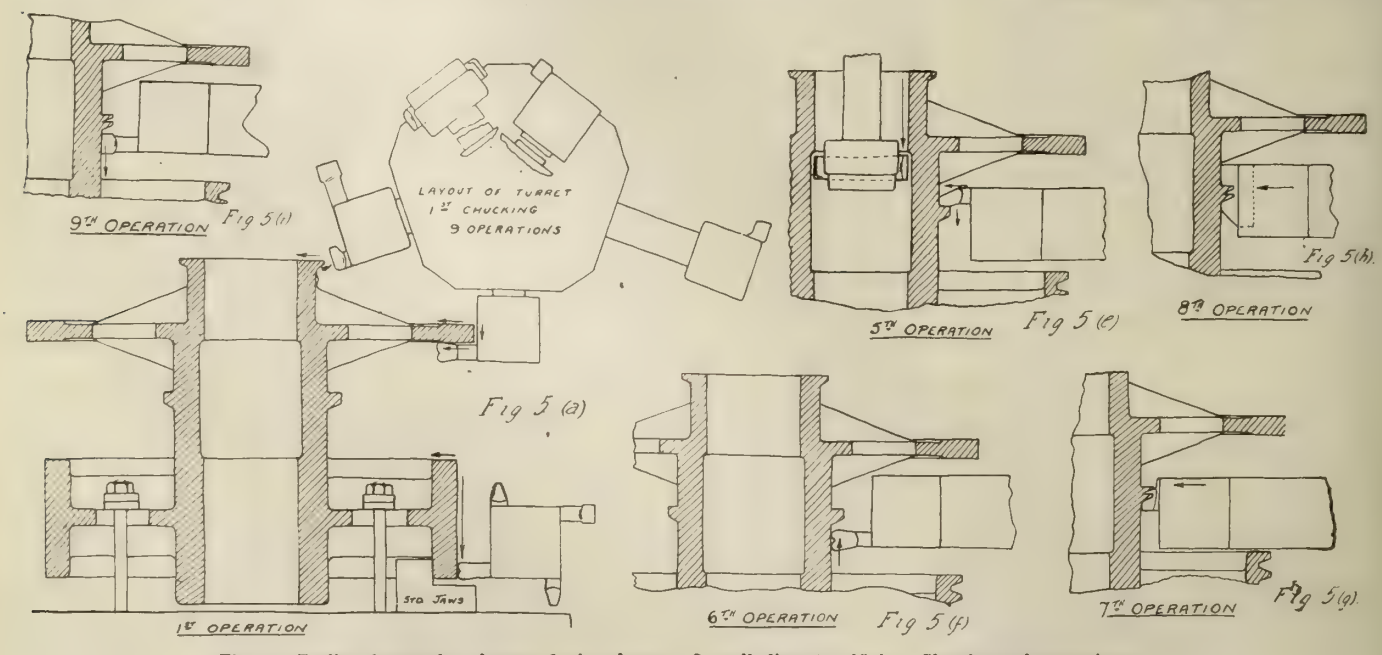


Fig. 5.—Tooling layout for elevator 32 in. sheave. Overall diameter 35 in. Showing sub-operations a, e, f, g, h, and i.

New Fibrous Material for Gear Construction

Water, Oil and Grease Proof—Tensile Strength Over 8,000 Pounds per Square Inch—Gears of Small Diameter Need no Shrouding—Insoluble and Infusible

THE MATERIAL is practically water, oil and grease proof. Ordinary solvents, alcohol, acetone, benzine, etc., do not affect it, and most acids and weak alkalaine solutions do not influence it in any way." These, and the following claims and uses are issued by the Diamond State Fibre Co., Toronto, who manufacture a non metallic gear cutting material known as "Condensite Celoron."

It is rodent proof, will not absorb moisture from the atmosphere, and will not deteriorate with age. It is highly resilient and amply able to withstand the sudden shocks and jars to which gears and pinions are often subjected. It is self-supporting. Gears and pinions cut to standard sizes require no shrouds or end plates. Only in extreme cases where the diameter and face are out of all proportions, or the stress at the key way is excessive, are end plates used, and then their function is usually one of reinforcement at the bore. Meshing end plates are never necessary. So far as their efficiency is concerned, gears made of this material require but two simple principles of common sense in their installation:

1.—They should never be meshed with gears of similar material or with gears having uncut or badly worn teeth.

2.—The face of the mating cut metal gear should always be equal to or wider than the condensate celoron gear. Grade F, the basic material from which these gears are made, may be described as a vulcanized woven fibre thoroughly impregnated with condensate and then hardened. This is a condensation product made of a combination of phenol and formaldehyde. When combined with fibre and hardened, it becomes extremely water-resistant, high in dielectric strength, and to all practical purposes is chemically inert, insoluble and infusible.

In general appearances it is smooth, hard, may be subjected to every machining process, and is suited to the cutting of silent gear and pinions. It is regularly supplied in standard sheets 36 in. by 36 in. and 36 in. by 40 in., and in standard thickness and from 1-32 in. to 3 in. inclusive.

To give an adequate idea of the physical properties, the following data has been prepared. Tests show that the material has a tensile strength of 8,000 to 10,000 pounds per square inch. Its compressive strength is approximately 40,000 pounds per square inch, laminae horizontal, and 2,500 pounds per square inch laminae vertical. The transverse strength is approximately 23,000 pounds per square inch, laminae horizontal; and 25,000 pounds per square inch, laminae vertical. Modulus of elasticity (the load per square inch divided by the elongation per inch) is approximately 1,550,000 pounds on the average of 10 readings. Specific gravity 1.3 to 1.4.

Brinnell hardness (by applying standard formula to the measurement of the impression made by a 10 mm. steel ball held under pressure of 500 kg. for 15 seconds) on natural face 45, on sawed face 36.40. Coefficient of expansion .000017 per degree Fahr. With absorption, test pieces 1 in. thick, .46 in 24 hours, 1.08 in one week. Absorption measured in percentage of original weight. The tests given are the average of many in order that any user may compute the factor of safety with greater security.

Standard Construction

The maximum thickness of a single sheet is three inches. In making gears up to a three-inch face certain standards of practice obtain, viz: The diameter of the whole depth circle must not be less than two times the diameter of the shaft. The distance from the root of the tooth to the key way should not be less than one and one-half times the height of the tooth.

For gears over three-inch face, the practice is to use two or more pieces fastened together. In this case the outside blank should not be less than one inch thick. Riveting is done under pressure. Where rivets are impractical, bolts may be used. If machine bolts are used countersink one outside blank to accommodate the head of the screw and tap the opposite blank to take the thread. Under a steady load, one way rotation, the maximum fibre stress on the key way may be safely estimated at 3,000 pounds per square inch. This figure, of course, where conditions are bad, and reversing service is necessary, must be reduced accordingly. In extreme cases the use of a larger key may help or end plates may be necessary.

On standard gears the use of shrouds is not recommended. Gears of large diameter in proportion to their face may, because of high pressure on the key way, require end plates or metal hub to relieve fibre stress. Gears of small diameter and larger bore may require end plates to prevent distortion when the key is driven. Extra hub strength may be necessary for a number of good reasons, but the usual duty of end plates is merely to preserve rigidity and good alignment.

Data on End Plates

Where end plates are used they should be steel, although for small gears brass may be used to advantage. Their outside diameter should be just a reasonable allowance over the rivet circle. They should never extend beyond the root of the tooth. Thickness should be as follows: up to 2 in., ⅛ in. dia.; from 3½ in. to 8 in., ¼ in. dia.; from 8 in. to 10 in., 5-16 in. dia.; from 10 in. and above, ⅜ in. dia.

In this type of construction the usual method is to mount a condensite celoron ring over the metal spider and fasten with rivets. To treat any gear right is to lengthen its life. A good trade of heavy graphite grease is recommended for gears of this material.

AN ENGINEERING MYSTERY

It seems impossible that an iron bar with a hole through the centre should be stronger than a solid bar of the same diameter, but this has actually been proved to be the case. A British firm has developed a very ingenious process of making what it calls a hollow cored bar with this increase of strength. The hollow core is really a small hole which extends from end to end of the bar. Obviously it would be a very costly business to bore a hole through the bar, and in consequence this firm has developed a clever way of making the bar hollow without drilling. The mass of metal from which the bar is drawn is drilled in the first case, and the hole is packed tight with a special composition. The ends of the hole are subsequently sealed by a patented process of welding. When the piece of metal is rolled in the mill into a long bar the packing stretches with the metal and preserves the continuity of the hole. One of the most important applications of this hollow cored bar is for mining drills where the hole is used for a current of air or a jet of water to cool the cutting edge. Where water is used it converts the dust made by the tool into slush before it can rise and be breathed by the miner. Thanks to this invention it is probable that the liability of miners to tuberculosis trouble will be greatly minimized. Hollow cored bars are also being used for a great variety of purposes in motor car construction and elsewhere. Arrangements have recently been made for the production of these hollow bars on a much larger scale than formerly.

All hoisting chains subjected to heavy stresses should be carefully inspected from time to time, for any signs of deficiency.

Never allow an emery wheel to vibrate when running at normal speed. If there is vibration, true up the wheel or re-babbitt the bearings after trueing up the journals.

Value of Experimental Work in Machine Building

Determining the Best Materials to Use for Various Purposes—Special Apparatus Provides Effective Test—Over 100,000 Reversals Made on Clutch in a Few Hours

THE EXPERIMENTAL department of the Alfred Herbert Co., has been of the greatest value in determining the best materials to use for various parts of machines and the best allowances for the various fits.

By the use of suitable experimental apparatus they have been able in many cases to give a machine, in a few hours, a test which would be equivalent to many years' working under ordinary conditions, and have thus been able to arrive at conclusions very much more quickly than by the ordinary method of trying machines out in the customers' works. The result is that in some cases constructions which might be criticised by casual observers are retained in use because exhaustive experimental tests have definitely proved them to be satisfactory.

Test on Clutches

An example of a test of this kind is shown in the accompanying illustration, showing a test which was made on the forward and reversing clutches of the 6½-in. single pulley head as fitted to the No. 4 Capstan Lathe and N. 1 Patent Hexagon Turret Lathe. In the early days of single pulley heads trouble was experienced with friction clutches, partly owing to the material from which they were made, partly owing to the methods of machining and the allowances for fit and wear.

The tests in question were made with clutches of various materials, and the particulars given refer to one series of tests showing a clutch which proved satisfactory in use. As will be seen from the illustration, a special reversing lever was fitted to the headstock and was connected to a simple worm-driven crank motion rigged up for the purpose and driven by a pulley from overhead so as to reverse the spindle 18 times per minute. In order to thoroughly test the reverse a very heavy pattern chuck was fitted to the spindle, the weight of the chuck being 105-lbs. and the momentum such as to severely stress the friction clutch at the moment of reversal.

At the beginning of the tests the chuck speed was 224 r. p. m., and it was noted that after 1,620 reversals the clutches became very hot but caused no trouble. After 3,683 reversals the reverse clutch was adjusted and the head re-started, the chuck speed being raised to 334 r. p. m., which was continued throughout the entire tests. At 6 reversals the forward clutch was adjusted. At 10,163 reversals the reverse clutch was again adjusted. At 12,323 reversals the clutches were taken apart and examined; it was found that the friction rings and shells showed no appreciable signs of wear except at the corners of the rings, where slight wear was evident due to lack of roundness when sprung open. The clutch parts showed some signs of over-heating, so the speed of reversal was reduced to 8 reversals per minute, the chuck speed being as before, 334 r. p. m.

At 47,483 reversals the forward and reverse clutches were adjusted and the head taken to pieces for examination and cleaned out. The clutches were in good condition, and the grinding marks in both rings and shells were still visible. At 57,923 reversals the forward and reverse clutches were adjusted. The machine was then run until the number of reversals reached 101,603, which was considered sufficient, and the test was terminated.

Results of Test

On inspection of the clutches they were still found to be in excellent condition, the only wear in the rings being near the corners where expansion is at a maximum, and grinding marks were still visible in both friction rings and shells. During the whole of the tests the forward clutch was adjusted five times and the reverse clutch six times. The head was reversed 43,680 times after the last adjustment of the clutches, there being no further need for adjustment, and the clutches were in good condition at the end of the tests.

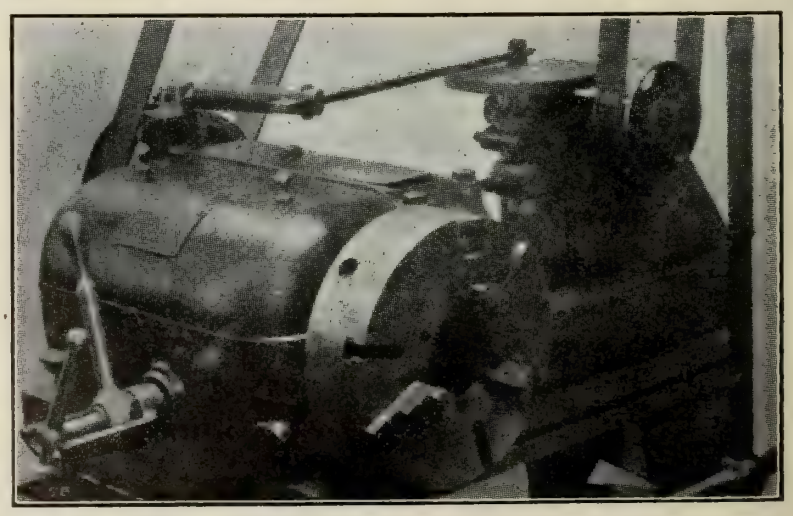
The above tests represented one stage in the progress of the friction clutches in question, further improvements having been made later on and additional tests of a similar character carried out.

The conditions under which these experiments were made were much more severe than anything which could take place in practice, as reversal of these heads in practice is only an occasional operation, and the heating effect caused by the constant reversal at high speed with a heavy chuck on the spindle would never take place in ordinary practice.

The knowledge that experiments of this kind give us is of the greatest value in ensuring that our machines shall work in a satisfactory manner after leaving the plant, and results in something of value in the machine which cannot be represented by catalogue particulars, but only by the reputation of the maker founded upon the performance of the machines in the works of the user.

CARBON TOOL STEEL STILL DESIRABLE

In these days when high-speed tool steel is being used by some people almost indiscriminately for all sorts of purposes, it is worth while remembering that carbon tool steels are still quite efficient when used with discretion. If users of tool steel will study the uses for which carbon steels can be relied upon, they will not use dearer steel than a given tool requires, and will thus be able to afford not to make other tools of poorer steel than will result in a perfect job. Economy in tool-making is very largely a question of choosing the right steel for every tool. The rules laid down by Messrs. Edgar Allen and Co., Limited, in their free pamphlet, "Carbon Tool Steels," cannot be applied blindly to every steel that the market offers; but they are right for each of the four classes, and six degrees of hardness in each class, which the "£.s.d." series provides. It is safe to say that if the rules laid down in this pamphlet as to the choice and the treatment of "£. s.d." carbon steels are followed, no tool maker need fear competition.



Experimental testing of friction clutch.

Mechanical Technology of Forge Shop Practice

Interest Shown by Manufacturers in Technical Training of Youth —Art of Welding and Working Iron—Model Forge Shop Lay-out—General Practice Exemplified

THE OPEN hearth method of making steel was discovered about the year 1845. It is under better control than the Bessemer process since at any time it affords opportunity for testing and for making such additions as may be necessary to yield the desired product. The open hearth furnace also permits of the highest temperature without requiring a strong draft. These furnaces are built to hold from ten to fifty tons of metal. The time for an operation or "heat" is from eight to eleven hours. Steel rails, structural materials, plates, etc., are produced by this process.

Bessemer Steel

The Bessemer process is named after its inventor, Sir Henry Bessemer, an Englishman, and was introduced in 1856. For many years after its introduction it ranked first among all the processes. Bessemer steel is made by decarbonizing cast-iron by forcing a current of air through the molten metal in a pear-shaped crucible or vessel called a "converter." There has been little change in the design of the converter from that originally used. A common size of this converter has the following dimensions: Diameter 8 ft., height 15 ft. It is made of boiler plate, lined with refractory material. It is suspended upon an axis to admit of its being turned from an upright to a horizontal position. In the bottom there are twelve tuyeres, which have to be replaced after about twelve or fifteen blows or heats. The usual capacity of the converter is from six to fifteen tons of cast-iron. The blast of air forced through the molten cast-iron, produces great heat. The resulting gas and flame escapes from the mouth of the converter, the combustion of carbon and silicon producing a temperature sufficient to keep the mass thoroughly melted, thus quickly burning out the carbon and silicon, this last result being indicated by the color of the flame. The molten metal is poured into a ladle and then there is added to it, manganiferous pig-iron, which reintroduces the necessary amount of carbon and manganese. This entire process takes about twenty minutes. It is then cast into ingots, and, after being treated in the reheating furnace or "soaking-pit" is rolled to the required thickness. Bessemer steel is used for nails, screws, wire, and in fact, for all products where cheapness rather than quality is the requirement.

Crucible Steel

Crucible or tool steel, the oldest and simplest process, takes its name from the methods employed in its manufacture. In this process, carbon is added to a low phosphorus and sulphur wrought iron. Swedish or Norway iron is used in preference to other kinds, as it has proved superior in making high grade tool steel. The iron is cut into small pieces one inch long from flat iron bars 2" x ½". These pieces are then placed in a clay crucible (sometimes a graphite crucible is used, although it is not as good) which is about 20" high and 1 foot in diameter. A certain amount of powdered charcoal is mixed with these pieces and the crucible is then tightly sealed, and subjected to great heat which melts the iron. After having remained in a molten state for some time, it is poured into molds and form-ingots which are afterwards rolled or hammered under a steam hammer into bars. This process has undergone but little change in all the years it has been employed, the only important change being a more direct method for introducing the carbon into the steel. In the main, however, the method now used is the same as that used centuries ago. Owing to the high cost of production this method is now used principally for making high grade tool steel. The elasticity of this steel, makes it of use in many places where no other steel could be safely used.

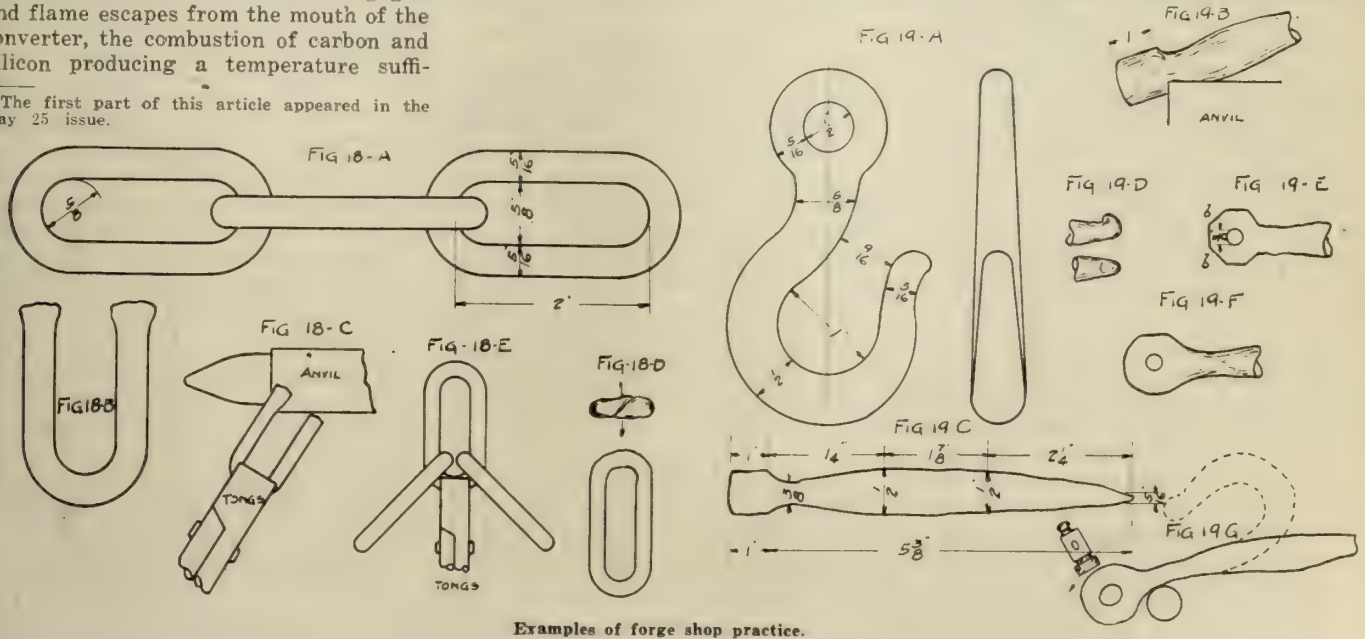
Tempering

The term "temper" as used by steel makers, refers to the percentage of carbon in the steel. It has a different meaning when used by the steel maker than when used by the hardener. In the steel mill, it means the amount of carbon the steel contains. According to "Metcalf" the meanings may be tabulated as follows:

Very high temper .....carbon 150
High temper ..... carbon 100 to 120
Medium temper ..... carbon 70 to 80
Mild temper ..... carbon 40 to 60
Low temper ..... carbon 20 to 30
Soft or dead soft temper, carbon 20

A point is 1/100 of 1% of any element that enters into the composition of steel, so: a 150 point carbon steel, contains 1½% carbon. In the steel mill such a steel is spoken of as 150 steel. "Tempering" on the other hand, denotes the process by which steel is brought to a previously determined degree of hardness. A steel chisel can be made so hard that it will cut another piece of steel; or so soft that driving it into a piece of hard wood will dull its point. This property of steel enables the mechanic to make it into tools suitable for

The first part of this article appeared in the May 25 issue.



Examples of forge shop practice.

any kind of work. Steel is tempered by various means, all of which depend upon a heating and subsequent cooling of the metal. For instance, a piece of tool steel which is heated to a cherry red heat and then plunged into cold water, becomes very hard. If allowed to cool slowly, it becomes soft. Between these extremes all degrees of hardness can be obtained. Every tool is tempered to the hardness that makes it most useful. When a polished piece of steel, hardened or unhardened, is exposed to heat in the presence of air, it assumes different colors as the heat increases. First will be noted a faint straw color, which changes to a deeper straw, then to a dark brown with purple spots, then to a dark blue, and finally to a light blue. These colors are due to a thin film of oxide that forms as the heat progresses. These colors are valueless, however, to the tool maker unless the metal has first been cooled in a bath of water, oil, or some other liquid, when at red heat. Drawing hardened steel to any of these colors is called "tempering." The following list of colors applies to all of the tools we are likely to make:

Color

Pale or light straw, lathe tools; dark straw, taps, dies, milling cutters, etc. Woodworking tools (cooled in oil); purple, center punch, stone drills; dark blue, cold or cape chisels; light blue, screw drivers.

Tool Tempering

Let us consider the tempering of a tool, taking, for example the cold chisel, a tool widely known and generally abused. To obtain a good chisel it must be properly forged at a comparatively low heat, and then hammered with light blows at the last until it has cooled considerably below the heat ordinarily used when metal is displaced. The object of the light blow on the cooling metal, is to close the grain or refine the steel, making it tough. Tools of this character stand up better if they are heated to a cherry red heat and allowed to cool before hardening. This is not always possible, but when it is, make the hardening heat a separate operation. To harden, heat two-thirds of the part forged to a cherry red heat, using great care not to overheat the point, and then cool one-half the blade in cold water; always move the tool about or set the water in motion, avoiding any danger of making a water crack at the water edge. The next operation is to brighten one broad surface with an emery stick. A piece of emery cloth tacked over a stick of wood makes a very good polisher. The heat remaining in the body of the chisel will reheat the end already cooled, and the various colors will appear in order on the polished surface. The proper color for a cold chisel when correctly tempered, is dark blue. When this color is attained at the point the entire tool is then immersed in water and is not removed until cold. If the tool is not cooled off enough in the first operation, the colors will run down very rapidly and become compact, and if not watched closely, they will be gone before the tool can be cooled. When a tool is to be hardened all over, it is first heated to a cherry red heat and then cooled. After brightening with the emery stick, place on a square or flat piece of hot iron. The tool will absorb the heat and the colors will soon commence to run. When the desired color is attained cool again in water or oil. In a commercial plant where a great many tools of the same kind are made, and where the composition of the steel is known, a hardening bath is used.

Spring Tempering

The method employed in hardening a spring in oil is as follows: First, heat to a cherry red heat, as in hardening in water; cool all over in oil; hold over the fire until the oil upon the surface blazes. This is called "flashing." Cool again in oil. This "flashing" is done three times before the process is complete. Another method of hardening a spring employs a water bath instead of the oil. Pass the spring over the fire or through a flame until it is hot enough to make a pine stick show sparks; then cool in water and a spring "temper" results.

Annealing

The process of softening a piece of steel is called "annealing." A piece of steel is softened or "annealed" prior to being worked upon in the lathe or otherwise machined, as this process brings about a uniform softening, relieving any strain that might have occurred in forging. To anneal a piece of steel it should first be heated to a cherry red heat, and then allowed to cool slowly. When long pieces of steel, or a number of pieces, are to be annealed and a furnace is employed, the pieces are placed in a long tube or pipe, and both ends sealed. They are then brought to a cherry red heat and allowed to cool. When a piece is heated in the forge, it is covered over in the annealing box.

Exercise No. 19

Stock—Norway Iron—⅜″ x 1″—4½″ long. The hook as shown by Fig. 19 A is the finished piece. Operation—Lay off center punch mark 1″ from one end. Heat and draw first to the form shown by Fig. 19 B, then to that shown by Fig. 19 C. Set over the end, Fig. 19 C, and finish as shown by Fig. 19 D. Cut the corners, punch the hole, Fig. 19 E, and draw the eye on the horn to the form shown by Fig. 19 E. Heat at O, Fig. 19 F, cool the eye and bend as shown by Fig. 19 G. Complete the bending as indicated by the dotted lines, Fig. 19 G.

Exercise No. 18

Stock—Norway Iron—3 pieces—5/16″ diameter—6″ long. Three links of a chain, shown in Fig. 18 A, form the finished piece. Operation—Upset each end of the piece, taking one heat for each end. Heat the piece in the center, cool about 1½″ of each end and bend to the shape of the letter U, Fig. 18 B. In scarfing the ends, place one end upon the sharp edge of the anvil, Fig. 18 C, and striking light blows, swing the piece around bringing the toe of the scarf to a thin edge. After one end is scarfed turn the piece over and scarf the other in the same manner. Bend the scarfed ends over the horn of the anvil so they will lap as shown by Fig. 18 D. Weld and finish two links each independent of the other and complete in itself. Bring third link to the form of Fig. 18 D. Spread the ends in the direction shown by arrows and slip on the finished links. Apply the tongs as shown in Fig. 18 E, close the ends of the link, and weld. In finishing see that the links are of the same size and form.

WHAT A MACHINIST SHOULD LEARN DURING HIS TRAINING

Lathe work: Grinding tools; centering; laying out; facing; straight turning; turning to shoulders; taper turning; combined straight and taper turning; turning precision work to micrometer, limit, ring and snap gauge; cutting V, U. S. S., U. S. F., Acme, Whitworth, Square, Buttress and Worm Threads; boring; facing; turning, recessing, threading, etc., in chuck; setting up work on face plate; eccentric crankshaft, and oval work; taper turning and boring, three cases; making running, sucking, wring, press, and shrink fits; use of hand tools and various attachments, such as grinding, relieving, etc.

Milling machine work: Milling surface on cast iron, steel, brass, etc., held in chuck clamped to platen, or held in jigs or fixtures, using vertical and vertical and horizontal feeds; use of spiral, helical, and straight cutters, and mills, butt mills, etc.; use of dividing head for cutting keyways, shapers, spur, bevel and worm gears; helical milling; fractional or degree spacing; simple, indirect, compound and differential indexing; making jigs and fixtures; precision work.

Grinding: Knowledge of grade and grain of wheels, and ability to make choice to suit conditions; method of mounting; truing and balancing; care of the machine, supporting the work; external and tapering roughing and finishing; taper, form and plane surface grinding; sharpening cutters, reamers, taps and dies.

Miscellaneous work: Rigging up to handle heavy work; methods of doing work too large for machines at disposal, making special appliances to do unusual jobs; emergency repairs; knots and splices in rope and cable; hanging shafting; fitting belts; various methods of lacing belts; setting up machinery.

Floor and heavy assembly: Lining up machinery; babbitting, scraping, and line reaming bearings; fitting bushings; assembling heavy parts; adjusting and timing cams, valves, and motions; trouble shooting; fitting and removing keys; grinding in heavy parts; use of portable tools, final testing and adjusting.

In addition, says this report of the Metal Trades Association, those being prepared for the precision divisions of the trade should be thoroughly taught to use all the instruments which are used, and have an extended knowledge of the button, disc, and datum bar methods, as well as any others that may be introduced commercially.

A Newly Developed Heat Resisting Alloy—Calite

Compound That is Strong Will Withstand Shocks, Can be Quenched Repeatedly, and is Highly Resistant to Oxidation—Metal Runs Freely—Shrinkage Same as Steel

By G. R. BROPHY

FRESHLY cut aluminum, like all metals, will show a bright lustrous surface, but after a very short time in the atmosphere becomes dull. On longer exposure little change takes place in this strongly adherent coating. This is recognized as a protective coating of oxide. Aluminum when alloyed in solid solution with other metals still retains this property of oxidizing and lends this property to the alloy.

Advantage of this property was taken a few years ago when calorizing was developed. This process, which has been described many times, consists of coating metals with aluminum at high temperature, actually forming a surface alloy which is highly resistant to oxidation at high temperature and to many forms of corrosion. Calorizing is not suited for work above 1,832 degrees Fahr., due to the rapid diffusion of aluminum and the consequent lowering of the surface aluminum content to the point where breakdown under oxidation occurs.

A homogeneous alloy made by melting aluminum with iron naturally will show no such diffusion on subsequent heating, and provided the aluminum content is sufficiently high, the alloy will resist oxidation at temperatures nearly up to its melting point. Unfortunately, on repeated heating and rapid cooling, or uneven heating, these alloys crack badly and no homeopathic doses of any third metal tried—and nearly all were tried—helped this condition. The hot metal when the least moisture touched it acted like hot glass, flying to pieces.

The low expansion of high nickel together with the fact that aluminum and nickel form a high melting compound led to investigating the promising ternary alloys of aluminum, nickel and iron. Therefore, keeping aluminum at a minimum and substituting nickel for iron in various percentages, a series of alloys was obtained which showed increasingly good properties. However, when nickel reached 15 per cent. the alloy was soft and lost nearly all its resistance to oxidation. This was probably due to the formation of a high melting compound corresponding to the formula Ni_3Al, which, while highly resistant to oxidation itself, robbed the iron of its protection and allowed the iron to scale badly. Further additions of aluminum and nickel in proportions other than that of the above compound finally gave an alloy which was strong; would stand shock, hot or cold; could be quenched repeatedly and was highly resistant to oxidation. A few further refinements gave the alloy which was finally adopted and which we will call calite.

Manganese and silicon above 0.75 per cent. both tend to decrease resistance to oxidation, but with care in melting, no trouble is experienced. Carbon increases brittleness and should be kept as low as possible and easily runs under 0.05 per cent. On account of the ease with which SiO_2 slags with aluminum, the melting must be done in a basic furnace. Also the ladle used must have a basic lining.

Basic Heroult type furnaces are used with good success. Steel scrap is first melted down and decarburized; slag is removed and nickel is added and a new slag made. When all is thoroughly deoxidized, the final slag is removed and scrap calite added to the extent of 25 per cent. of the melt and dissolved. The melt is then poured in a preheated ladle containing the required amount of molten aluminum. As this alloying takes place, an exothermic reaction occurs of sufficient intensity to dissolve additional scrap, and up to the present, scrap amounting to 15 per cent. of the melt has been dissolved with sufficient residual heat to necessitate holding in the ladle several minutes. The ladle is bottom poured so that the time of holding allows all oxide to float and nothing but clean metal to be poured.

The metal runs freely, and sections of 3/16-inch have been cast successfully. Any casting which can be made of steel can be made of calite. The shrinkage being the same as steel, the same precautions must be taken.

Calite resists oxidation up to 1,300 degrees Cent. (2,372 degrees Fahr.) but 1,200 degrees Cent. (2,200 degrees Fahr.) is recommended for indefinite service. The protective oxide formed is tight and does not snap off even on quenching from high temperatures. Quenching after 100 hours at 1,200 degrees Cent., calite lost but 0.03 gram per square centimeter exposed, while the best heat resisting base metal alloy other than calite lost 0.56 gram under the same conditions. The same samples were run at 1,300 degrees Cent. for an additional 25 hours. Calite lost 0.003 gram, the other 0.09 gram per square centimeter exposed. From these figures it appears that calite is 20 times as resistant at 1,200 degrees Cent. and the only base metal alloy to stand at temperatures higher. At 900 degrees Cent. or ordinary operating temperatures the loss per square centimeter was measured in 1/10 milligram, or for all practical purposes no loss.

Calite is practically non-corrosive. Samples have been polished and run in a spray of saturated sea salt solution at 100 degrees Fahr. for 200 hours and at the end of this time still retained the perfect polish. So called stainless steel will last but a few hours in this test. For fittings exposed to salt atmosphere calite should be excellent.

Twenty-five per cent. sulphuric acid dissolves calite rapidly; hydrochloric acid slowly and nitric hardly at all. Forty-eight hours in 25 per cent. nitric acid, the metal lost 0.0004 gram per square centimeter exposed. Acetic acid has no effect. Molten carbonates, chlorides, nitrates, cyanides, Ph, Zn, Sn, type metal, sulphur and sulphur vapor do not attack calite. SO_2 gas at 900 degrees Cent. has no attack. Fluxes such as cryolite, borates and silicates attack calite rapidly.

In general, the physical properties are as follows:

Melting point, degrees Fahr.	2,777
Softening temperatures, degrees Fahr.	2,500
Working temperature, degrees Fahr.	2,200 2370
Specific gravity	7.03
Weight per cubic inch, pounds	0.25
Brinell hardness, annealed	286
Scleroscope hardness, Annealed	40
Thermal conductivity, per cent. of iron	25
Transverse stress, 1-inch square bar, pounds per square inch	4,250
Tensile stress, pounds per square inch	36,800

Calite cannot be machined in the cast condition, nor cut with oxy-acetylene. Any change of dimension or finish must be done by grinding. It is more resistant to oxidation at high temperatures and will stand higher temperatures than any base metal alloy tested. Its first cost is low and operating cost lower than other non-oxidizing alloys. Boxes shown in the accompanying illustration have been run for 1,500 heat hours and will be seen to be in the best condition. Measurements of these boxes show no warpage or growth. The oxide coating is no heavier now than after the first heat.

The total value of building permits issued in the city of Oshawa for the month of May exceeds that for any previous month this year. Among the permits is one for a large industrial plant and many residences.

Among the articles scheduled for coming issues are: Belting—Its Use and Proper Care, June 15; Hints to the Operator in Setting Up Planer Work, June 22; Value of Keeping a Product Clean, June 29.

Practical Ideas From Practical Men

FRACTIONS AND DECIMALS

By W. F. Schaphorst

There is a difference between decimals and fractions, as everybody should know: .005 inch means 5/1,000 inch, and .0005 inch means 5/10,000 inch., or one half of one one-thousandth—a term that is very much used nowadays. Yet, there seems to be a tendency on foot to confuse the simplicity of decimals and make a deplorable combination of the two, like this: — .000½ inch. What does .000½ inch represent? A half of a thousandth or a half of a ten-thousandth? I don't know. Although those who write such expressions claim that it means a half thousandth, I rigidly maintain that it means nothing. There is no such animal. There is no excuse for balling our mathematics up in such a way as that and the habit should be stopped before too many catch it. If a half of one-thousandth inch is to be written it should be written in this way:

$$.0005 \text{ in.} = \frac{1}{2{,}000} \text{ in.}$$

$$\text{or} \quad \frac{1}{2} \times \frac{1 \text{ in.}}{2{,}000} = \frac{\text{or } 0.5 \text{ in.}}{1{,}000}$$

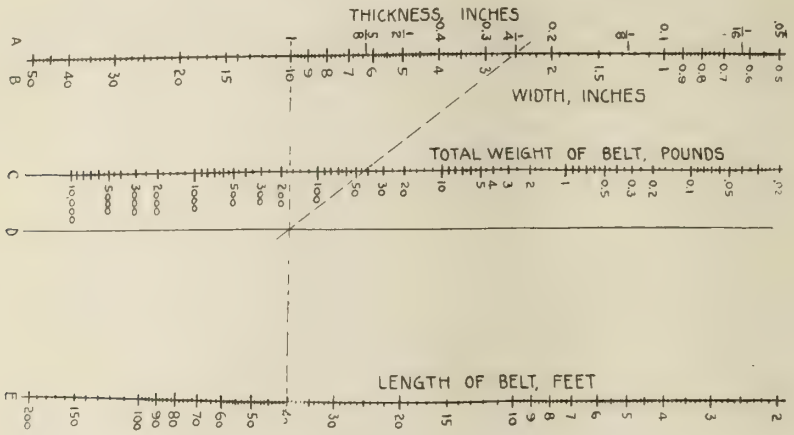
All of these are in perfect accord with mathematical practice and there is no question as to their meaning. Why use a questionable method?

FINDING LENGTH OF A LEATHER BELT BY WEIGHING

By W. E. S.

Put your belt on a pair of scales, get the correct weight, measure the thickness and width, and then lay the ruler across this chart twice and column E will tell the length in feet. The belt needn't be rolled up neatly; it can be a jumbled up mess, as belts sometimes are, yet the scales won't lie. There is nothing miraculous about this method. It is based on the fact that leather belting weighs 0.035 pounds per cubic inch. So, knowing the width and thickness one can solve "backwards" for the length. This chart, however, does away with the figuring. For example, what is the length of a belt whose thickness is ¼ in., whose weight is 42 pounds, and whose width is 10 inches?

Connect the ¼ (column A) with the intersect column D (as indicated by the dotted line) then run a line through that intersection and the 10 (Column B) and the intersection with column E gives



42 (column C) and extend the line to the answer as 40 feet.

When measuring the thickness of a belt it is well to use considerable care since a fractional part of an inch on this chart will make a great difference in the answer as you may readily observe. If the belt is rolled up, measure the total thickness of ten layers. It is then easy to divide by ten. For example if you find the total thickness of ten layers to be 2⅜ in. you know that to equal 2.375 in. Dividing by 10 the thickness of the belt is therefore 0.2375 in. You couldn't do much better with a pair of micrometer calipers. The range of this chart, it will be noted, is great enough to include all ordinary and many extraordinary belts.

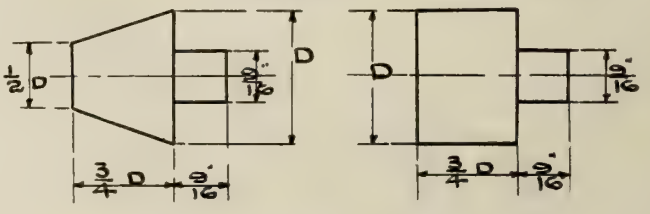
STANDARD CORE PARTS

By Robert Mawson

The trend of the times in machine shop practice is to standardize the various elements used for the machines as far as possible. This practice has at least a two-fold advantage—the making of less varied elements and, as will naturally follow, the keeping for repair purposes more parts similar in design. We have recently followed the same idea in our pattern shop. It is a well known fact that if a number of patterns were made in the same shop even by the same man with an intervening length of time between them, the necessary though often considered unimportant core print would be of a different shape on the various patterns. This necessitates an excess of core boxes even for the same diameter of core which could be avoided by standardizing the core prints.

Referring to the illustration it will be seen that both taper and straight core prints are shown—to be used on the cope and drag sides of the patterns. The shank, which fits into the pattern is made of one size so that the pattern maker will not have to use different sizes of drills for various core prints—he gets used to one standard size—9/16 in. The length of the core print body is made to one ratio—namely ¾ of the diameter. I have given a list of the prints we carry in stock, but some of these could be conveniently dropped in many shops. The obvious advantage of these standard core prints is the reduction of core boxes required, only one being necessary for each diameter of core. The following of such a system will be found profitable to both the small and large machine shops or foundries.

STANDARD CORE PRINTS.



STOCK SIZES

3/8" - ½" - 9/16" - 5/8" - 11/16" - ¾" - 13/16" - ⅞" - 15/16" - 1" - 1 1/16" - 1 1/8"
1 3/16" - 1 1/4" - 1 1/2" - 1 3/4" - 2"

MACHINING A FORKED CONNECTING ROD

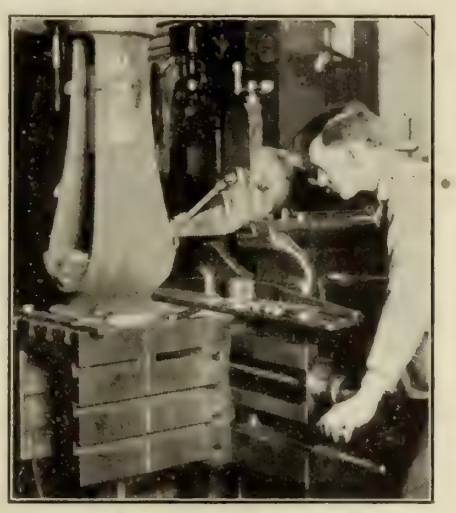
By H. Alton

A rather unusual set-up for machining the surface indicated at A in Fig. 1. was recently noticed in a Montreal shop. The part is a connecting rod for an engine which drives a pump forming part of

the auxiliary equipment in marine engine rooms. The surface is a segment of a circle and the operation was done on a shaper to which a special fixture was attached.

A diagram of the fixture, the method of attaching it to the shaper and the means of mounting and feeding the work is shown in Fig. 2. The connecting-rod is driven on an arbor B which is mounted in a frame. Spacers are placed between the ends of the forked rod as shown at C. Then the nut D is drawn up tightly. The frame of the fixture is bolted to an angle plate E which in turn is bolted to the shaper table as shown. On the inner end of the arbor, a worm wheel F is keyed and bolted. The worm G works into the worm wheel F. The worm is keyed to a small shaft on the end of which is a handwheel. The shaper tool is of the ordinary round nose type, carried in a standard tool holder. The ram works in the usual way and the cut is started at X as shown in Fig. 1. The rod is thus at the position shown in Fig. 3 at the commencement of the cutting. In order to obtain good cutting results and to overcome the fact that gravity permits the rod to move downward if there is any blacklash in the worm and worm gear, a weight is hung on the rod as shown in Fig. 3. This weight is sufficient to counteract the tendency of the tool to rotate the rod in a direction opposite to that which gravity tends, when cutting is actually taking place. When the weight is heavy enough the worm and worm gear feed the rod in much the same manner as it would, if the theoretical condition of no back-lash, existed. The worm just permits gravity through the combined weights of the rod and weight to advance a certain distance every time the worm is moved. Thus regular, even movements of the hand wheel produce as good results as can be obtained under any hand feed conditions. When the rod has passed that point where it is vertical and it commences to rise on the other side the weight is removed. Under the new conditions gravity holds the rod in a manner that the backlash is automatically taken care of.

The work is quickly and neatly done. By using a finishing tool with rather a flat cutting edge, but with the corners rounded to make fillets at the beginning and end of the cutting, a very satisfactory surface can be obtained. As the work is largely overhung an integral extension of the arbor is provided. This is shown in Fig. 3. The extension is supported by a rigid but adjustable floor stand. The cutting is accomplished with little of the objectionable spring and chatter.



UNUSUAL SHAPER JOB

By G. P. B.

Out-of-the-ordinary jobs are often performed on shapers, but here is a regular shop production job, being performed on a 24-inch Gould & Eberhardt shaper, that has proven itself to be much more economical from the viewpoint of handling the work, ease of setting up the job, and actual cutting time, than has been found possible by any other method. The operation consists in planing the bearing seats for the caps on 6 in. x 6 in. horizontal compressor frames, built by the Brunswick Refrigerator Co. at New Brunswick, New Jersey.

A special extension tool holder, with an over reach of 6 in. beyond the regular tool position, is used. It enables the tool to plane the entire length of the bearing which is 4⅝ in. long, without having the shaper head interfere with the compressor frame, since the sides of the frame are not far enough apart to permit the shaper head or ram to pass through. The two sides of one bearing are planed, then the casting is turned through a 180 degree position, bringing the opposite bearing in place to be planed. The high duty shaper with its ruggedly supported table, adapts itself very easily to such unusually heavy castings; also on account of the convenient size table which permits the operator to work on three sides for setting up the large heavy casting; and then, the rigid construction of the ram permits the taking of unusually heavy cuts in roughing operations; two vitally important factors to be considered in performing heavy work of this type. Previous to performing this operation on a shaper, it was done on a planer; but actual time studies prove that a saving of thirty per cent. in time for handling and setting-up the casting, also in machining costs, is being effected by the shaper method—a very noticeable saving indeed, considering the similarity of the operations on these two types of machine tools.

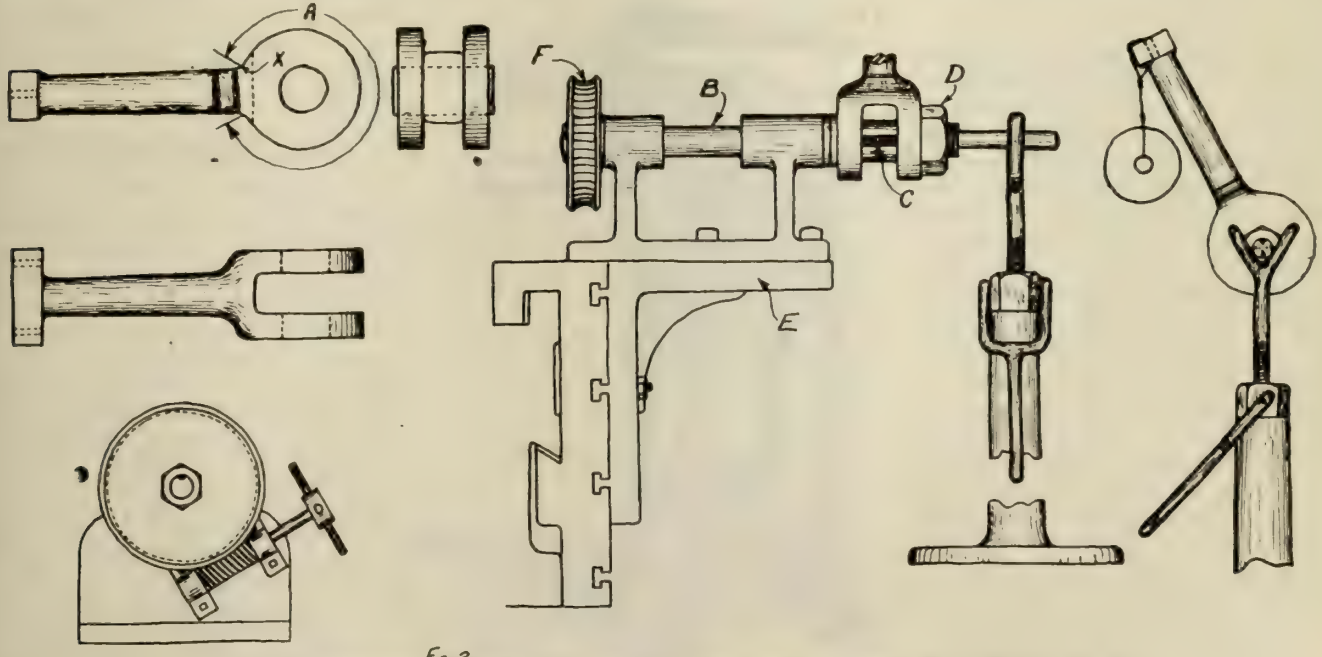


Fig 2

Fig. 1.—Upper left; connecting rod. Fig. 2.—Centre; general arrangement of set-up. Fig. 3.—Right; starting position.

New Things in Shop Equipment

METAL PARTS WASHING MACHINE

An automatic metal parts washing machine which consists essentially of an endless belt conveyor combined with a washing apparatus has recently been placed on the market. As the work travels over the conveyor it passes through two sets of sprays which operate on both sides and on the top and bottom of the work. The fluid is circulated by means of a pump. All parts that can be handled by racks are put through the machine in that manner but larger castings may be placed directly on the conveyor. The machine is manufactured by the Colts Patent Firearms Manufacturing Co., of Hartford, Conn.

PORTABLE POWER HACK SAW

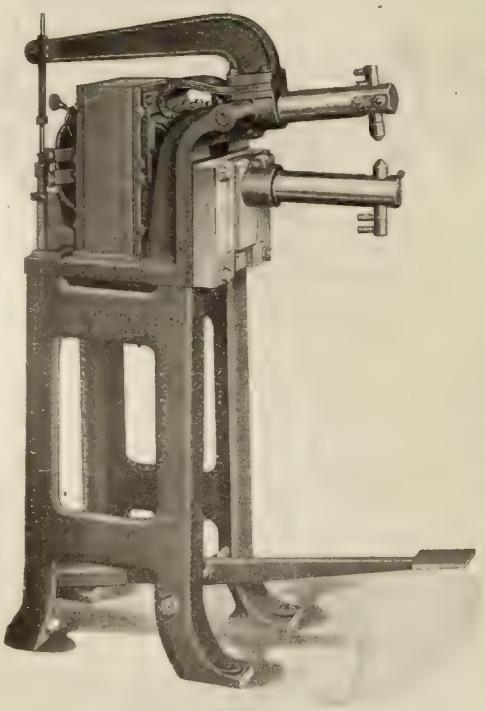
A portable power hack saw for cutting both machine and tool steel has recently been placed on the market. The saw is driven from a small motor direct connected through cut gears. The current is taken from any light socket. The cutting is done on the back stroke, the saw blade being automatically relieved on the forward stroke to reduce the wear and prolong the life of the blade. The feed is regulated by a weight that can be adjusted to suit the work. When the saw arm is raised to enable the work to be put in place, it is automatically held in position until released by the operator. The machine stops automatically when a cut is finished, and can be arranged to stop at any time during a cut. The machine is manufactured by the Edmund Machinery Co., of Cortland, N.Y.

TRIPLE COMBINATION PUNCHING AND SHEARING MACHINE

A combination punching and shearing machine that can be adapted to different types of work without the necessity of changing tools has recently been placed on the market. Every convenience is provided for the economic operation of the machine as the fly wheel and driving gears are placed on the opposite side to that of the operator. The knives of the plate shear are longer than in former models of this machine. Ample room is provided behind the knives to avoid any binding while the plates are being cut. Any of the standard structurals may be handled conveniently in this machine. The standard equipment with the machine provides for cutting rounds, squares, angles and tees only. The knives can be easily changed for cutting special shapes. The frame is made of cast steel and all pin bolts are provided to keep the covers of the slides from working loose. The machines are made in a number of sizes and are fully standardized and provision made for carrying cranes, gauges and other attachments, which can be furnished with the machine or supplied when needed. These machines are being offered to the trade by Amplex Incorporated, New York, N. Y.

SPOT WELDING MACHINE

A spot welder as shown in the illustration has been placed on the market recently. This machine will handle all classes of material up to two 10 gauge thicknesses. It can also be adapted to weld stock as thin as 26 or 28 gauge without difficulty, or 26 gauge can be successfully welded to 10 or 12 gauge material. This feature is obtained by a rheostat having five points which allows operator to stop the current up or down according to work being welded. The arms are adjustable, and the lower one can be raised or lowered as desired. They are 14 inches long, and the points at end of arms are both adjustable and interchangeable. Special point can be applied for welding angles, or for close welding in corners on such work as rectangular boxes, etc. Two models are made, 220V, and a magnetic switch is provided on both machines. All parts are of rugged construction, and the new tool has been officially passed by the Hydro. This concern also make welding machinery and intend developing other sizes of spot welders. These machines are manufactured by the Globe Engineering Co. of Hamilton, Ont.



Spot welding machine.

DEMOUNTABLE STEEL TRESTLE

A specially designed trestle for use in industrial plants, made entirely of steel, has recently been placed on the market. The supports are made in pyramid form. The top bar is provided with several notches at either end for adjusting the distance between the trestles. The demountable feature of the appliance provides for ready and swift assembly and likewise requires a small amount of space for storage. The heights vary from 13½ to 30in. and the weight ranges from 11 to 30 lbs. They are manufactured by Reinhold Bettermann, Johnstown, Pa.

COMBINATION BENCH MACHINES

A combination tool intended for use in garages and service stations has recently been offered to the trade. It is equipped with various attachments, these being used for drilling wood or metal, for surfacing or sanding, disk grinding, polishing, buffing, tool grinding, or for rip sawing wood. The attachment can be fitted to the machine by removing the table. The table can be tilted if necessary for sawing at an angle. The frame, which may be attached to the bench, is made of cast iron and in one piece and the spindles are made of high-grade carbon steel. Connection is made between the horizontal and spindle by means of bevelled gears and is driven to a positive steel clutch. Bronze bearings are provided in both spindles. A Jacobs chuck is provided that takes drills up to ⅝ inch. The appliance is manufactured by the Ster-O-Lock Mfg. Co., Chicago, Ill.

PISTON-PIN BUSHING REAMER

A piston-pin bushing reamer has recently been placed on the market. The cutter of this tool is very similar to the regular reamer of the same make and is adjusted in the same manner. The shank and pilot stem are ground to an accurate sliding fit with a taper. The reamer is centralized and supported by means of a pilot stem passing through the piston-pin bushing. When short pins are used in pistons of small diameter it is sometimes necessary to ream first one bushing and then reverse the reamer and plug and ream the other bushing. There is no adjustment needed on the taper plug. There is a gradual adjustment on the plug but sufficient to cover the range of the reamer. Reamers are made in eight different sizes and are manufactured by the Alvord Reamer & Tool Co., Millersburg, Pa.

TWO-WAY BORING MACHINE

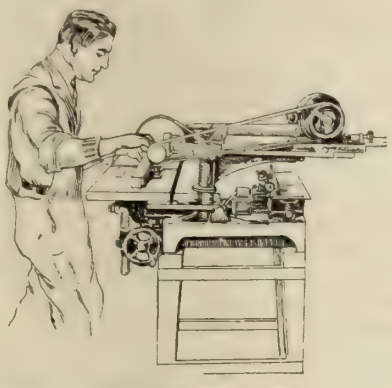
A very interesting machine that has been designed for boring simultaneously both sides of a piece of work, has recently been placed on the market. It is especially applicable for boring, bottoming, and reaming, both the exhaust and in ake ports of gas engine cylinders. The machine is motor driven and is semi-automatic in operation. The work holder to which the cylinder blocks are clamped accommodates four cylinders and is arranged to rotate about its central axis. The multiple heads at the two ends of the machine are fed towards the centre simultaneously where they finish the work and then return to their outer positions. Thus both sides of the cylinder are finished at the same setting. The work holder is then indexed to the next position and the feed for the heads again engaged and the cycle repeated. Loading and unloading the work is done while the machine is in operation. In fact the machine is capable of machining the castings as fast as the operator can feed it. The cycle of operations requires 20 seconds in which time one cylinder block is completely bored, reamed, and bottomed on two sides. Two holes 1-9/16in. in diam. and 1in. deep are held to 0.001in. limits in dia. and plus or minus 0.005in. in depth. The machine is manufactured by the Manufacturers' Consulting Engineers of Syracuse, N. Y.

REAMER HOLDER

A very unusual reamer holder has been placed on the market. The holder is not intended to float, but operates on a different principle. In order to ream a straight true hole it is assumed necessary to hold the rear end of the reamer in line with both the centre line of the machine spindle and the hole to be reamed. To accomplish this a bushing or adapter is provided which fits in the hole in a turret. On the face of the bushing a large flange is provided and to this is fastened by three cap screws a face plate. The holes in the face plate, through which the screws extend are larger in diameter than the screws themselves, permitting a certain amount of movement. A cone-shaped centering plug extends from the face plate and is integral with it. In using this equipment on a turret lathe the work is first bored, then faced a short distance from the hole and the corner chamfered so as to provide a proper bearing for the taper plug on the front of the face plate. The three screws are loosened and the coneshaped centering plug is placed in the hole in the work. As soon as this cone plug enters the bored hole it brings the face plate concentric with the spindle of the lathe. While the plug is held tightly against the work, the cap screws are tightened so as to secure the face plate. The turret is then backed away, the cone is removed and the reamer holding sleeve is inserted in its place. This sleeve maintains the reamer securely in position and insures that its rear end will be in line with the centre line of the work and of the machine spindle. The reamer holder can be disengaged in order to fit it to other reamers. Ordinarily the entire reamer may be passed through the adapter sleeve so that only that portion of the reamer necessary to make the cut is required to overhang. The reamer shank thus projects into the turret. The face plates, the holder sleeves and the centre plugs are all interchangeable and only one plug is ordinarily required for a group of machines. The reamer holding sleeves can be supplied in sizes to suit the reamers that are used. The tool is manufactured by the Marvin & Casler Co., of Canastota, N. Y.

INTERESTING WOODWORKER

A woodworking machine which is a complete, portable little planing mill for performing 14 different operations has been placed on the market recently. This machine was brought out to meet the demand for a light tool to do the



Universal Woodworker

work of a large machine. It can be taken "to the work" and may be located on a bench in any part of the shop. Among the many operations performed are: cutting like a big swing saw, square cuts on long pieces, dadoes out for shelves and racks, grooves and plows for furniture building, screens, window frames, stairs, etc. Many other uses are found for this interesting machine. It is of a convenient size for economic service in factories, hotels, apartment stores, and places where considerable box making or crating is desired. The bench space required is one square yard, saws of 6-8-10 in. are used at a speed of 4,200 r. p. m. The weight of the machine is 245 lbs. It is manufactured by the Hutchinson Mfg. Co., Morristown, Pa.

ELECTRIC ATTACHMENT FOR HOISTS

Recently there has been placed on the market an electric device for operating hand power hoists of five ton or larger capacity. It is an electrically driven machine that may be suspended in the bight of the operating chain. It has a capacity of overhauling 138 feet of chain per minute, with a chain pull of 150 pounds, thus overhauling the chain about four times as fast as a man can do it. The machine consists of a cast iron housing in which is contained a hardened worm and worm gear running in oil and driven by a ¾h. p. motor attached to the frame. The worm wheel shaft carries a grooved sheave with a rubber tread, which is V-shaped and will fit any size and pitch of operating chain giving sufficient tractive effort to prevent slipping. The machine is counterbalanced so that it hangs with the centre of gravity in the plane of the operating chain. Current may be supplied from any convenient lamp socket by a flexible conductor. A plug socket for attaching the flexible conductor, and a reversing switch that enables the motor to be run in either direction, is mounted on the machine. The apparatus is intended for use on hand operated equipment where it is desired to obtain faster and easier operation. It is useful in many places where it would not pay to install an electrically operated crane. The apparatus is marketed under the trade name of "Handiman" and is not in itself a hoist, but simply a portable machine that may be carried from place to place and used to operate a number of hand hoists. The machine weighs 165 pounds and is manufactured by The New Jersey Foundry and Machine Co. of New York City.

BENCH WET-GRINDING MACHINE

A bench grinding machine that has recently been adapted to wet grinding has recently been placed on the market. The machine is thus suitable for use of cylinder re-grinding shops and piston distributors, where rapid production on a semi-manufacturing basis is necessary. The wheel head is equipped with a half horsepower motor and carries an 8 x ¾ in. abrasive wheed. There is a tool holder mounted on the front of the wheel slide which can be swung into, and out of, the operating position without changing the position of the set-up or dismounting the grinding wheel. It is thus possible to remove a considerable amount of metal by the turning tool and then swing the tool out of position and finish the work on the grinding wheel. The work is ordinarily held on a bull centre or an adapter, and the tail-stock centre is used as an additional support. The grinding wheel does not rotate while the lathe tool is cutting. The tool holder can be entirely removed if it is not required. An adjustable stop is provided to maintain the proper position of the table. The machine is adapted to the grinding of wrist pins, valves, reamers and such small work requiring either cylindrical or taper turning operations. It is very useful in tool rooms and experimental shops. The weight is about 600 pounds. The grinder is manufactured by the Van Norman Machine Tool Co. of Springfield, Mass. It is known as their No. 2 machine and is marketed under the trade name of "Re-li-o."

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A Start In The Right Direction

IN COMMENTING upon the fact that the United States Railroad Labor Board has begun to reduce the pay of rail workers, the Toronto *Mail and Empire* says that, as usual, the common laborers are the first victims, and asks why the poorest paid workers should be the first to suffer. Our contemporary in asking this question is assuming that the least paid workers are the poorest paid.

The contrary is in all probability the case. The common laborer at the present time is, in many instances, the highest paid worker in the community. The skilled worker may be receiving more actual money (and in some cases it is very little more) but, in proportion to his skill which it has perhaps taken him years of apprenticeship and application to acquire, he is far more poorly paid than the common laborer, who from lack either of intelligence or of application has never been able to make himself a skilled man.

The conditions which the writer in the Toronto paper would apparently like to see continued are responsible in no small degree for the unrest in the labor world at the present time. Skilled workmen such as carpenters and machinists who have had to devote several years of their life to make themselves competent men in their line and who are subject at certain periods of the year to unemployment, see men with steady jobs at street-cleaning or garbage-collecting getting nearly as much money as they themselves can earn.

Small wonder that they are discontented and feel that they are suffering from an injustice when they see that their years of hard work and application have given them no advantage over the idler, the drifter and the casual laborer.

Proportionately, the latter are the highest paid workers in the community, and, as it is inevitable that before we can hope for a return of prosperity such anomalies in existing rates of wages as we have referred to will have to be removed, we welcome the news that the Railway Labor Board have had the courage to make a start in this direction, unpleasant though the duty may be.

Who is Responsible?

THOSE WHO are in the habit of girding against what they term "the capitalistic system" would do well to consider some recent remarks of Lord Leverhulme and to ask themselves whether it is not themselves rather than the "system" which is at fault and responsible for the evils they deplore.

"Shall we take the growth and development of a capitalist," he says, "and see how he begins?

"I venture to say, if you will search back during the last two thousand years, you will come to this germ growth of a capitalist. It has been so in all ages; it is so to-day. We will take six young men entering any trade, engineers, or whatever it may be, at the same time, approximately the same age. One of them takes the view of what is outside the wage envelope—he is hard-working and saves. The other five, like the man with the one talent, have no sin; they are simply pleasure-loving, easy-going, and they never think very much about to-morrow. When their money comes it is spent, but they have no sin, no vice—they are merely pleasure-loving, easy-going.

"Now, the young man who saw more outside his wage envelope, saves and prepares a home and marries the girl of his choice. In process of time he is made a foreman; a little later on he is made a manager; a little later on he is an actual employer himself, and further, later on in life, the other five—who have committed no sin, remember—seeing him go past in his motor car, with a smiling wife and bonny children beside him, wonder how it is, and they come to the conclusion that it is the capitalistic system that has placed one man in the motor car and left the other five just where they were when they began. They adjourn to the nearest public house and pass resolutions against the capitalistic system, and determine it must be overthrown immediately, if not sooner."

Behind the Scenes

THE TELEPHONE has become one of the most important assets to business generally. Without it, many transactions would be delayed, and in a thousand and one ways, the wheels of industry would become clogged. The proof is self evident when a severe storm occurs. Lines are down, communications cut off, and the usually calm and efficient business man is helpless.

Take for example the big storms of February, March and April of this year. During February approximately 1,175 poles on the long distance lines, and 350 on rural lines were destroyed. To effect repairs, some 100,000 pounds, or 665 miles of iron wire, and 1,430 miles of copper wire were required.

No sooner was this trouble cleared up than the March storm made its appearance. In this case about 4,000 poles on long distance lines and 1,550 on rural districts were broken or otherwise destroyed. This took 830 miles of iron and 2,860 miles of copper wire. Then to cap the climax, the April storm added its toll.

Summed up, the three storms involved a loss of 7,215 poles and 6,000 miles of wire, or enough to reach nearly one quarter around the world.

What of the interruption? Considering the damage, the delay was very slight, and shows the wonderful organization behind the service. Their forces remind one of an army, well generalled, for the moment undue pressure occurs at any point on the line, reinforcements are rushed to the spot, filling the breach in short order. Modern improvements have helped this reconstruction work, and the experimenters in various laboratories must not be overlooked when commenting on the good work performed. We owe a great debt to our telephones and the figures quoted may help you to sympathize with central the next time you cannot get the desired number as quickly as you think it should be secured. It may be something beyond her control.

Building Helps to Keep Steel Market Firm

Canadian Steel Prices Steady and Demand Good—Pig Iron Stationary—Non-Ferrous Metals Show Added Strength—United States Sheet and Tin Plate Mills Have Opened Books

VARIATION IN PRICE OF IRON AND STEEL BARS

WITH the exception of a slightly better tone in the non-ferrous metal field, Canadian markets remain much the same as last week. Iron and steel lines continue to move briskly, and so long as the present building activity keeps up, we can expect this market to remain firm.

Prices on bars are erratic, ranging between $2.75 to $2.90, but the capital buyer can usually secure the lower figure. In another week however, the $2.90 price may be standard as the tendency is upward. Those requiring bars would do well to place their orders at once.

Pig iron is simply holding its own. The production rate is not high, neither is the demand, so conditions are fairly well balanced. Some furnace operators are beginning to wonder how much longer the coal strike will last. Their coal is getting a little low and they are none too sure of future sources of supply.

Non-Ferrous metals are stronger in some quarters. Prices are firmer, and the demand has improved slightly in Toronto and district.

Scrap metals are not very brisk, but prices are firm. Dealers feel the market is bound to break soon, and believe the tendency will be upward. At present however, the only thing that is firm is the price.

Steel pipe is in good demand, and deliveries are getting more delayed every week. The delivery on sheets is also poor and in both cases,prices are decidedly firm.

Machine tools are holding their own but small tools and supplies have tapered off slightly in some quarters. Other localities report good business in the latter mentioned line. This market fluctuates very much at present.

Malleable fittings are now priced per piece. This became effective June 1. The demand is good, and it is expected that the new arrangement will simplify matters all round. Oils and waste are also firm.

In the United States, sheet and tin plate companies have opened up their order books for new periods at unchanged prices. Sheet bookings were opened by one firm for July only. This is a form of self protection as it leaves them free to advance quotations later.

Production of steel ingots for April and May totalled 6,000,000 gross tons. against 4,900,000 in February and March. This shows a 23 per cent. advance. Steel prices are strong, but the market is decidedly quiet, apart from the placing of orders against later requirements.

The automobile industry is not buying much steel, although their production rate has practically reached a record. The pig iron market is stagnant. Consumers are waiting for an expected readjustment in price when coke supplies become less scarce. Lake Superior iron ore prices have not yet been announced, the matter being held back by rail freights not being adjusted up to date of writing.

Toronto

June 7, 1922.

THE LOCAL market remains practically the same as last week, the only changes being a strengthening in the non-ferrous metal section, and a slight tapering off in the demand for small tools and supplies.

Iron and Steel.—These two lines continue strong. Building activity is responsible for the majority of business moving, and sheets and pipe are particularly active. Reinforcing material is also selling well, in fact all goods entering the building field.

"What price are you selling bars at?" seems to be a popular question among dealers this week. One merchant told us the price was positively $2.90, but in spite of this apparently sure tip, we know bars are still being sold at $2.75 by a few dealers.

From present outlook, it would appear that $2.90 will be the standard quotation in another week, but we can definitely state that bars were selling at $2.75 when this letter was written. Those requiring any bars had better send for them quickly if they want to get in on the low figure. The volume of orders is keeping up very good, and dealers generally are not complaining. Following are present quotations:

Iron bars	2 75
Steel bars	2 75
Reinforcing bars	2 75
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—There is no change in the pig iron situation. The price remains $29.15, and the demand keeps up fairly steady. The production rate is not high, however, as producers are getting ready to face a coal shortage. If matters are settled within the next two months, it will ease the situation, but should the strike last longer than the above mentioned period, the furnaces may find it difficult to keep going.

Non-Ferrous Metals.—There is a much stronger tone on this section. Copper and red brass are particularly active, but yellow brass and white metals still remain weak.

Business is now being closed, that two months ago would have met with a chilly reception. Prices have firmed a little, but nothing to feature, the change being from half a cent, to one cent a pound. As one dealer put it, "The market is certainly stronger than it has been for some time past, and while there is no definite advancement, there is enough extra business moving to give us encouragement." Following are quotations:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	6 75
Aluminum	26 00

Scrap Metals.—A slightly stronger tone is present, but very slight. The demand while better, is erratic, so we cannot report any definite improvement in this section. Following are present dealers' buying prices.

Copper, light, per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	4 85
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	11 00
Axles (wrought iron)	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools.—The demand for machine tools remains unaltered. There are no large orders being closed but a certain percentage of smaller orders continues to come in. One dealer reports that covering a space of three months, his last quarter was about 33 per cent. ahead of the former quarter. Even this, however, does not say very much, because the former period was very poor. One thing sure, dealers are all out fighting for business, and keen competition is the rule.

Small Tools and Supplies.—This section has proved a disappointment during the week. Every merchant interviewed, reported a drop during the week, but one dealer showed us figures for an extended period which were comforting, for the increase over a corresponding period last year, was more than 20 per cent. One merchant commenting on the situation said: "The demand is erratic. Next week there may be an influx of orders, and it is quite probable that the total figures for June will still be ahead of May."

Transmission equipment does not seem very brisk, while drills, reamers, cutters and taps are about best of all. This may not be true in all cases, but

taking the average, this is the way it shapes up.

Pipe Fittings.—As reported last week, a new price list has made its appearance on the market. From now on the price will be set per piece, and as stated on the table below, the discount will be 70/5. The demand is good, building activity being chiefly responsible for the increased orders. Following are a few of the new prices, showing how they are arranged.

NEW MALLEABLE FITTING LIST

	Black	Galv.
1 in. elbow	0 32	0 53
2 in. elbow	1 05	1 70
1 in. tee	0 43	0 70
2 in. tee	1 45	2 40
1 in. coupling	0 33	0 53
1 in. locknut	0 15	0 23

This shows the new style of pricing. Discount to dealers is 70/5 off list.

Steel Pipe.—This market is very strong. The lucky manufacturer is the one who has pipe in his plant racks, for deliveries are slow, and getting worse every day. The added tariff on pipe will not affect the industry or demand to any appreciable extent, and dealers will likely have to sell on a closer margin of profit.

Oils and Compounds. — These lines continue at about the same rate. Dealers and garage men are the principal buyers, but a certain amount of material is being purchased by firms direct. Waste is also moving at a fairly good rate, but prices remain unchanged. Following are present quotations:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	0 20
Palacine	0 23
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	10 80
Pure turp., single bbls. gal.	1 40
Linseed oil, raw, single bbls.	1 15

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

Boiler Tubes.—The demand keeps brisk, and prices have been revised. The new list appears below. Roughly speaking the average reduction is about 1 cent to 2 cents per foot. Following are present quotations:

BOILER TUBES

Size	Seamless	Lapweld
1 in.	18 00	8
1¼ in.	20 00	
1½ in.	19 00	
1¾ in.	20 00	
2 in.	19 00	16 00
2¼ in.	34 00	19 00
2½ in.	43 00	19 00
3 in.	29.00	24.00
3½ in.	22 00	26 80
4 in.	25 00	31 25

Montreal

June 7, 1922.

THE STIFFENING in prices of many lines, reported last week is still being maintained. The amount of business passing is also about the same. Iron and steel products are moving nicely, and are quoted at the same prices as last week. Pig iron is very quiet, also the machine tool market. Supplies are still moving well. Non-ferrous metals are firm in price, and the scrap market is improving slightly.

Iron and Steel.—Business does not seem to be affected by the fact that local jobbers last week increased their prices from $2.75 to $2.90 base. Very keen competition is still present and prices are sometimes shaded. The quotations of the mills to jobber still stand at $2.50 base Montreal, and to the large consumer $2.30 base. Transactions at this latter figure are made with the provision that the steel is for consumption by the purchaser and not for resale. Thus, none of the $2.30 steel finds its way to the jobber. It is understood that there is some stock of steel held locally by jobbers, which was purchased at the time of the lowest quotations made by local mills, and others some two months ago. This can be disposed of at a lower figure than $2.90, and may be responsible for some of the price shading.

Building is very active and is keeping up the demand for sheets, both black and galvanized, and a variety of small steel products. A small tonnage of structural sections is also traceable to this source. Local supplies of galvanized sheets come largely from British mills and some jobbers claim it is difficult to keep their stocks up, as the demand is great. Merchant bars show a gradual improvement, while there is a fair tonnage of structural steel moving.

Boiler tubes are still very firm but no actual advances have been made. The railways have not yet come into the market for rails, tie plates, joints, etc., this being a great disappointment in some quarters.

The quotations named by local jobbers are as follows:

Iron bars	2 90
Steel bars	2 90
Reinforcing bars	2 90
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—Last week was very quiet for pig, but matters are less active this week. Prices are unchanged, No. 1 pig being offered at $31.80. A little British iron is still coming in, but the total sales from all quarters are small.

Machine Tools and Shop Supplies. — Dealers report that machine tool sales are very disappointing. The only orders being secured are for small tools. Wood working tools are moving a little better than iron working machines. If the new budget is made effective as it now stands, it will not make much difference in the prices of machine tools. It will mean at most, a two or three per cent. advance.

Supplies are still moving nicely, some shops coming into the market in a very satisfactory way. One jobber in machine tools and supplies reports he is not selling a machine tool, but is turning over about what he considers fifty per cent. of his best pre-war days. When this figure is gained from the sales of supplies, he thinks it shows up pretty well. In this case everything is in demand from rivets, set screws, and other small articles, up to portable machines. When the demand for machine tools returns, he expects to have a record turnover.

Other firms report business very good, and say that May was a better month than April.

Non-Ferrous Metals.—The quotations on all non-ferrous metals are firm, but the business offering is not improving to any marked extent. Copper is very firm, and tin is up half a cent. Following are local quotations:

Lake Copper	17 25
Electric Copper	17 00
Castings, Copper	16 75
Tin	35.50
Lead	6 75
Spelter	7 75
Antimony	6 50
Aluminum	23 00

Scrap Metals.—The scrap metal market is firm, but with small holdings. The better demand for scrap in the States, and recent advances in nearly all metal quotations, have tended to firm up local quotations. Business is improving a little each week. The following is a list of prices asked.

Copper, light per 100 lbs.	9 50
Copper, Crucible	13 00
Copper, heavy	13 00
Copper Wire	13 00
No. 1 composition	10 00
New brass cuttings	7 50
Red brass turnings	8 00
Yellow brass turnings	5 25
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	13 50
Boiler plate, per gross ton.	9 00
Heavy melting steel	12 00
Axles (wrought iron)	20 00
Rails (scrap)	12 00
Malleable	10 00
No. 1 machine cast iron	23 00
Pipe, wrought	7 00
Car wheel	17 00
Steel axes	19 00
Mach. shop turnings	4 00
Stove plate	19 00
Cast boring	3 50

Pittsburg

ON JUNE 2 the American Sheet and Tin Plate Co., (Steel Corporation) opened its order books for new periods at unchanged prices, $4.75 for 100-pound coke tin plate, $2.40 for blue annealed sheets, 10 gauge; $3.15 for black sheets, 28 gauge; $4.15 for galvanized sheets, 28 gauge, and $4.50 for automobile sheets, 22 gauge.

In tin plate, order books were opened for the usual periods, second half of the year in the case of manufacturing consumers, and the third quarter for jobbers. In sheets there was an unprecedented action, as books were opened for July only. The old practice was commonly to name prices for six months at a time, but of late the practice has been to take the market a quarter at a time.

The book opening was unusually late this time, due no doubt to some uncertainties growing out of the coal strike. The majority of independent sheet pro-

ducers have been disposed to seek higher prices, and in the past three weeks several have "announced" advances, most of these so-called advances being $5 to $7 a ton. On account of increases in costs there was some basis for making an advance, but the Steel Corporation was reluctant to do this on account of the increases in cost being due largely to the coal strike, the essence of which is an effort on the part of coal producers to get costs down.

Then there has been plain evidence in the market that while a number of independents had announced advances in their prices, there had been much selling into the third quarter, if not through the whole quarter, at the old prices. These, presumably, are the considerations that moved the corporation to continue its old prices, but to limit sheet sales to July so that if necessary an advance could be made later.

Tin Plate.—Most of the independents were eager for an advance in price from the $4.75 figure, although in the past fortnight, when it appeared unlikely the leading interest would not make an advance, some of the independent mills have refrained from expressing an opinion that the market ought to go up. The reaffirmation of $4.75 as the regular price would mean an advance to some of the mills, if they adhere to the price, for many sales were made for the present half year at well below $4.75, perhaps down to $4.50. Mills that have made such sales can secure an advance now by simply sticking to the regular price.

It now seems to be well established that sheet bars are to be $35 for third-quarter, against $29 for the first-quarter of this year, and the current quarter. In seeking an advanced price for sheets, over the present $3.15 basis, some of the mills urged the $6 a ton advance in sheet bars, but it is to be noted that the bi-monthly wage settlements showed average invoice prices January to April inclusive, on the basis of about $2.85, although "the market" had been $3.00 for months up the beginning of April when the advance of $3.15 occurred.

Thus at $3.15, mills would be obtaining $6 a ton more for sheets than in the early months of the year, with a $6 advance in sheet bars. No doubt the sheet mills ought to get an extra margin, but the experience of the years before the war was that frequently they did not advance in the sheet market frequently passing simply to the steel mill.

Heavy Steel Production.—Production of steel ingots in April and May totaled fully 6,000,000 gross tons, against about 4,900,000 tons in February and March. That is, in the first two months of the coal strike, the mills made 23 per cent. more steel than in the two months before the coal strike, which is as strong an answer as could be made up to this time to the threat of the coal strike interfering with steel production. The rate of production in the past couple of weeks has been about 38,000,000 tons a year, against a rate of about 35,000,000 tons.

It has been no secret that a part, and probably a considerable part, of the strength of the steel market in the past few months has been due to the coal strike, making buyers of steel fearful that they might not secure all the deliveries they would need. The record of production to date, and the continuance of a high rate of output now, suggest that there is no occasion for uneasiness on this score, and perhaps that is the reason the steel market has been growing quieter and quieter in the past three or four weeks.

The steel market is now decidedly quiet, apart from the placing of orders against new wants arising, particularly in connection with freight car orders and contracts for fabricated steel. The freight car buying keeps up quite well, but fabricated steel is growing quieter. Fabricated steel contracts let, in proportion to capacity of the fabricating shops, amounted to about 77 per cent. in March, 99 per cent. in April, and 66 per cent. in May.

The automobile industry does not seem to be buying much steel at the moment, although it has been producing cars in the past few weeks at nearly, if not quite a record rate. Probably the factories are uncertain as to their operating rates after about July 15. The heavy buying of automobiles in the past few months has surprised almost everyone, perhaps even the automobile makers themselves. Production of automobiles, trucks and accessories at the rate of the past couple of months absorbs a tonnage of steel equal to about 5 per cent. of the total production of finished rolled material at the present time. Most people, without investigating, would guess a much higher percentage.

Steel prices are very strong at base rates, while there is not as much paying of premiums to secure early delivery as was expected. Even in merchant steel bars and sheets the tonnage going at extra prices is only a small percentage of the total production. Regular prices are: Bars, shapes and plates, $1.60; hoops, bands and hot rolled strips, $2.25; standard steel pipe 71 per cent. basing discount; blue annealed sheets, $2.40; black sheets, $3.15; galvanized sheets, $4.15; automobile sheets, $4.50; tin plate, $4.75; plain wire, $2.25.

The curious condition remains of there being two prices on nails, as about the middle of April all the independents advanced from $2.40 to $2.50. For a time it was expected the Steel Corporation would advance also, but in the past fortnight this prospect has become slim.

Pig iron remains quotable at $25 for Bessemer and basic, and $24 to $25 for foundry, f. o. b. valley furnaces. The market is stagnant, as consumers expect a readjustment in prices when supplies of coke become less scarce. Connellsville coke is quotable at $7.00 for furnace and $7.50 for foundry, with a light turnover.

Lake Superior iron ore prices for the 1922 season have not yet been developed, the matter being held back by the rail freights from mine to lake not having been adjusted. The ore interests have been seeking a 25-cent reduction.

Canadian Vickers To Build Mining And Milling Equipment

CANADIAN Vickers, Ltd., have recently undertaken the manufacture of mining, power and general industrial machinery at their Longue Point works in Montreal. The plant is well equipped with heavy tools and handling facilities suited for the economical manufacturing of this class of machinery. Agreements have been made with several American firms to manufacture a wide range of equipment, including many items which heretofore were not built in Canada. In selecting a line to manufacture the most modern designs have been chosen, and all of these designs call for a high standard of workmanship.

The firm fully expects that the demand for equipment to develop Canadian natural resources will increase rapidly, and with manufacturing facilities, skilled labor and technical direction available in the country, the necessity for importing the major part of the mining industries' requirements can be avoided, and a material saving made to the purchasers on duty and freight.

A special technical organization has been built up to work in co-operation with the engineering staffs of the firms whose lines are being manufactured at the Canadian Vickers' works. The marine department has commenced the manufacture, under the Hickman Patents, of sea sleds, a new type of high-speed, shallow-draft motor-boat with surface propellers. These craft have a remarkably high deadweight carrying capacity for given speeds and powers, as compared with the usual type of hull construction and propeller arrangement. The ability of these craft to navigate at high speeds, in rough water that would swamp a standard type of boat, may solve the problem of transporting men and supplies to isolated prospects or construction jobs on inland waterways and lakes in all weather. The shallow draft and surface propellers will permit the navigation of streams and rapids prohibitive to an ordinary motor boat.

As the operating conditions of cranes necessitate frequent and rapid starting, stopping, and reversing, an economical and efficient method of controlling the speed of crane motors is a great desideratum. A crane controller of modern design is of the drum type, consisting of a combined starting, reversing, and speed-regulating switch, and may be safely operated by unskilled labor without sustaining or causing damage to the electrical equipment.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 75
Steel bars, base, Toronto	2 75
Iron bars, base, Montreal	2 90
Steel bars, base, Montreal	2 90
Reinforcing bars, base	2 90
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Chequered floor plate ¼" and heavier	5 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.60
Tank plates, Pittsburgh mill price	1.60
Structural shapes, Pittsburgh mill prices	1.60
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2.38
Structural shapes	2.48
Plates	2.48
Small shapes under 3-in.	2.38

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 25	$17 00
Electric copper	17 00	17 00
Castings, copper	16 75	17 00
Tin	35 50	34 50
Spelter	7 75	7 25
Lead	6 75	6 75
Antimony	6 50	6 75
Aluminum	23 00	25 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.2[illegible]	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 9 50	$ 8 50
Copper, crucible	13 00	11 00
Copper, heavy	13 00	11 00
Copper, wire	13 00	11 00
No. 1 machine composition	10 00	9 00
New brass cuttings	7 50	6 00
Red brass turnings	8 00	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	13 50	11 00
	Per Ton	Gross
Boiler plate	$9 00	$ 7 00
Heavy melting steel	12 00	10 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	12 00	11 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	23 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	19 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	19 00	14 00
Cast boring	3 50	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb.	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	60
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 40	$4.40
Sheets, blue ann., No. 10	3 80	3,75
Canada plates, dull, 52 sheets	5 75	6 00
Can. p'ates all bright	8 25	...
Galvanized sheets, No. 28		5 60
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's Best, No 28	....	....
Colbornes Crown. No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 35
Premier 10¾ oz	6 00	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	18.00	$
1¼ in.	20.00	
1½ in.	19.00	
1¾ in.	20.00	
2 in.	19.00	16.00
2¼ in.	22.00	19.00
2½ in.	25.00	19.00
3 in.	29.00	24.00
3½ in.	34.00	26.80
4 in.	43.00	34.25

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	20
Palacine	23
Machine oil, per gal.	33
Black oil, per gal.	17½
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	1.40
Pure turp., single bbls. gal	10.80
Linseed oil, raw, single bbls.	1 15

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets, 24 gauge and heavier, base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White 18 Dark colored. 13
Mixed colored. 14

This list subject to trade discount

RUBBER BELTING

Standard 86 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Copper Bars, ½ to 2 in	$29 00	$28 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	30 00	28 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	35 00
Copper sheet, planished, 16 oz. base	42 00	40 00
Braziers', in sheets, 6 x 4 base	30 00	28 00
Copper tubing, seamless		29

LEAD SHEETS

	Montreal	Toronto
Sheets, 8 lbs. sq. ft.	$ 8 50	$ 9 00
Sheets, 3 1-2 lbs. sq. ft.	8 25	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 00	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

How U. S. Views St. Lawrence Canal Project

Governor Miller, of New York, Demands Thorough Examination of Scheme—Would Be Willing to Spend a Million Dollars for This Purpose and Promote Carrying it Through if Report Favorable

THE ADVISABILITY of raising and spending several hundred million dollars in making the St. Lawrence River navigable for ocean-going craft and thereby making virtual seaports of the cities on the Great Lakes has lately been widely discussed in the United States. The project appears to be regarded by New York as one actuated by hostility to its interests. Darwin P. Kingsley, president of the New York Chamber of Commerce, addressing that body recently defined it as honest hostility based on imperfect information and local ambitions and not as dishonest hostility actuated by political motives. The plan is nominally approved by eighteen states which include roughly all those having no seaboard outlet. Its appeal, however, in Mr. Darwin's opinion rests largely on an alluring suggestion. To tell Chicago, Duluth, Cleveland and Milwaukee that they ought to be and can be great seaports is to fire the imagination of their people, he considers.

In a debate before the National Rivers and Harbors Congress in Washington, Governor Nathan L. Miller, of New York, expressed his willingness for Congress to appropriate a million or more to have a thorough investigation made by impartial experts and, he declared, if they pronounced it feasible he would support it no matter what it might cost. At the same time Governor Miller offered an alternative plan in suggesting that the Mississippi River and its branches be improved so that the Middle West might ship its products by barge to New Orleans and thence to foreign ports, thus saving the heavy railroad charge of assembling such freight at the Lake ports for export via the St. Lawrence River.

Governor Allen, of Kansas, dwelling upon the "tragedy of transportation" under which he said the Middle West was suffering, declared that the eighteen states in favor of a St. Lawrence Ship Canal produced 70 per cent. of all the wheat grown in the United States, 66 per cent. of the corn, 80 per cent. of the oats and 70 per cent. of the barley. He argued, relative to bringing the sea coast, 1,200 miles nearer to the Middle West, that, "without any intention whatsoever to injure New York, we do say that if that sea coast is a good thing for New York, we would like to have it also." He referred to the statement that New York would be called upon to pay 30 per cent. of the cost of the canal as merely New York's "quaint way of explaining that she gets more than anybody else." As to the New York State Barge Canal, which is placed in some jeopardy by the St. Lawrence project and which is capable of transporting 10,000,000 tons each way annually, he asserted that the transportation demand of the eighteen states involved is 200,000,000 tons. Consequently "there is nothing in the Barge Canal that competes with our project. The Buffalo papers have been screaming at us in the Middle West, 'Come on here! Here you have it now!' Well, we are not bound for Buffalo. We are bound for Liverpool."

Advocates of the canal maintain that it will save the Middle West $350,000,000 a year and that to offset the cost of the canal will be the development of 1,400,000 hydraulic horsepower to be marketed under the jurisdiction of the United Commissions of the states in which it is distributed.

Governor Miller questioned these and other figures, declaring: "There is no market or practically no market whatever at the place where this power will be developed; and there are many engineering features yet to be studied before it is determined where that market is going to be and how much it is going to cost to get the electricity to that market. At any rate, it is going to take years—how many I do not know—during which fresh charges are going to pile up.

"But they give it out over the country that this thing can be done for $250,000,000 a mere bagatelle, less than they will save in one year on wheat. And then they want to commit the government and the Federal treasury to the assumption that in some way not designated, not even studied, water power is going to pay for it."

With regard to the statement which had been made that the Middle West was seeking an outlet for 200 million tons of products, Governor Miller stated that in the banner year of 1920 the total export and import tonnage of the United States was only 54 million tons.

It was also his contention that a 30-foot instead of a 20-ft channel would be required for the canal and that this would cost at least $500,000,000. The fact also that the advocates of the plan were trying to rush the proposition through upon the assertion that it would cost only $250,000,000, upon a superficial examination only, and upon the assertion that it was not necessary to consider the deepening of the channels of the Great Lakes, was an indication to him of a lack of good faith. It showed, in his opinion, that they were not willing to have the facts examined, and that they were trying to commit the government to something that neither they nor anyone else had computed.

FEEL THAT CONDITIONS ARE MUCH IMPROVED

The industrial centres of Eastern Canada display a more hopeful spirit, according to a monthly commercial letter of the Canadian Board of Commerce.

A number of manufacturers in Western Ontario find that the amount of goods produced during the winter is insufficient to meet the present demand, and in consequence are extending their operations. Knitting and woollen mills, and brass and stove foundries, located at a number of points, report activity, and in some cases difficulty is being found in keeping pace with orders received.

In important centres, such as Hamilton, it is stated by manufacturers that business is improving, and that prospects are better now than at any time during the past year. The majority of factories in Hamilton are taking on additional hands, and the unemployment situation is consequently considerably easier. At Shawinigan Falls, one of the important industrial centres in the Province of Quebec, business is active, and there are no complaints of unemployment.

There is noticeable improvement in the iron and steel industry. Official returns indicate an increase in the output of domestic pig iron during March to a total of 41,733 tons, composed of 25,974 tons of basic pig iron, 10,123 tons of foundry iron, and 5,636 tons of malleable iron. With the exception of 71 tons, the output of basic iron was all used by the producing firms. Foundry iron, on the other hand, was produced largely for sale, the total under this heading being 10,080 tons, with only 43 tons made for the use of the firms reporting. Compared with the preceding month the production of basic iron was only slightly higher, but the output of foundry iron was almost 2,000 tons greater than in February. The malleable iron made during March was the first produced this year.

BOOKLETS

A booklet, known as circular 1579-B, containing general information and technical data for cutting micarta gears and pinions, has recently been issued by the Westinghouse Co. for distribution among gear cutters. The book contains a great amount of useful information for gear manufacturers.

News From the Industrial Field

Sault Ste. Marie, Ont.—A dock to cost $60,000 is being constructed by A. B. McLean & Sons.

La. Cie. Electrique of Papineauville, Que., will construct a power house and dam costing $30,000.

The C. P. Railway is contemplating the erection of freight sheds at Yorktown, Sask., at a cost of approximately $70,000.

R. A. Thompson is going to erect an addition to his flour mill at a cost of about $10,000.

Allison Peck Hillsboro N. B. is contemplating the erection of a woodworking factory to cost about $10,000. Moncton N. B. is spoken of as the site.

Welland, Ont.—A cold storage plant may soon be erected by the St. Thomas Packing Co., St. Thomas, at a cost of $50,000.

A bridge may soon be erected over the Pembina River, north of Cherhill, Alta., if present plans go through. The dept. of public works, Edmonton, is interested.

Tenders will be called shortly for repairs to dry dock retaining wall to cost $25,000 for Halifax Shipyard, Ltd., Halifax, N. S. C. A. Fowler & Co., are acting engineers.

The Canada Machinery Corporation, Galt, through Chas. A. Strelinger Co., Windsor, have secured the contract to install three lathes, a bandsaw, and grinder, in the technical department of Walkerville Collegiate.

The machinery and equipment of the Union Iron & Metal Co., Toronto, is being sold by tender. Bids will be received up to June 14. Further information can be secured from F. C. Clarkson, trustee, Toronto.

A writ has been issued by the Trust & Guarantee Co., Toronto, asking for an order for its appointment as receiver and manager of the Ontario Smelters and Refiners, Welland, Ont. Default of interest on outstanding bonds is the reason given.

Niagara Falls, Ont.—Tenders will be called for construction of asphalt plant for this city. J. C. Gardner is the man to write to. Falls Machinery & Supplies of the same city is contemplating the erection of a warehouse and office.

A Hydro-Electric power plant will be constructed at Thessalon, Ont. This will consist of dam and power house, 200 h. p. turbine and generator, and three miles of transmission line. It is also proposed to electrify the pumping station by installing motor-driven pump and gasoline-driven fire pump. Tenders will be called by James Proctor and Redfern, Engineers, 36 Toronto St., Toronto.

H. C. Crow, for several years sales manager of the Canada Metal Co., Toronto, has resigned to devote his entire time to his mining interests.

A fire at the Don Valley Paper Mills, Toronto, destroyed approximately $100,000 worth of property a few days ago. Over $250,000 worth of machinery and stocks was saved.

Halifax, N. S.—Exports from this port for January, February and March of the present year totalled $14,235,027. The 1921 total for corresponding period was $11,063,553, or $3,171,474 lower.

W. Bruce, manager of the Empire Brass Foundry, 128 Wellington St., Montreal has plans made and will receive tenders on additional work and alterations to present buildings. No closing date has been set.

The penalty clause of the recently proposed engines bill has been removed, and in the modified form the bill to incorporate an association of engineers in Ontario has finally passed through the committee of the House.

Harold F. McCormick, has resigned as head of the International Harvester Co. Alexander Legge, vice-president and general manager was unanimously elected to Mr. McCormick's former position.

The Canadian Steel Corporation will construct three thousand houses at Ojibway, Ont., according to J. H. Jewell, a contractor at Windsor, Ont., who claims his construction offer has been accepted. So far no definite date has been set when erection will commence.

J. H. Bertram, collector of customs at the port of Toronto, states that the customs-excise revenue for Toronto, May 1922, was $4,156,067. This is a gain of $766,067 and is distributed as follows: Customs duty and sales tax, $460,788; excise sales tax on domestic goods, $280,692, and excise duty and other collections $24,587.

The Grand Trunk Shops at Point St. Charles, are building fifteen switching locomotives of the 0-6-0 and the 0-8-0 types. The first of the fifteen is about completed. These locomotives will be used for switching, and in addition will be adopted for longer hauls across the larger cities, such as Montreal and Toronto.

Following are recent incorporations under the Companies Act: Wilson Lumber Co., Hull, Que., $300,000; Canadian Polishes, Hamilton, $750,000; Peerless Box Co., Ottawa, $250,000; Gill & Fortune Lumber Co., Trenton, $3.000,000; Carswell Construction Co., Toronto, $100.000; Nelson-Blood Trap Co. of Canada, Windsor, $50,000, and Lockhart-Westcott Lumber Co., Winnipeg, $50,000.

Messrs. Darling Bros, Montreal, who for a number of years have operated their own grey iron foundry have just started a brass foundry. The first heat was taken off the last of May.

Montreal, P. Q.—The Parker Motor Car Co, have about completed extensive tests on a small four cylinder air cooled motor car, which they expect to manufacture in the near future and place on the market at a price below $1,000.

The Three Rivers Pulp & Paper Co., is being reorganized and will be hereafter known as the St. Lawrence Pulp & Paper Co. The capitalization of the new company will be $1,000,000 8 per cent. cumulative participating, preferred shares and 40,000 common shares of no nominal or par value.

Messrs. Darling Bros., Montreal, are building three Drysdale engines direct connected to pumps for use in the ships of the Canadian Government Merchant Marine. These will be used to pump the salt water through the surface condensers. The above factory have the manufacturing rights for this equipment in Canada, and it is considered standard equipment for the previous mentioned use.

Tenders will be received up to June 30 for the supply of 42,000 pairs of motor vehicle license number plates for the province of Alberta for the year 1923. Plate to be 24-gauge metal, 4½ in x 12 in., with embossed figures and the words "Alta" and "1923" on the righthand side of the plate. Colors: White lettering on a royal blue background. Sample of plate bid on must be furnished. Submit prices to Deputy Provicial Secretary at Edmonton.

M. C. Ritchot, assistant claims agent for the Grand Trunk Railway System, retired yesterday under the pension plan of the company. Mr. Ritchot was with the railway continuously for fifty-one years. He entered their employ Jan. 3 1870, starting in the audit office. For over twenty years he was private secretary to the late Mr. Wainwright, and in that capacity met many men throughout the Dominion. Since 1907 he was assistant claims agent.

J. E. Dalrymple, vice-president of the Grand Trunk Railway, speaking on the U. S. drop in freight rates, effective July 1, says that in his opinion it will clear the atmosphere and tend to stimulate production and business. "Uncertainty in respect to freight charges always has an influence in the movement of traffic," continued Mr. Dalrymple, "particularly when the public anticipate a reduction. I look for an increase in business this coming fall, and all signs point to a revival," he concluded.

The Canadian Manufacturers Association will hold their annual convention this year at St. Andrews-by-the-Sea, B., on June 20, 21, 22 and 23. The mornings will be devoted to business sessions, while the afternoons and evenings will be given over to recreation. A large delegation from Toronto, Montreal and Quebec division is expected.

Montreal, P.Q.—Progress on the new Mount Royal Hotel is very satisfactory, and the date of completion, which was originally set at December 1, has been changed to November 1. The boilers, and a considerable portion of the heavy machinery are already on the site, and installation will be made shortly. The motors for running the elevators, etc., are being placed and connected, and it is expected within a week or ten days that all elevators will be running. This will assist materially in the completion of the structure.

The Franklin Institute of the State of Pennsylvania recently presented to Samuel T. Freas, of Henry Disston & Sons, saw, tool, steel and file makers, Philadelphia, the Edward Longstreth Medal in recognition of his invention of the "Interlocking Tooth Metal Cutting Saw." The presentation was made upon the recommendation of the Institute's Committee on Science and the Arts after a very complete investigation of the development of the inserted tooth circular metal cutting saw.

Mr. Freas, the inventor, has been associated with the Disston Co. for the past 21 years.

Montrea', P. Q.—P. Lyall & Co., construction engineers, have secured a contract for extensive alterations to the Windsor Hotel. The changes include the remodelling of the entire rotunda, all woodwork is to be replaced with marble; the Windsor Hall is to be removed to a new location which will be on the ground floor near the Old Rose Room, and five additional stories are to be added to this part of the structure. The work is to be started at once and will be accomplished without interference with the running of the hotel. The contract amounts to about $500,000 and is to be completed by the end of August.

Timmins, Ont.—According to preliminary estimates, the gold mines of Porcupine and Kirkland Lake produced upward of $1,735,000 during the month of May. A total of approximately 3,480 men were employed at the producing mines, while, approximately, 172,000 tons of ore were mined and milled. This shows that, approximately, 49 tons were handled by each man during the month, and that the average grade of ore at mines was maintained at a little over $10 per ton. The non-producers, as well as numerous others under exploration and development, are employing a substantial aggregate of men, and it would appear to be reasonable to estimate that at least 5,000 men are now employed directly at the gold mines of Porcupine and Kirkland Lake.

P. Purpur, Leader, Sask., is going to erect an elevator at a cost of $10,000.

Construction contracts awarded in Canada during May totalled $34,827,300. This is the second largest monthly figure since 1914. Residential building accounted for 45 per cent. of the May total, business building 33.1 per cent., and industrial buildings 2.4 per cent. Public works and utilities accounted for another 19.5 per cent. The trend of building costs is still downward.

Here is a good idea. Every salesman of the Canada Cement Co. is provided with a camera, and is given a dollar for every picture used. In addition special prizes of $25 and $10 are given for pictures showing most novel use and best picture respectively. A prize of $10 is also awarded for the best description of a picture showing the use of concrete.

How about this idea in your business? Can your salesmen take a picture of your product in actual use? If so, it may form the basis of the best advertising you ever started.

There was a general increase in shipments of grain down the Lachine Canal during the month of May as compared with shipments in the same month last year. There is a total increase of 2,746,133 bu. of grain. All grains show an appreciable increase except oats, which register a slight decrease. The heaviest increase is in wheat. Corn increased, also barley, rye, and flax. On the other hand farm products such as eggs, butter, and cheese show a decrease. There was also a falling off in the shipments of coal, this decrease being a very heavy one. The total for May this year was 21,725 tons, and for May last year 116,725 tons. There were no shipments of hard coal through the canal last month, while in May 1921, some 8,000 tons passed through. The number of trips during last month was 822, while in May 1921, the number was 903, which shows a decrease of 81. The total tonnage operated was 583,161, an increase of 21,945 tons. The total passengers carried were 1,649 an increase of 868 or more than 50 per cent. There was also an increase in cargo tonnage.

A report from Washington, D. C., states that there was a big decrease in the trade of the United States with Canada during the month of April as compared with the same month last year. United States exports to Canada amounted to $43,000,000 against $49,000,000 for last year, while imports were $21,000,000 against $31,000,000.

According to a statement by Thomas L. Chadbourne, attorney, at New York, a plan has been adopted whereby the properties of the Midvale Steel and Ordnance Co., Republic Iron and Steel Co. and Inland Steel Co., will be unified under the ownership of Midvale. The name of the new corporation will probably be the North American Steel Corporation. It is intended to provide $20,000,000 additional cash working capital from the sale of common stock. Negotiations are pending, Mr. Chadbourne says, for the acquisition of other properties, but, irrespective of the outcome of these negotiations, Midvale, Republic and Inland Companies propose to proceed with these merger plans.

Chambers - McCaffrey Construction Co., with head offices at Toronto, have incorporated with a capital of $50,000, to carry on a general contracting and supply business. Other incorporations are: Caledonian Construction Co., Ltd., head office at Three Rivers, P. Q., capital $20,000 to carry on the business of general contractors.

Hanover Cement & Stone, Limited, with head office at Hanover, Ont., capital $1,500,000, to manufacture and deal in cement, lime, brick, etc.

Agnew Bros. Limited, with head office at Toronto, capital $40,000, to carry on the business of contractors and builders.

McQuigge-Morse, Limited, with office at Toronto, capital $100,000, to carry on the business of a general engineering and construction company.

The Hon. J. A. Robb, Minister of Trade and Commerce states that the reason the Canadian Government Merchant Marine was not given the contract for a steamship service between Canada, West Indies, and British Guiana, was that the merchant marine officials said they could not tender for the service, having no steamers which would comply with the requirements as to passenger accommodations and cold storage, if the latter were necessary. The only tender received for the service was from the Royal Mail Steam Packet Co., London, England. The contract previously existing, was renewed for two years from April 1, 1922. It provides for a fortnightly mail, freight, and passenger, service from Halifax t Bermuda, the British West Indies and Demerara returning via the same ports to St. John, N. B. The annual subsidy is to remain at the same figure, namely $340,666.66. The contract provides that the minister may cancel it on 30 days notice, if there has been any breach in part of the contracts of any of the requirements of the agreement.

OBITUARY

William Nicholson, well-known railroad man, died at his home in Montreal a few days ago. At the time of his death he was general foreman of the C.P.R. blacksmith shop. Mr. Nicholson was born in Kingston 66 years ago, and was for several years connected with the Canadian Locomotive Works. He joined the C.P.R. in Montreal sixteen years ago.

BELIEVES CHEQUE TAX WILL HINDER BUSINESS

At a general meeting of the executive of the Montreal Branch of the Canadian Manufacturers' Association held to discuss the provisions of the Budget, there was a general objection taken to the stamp tax as a needless hindrance on business, and it was decided that as soon as possible a general meeting of the various associations throughout the country should be held to take action in this regard, and if advisable to send a delegation to interview the Minister of Finance with a protest against the proposed tax. The meeting was the first of the new executive and welcome was given the new chairman, Mr. Julian C. Smith when he assumed the chair. A long discussion took place on the proposals to demand a graduated scale of stamp taxes on cheques. The criticisms of the Budget proposals finally crystallized into the following resolution which was unanimously adopted:

"That whereas in the opinion of this meeting the provision introduced by Hon. W. S. Fielding, Minister of Finance, in his Budget address on Tuesday, May 23, 1922;

"That no person shall issue a cheque payable at or by any bank unless there is affixed thereto adhesive stamp or unless there is impressed thereon by means of a die a stamp of the value of, if the amount of money for which the cheque is issued (1) does not exceed $50, two cents; (2) exceeds $50 for every $50, or fraction thereof, two cents, and every adhesive stamp affixed to a cheque shall be cancelled by the bank at which the cheque is payable at or before the time of payment, will bear heavily upon business;

"That whereas it is believed that some more simplified method can be evolved as tax on cheques, eliminating for the business houses of this country additional clerical work and inconvenience which will be brought about by the enactment of the provision;

"Be it therefore resolved that the Montreal Branch of the Canadian Manufacturers' Association petition the executive council to make representations to the government, urging the amendment of this particular section, by some provision for the taxation of cheques which would achieve the end of the Finance Minister in raising additional monies, and at the same time could be applied to business generally with the least possible degree of inconvenience."

An addition was made to this resolution to the effect that, in the absence of more definite information, the committee would recommend that the stamp tax be imposed on units of $100, which was agreed to.

The resolution was forwarded to the Dominion executive council of the Canadian Manufacturers' Association at Toronto and a request made that it be sent to the government.

The item appearing in the daily press to the effect that the Massey-Harris Co. would shortly reopen their Brantford plant and start with 700 men is only true in part. Canadian Machinery is advised on good authority that within a week or so the plant will commence operations but the number of additional men will not exceed 400. It was also stated that the orders to be filled will be largely for stock in anticipation of late summer demand to take care of a good harvest season in the West.

J. G. Stirk, of the Stirk Planer Co., Halifax, England, will soon be in Toronto. He will arrive this week and will spend a few days with his Canadian agents, Messrs. Alfred Herbert, Ltd., 1 to 3 Jarvis Street, Toronto.

Mr. Stirk is recognized as one of the foremost planer designers of the world, and readers will no doubt recollect the description of his electrically-controlled "Hilo-Plane" which appeared July 1, 1920, in Canadian Machinery columns. In this machine Mr. Stirk made many radical changes and improvements, including a reversing motor drive, magnetic feeds, simple stroke setting device, etc.

Through the Mexican Government, the Massey-Harris Company of Toronto, has just shipped, via the Gulf of California, 20 or more "binder reapers"—huge machines, which will cut, thresh and bag the grain at one operation. James Douglass, one of the company's chief officials, has gone with the shipment to see the machines in operation and to act in an advisory capacity in connection with the order. Instruction will be given by him in the efficient operation of the binders on Mexican farms. It is stated that these machines have been shipped with a view of testing their ability on the Mexican soil, and if satisfactory results are shown steps will be taken to enlarge the trade in this direction.

Quebec, Que.—Rapid progress is being made on the construction of additional accommodation facilities at the Chateau Frontenac. The popularity of the Chateau, both as a summer and winter resort, has resulted in its capacity being taxed to the limit and the new addition, which will have a tower twenty stories high, will greatly relieve the congestion. It is exected that the new wing will be in readiness to cope with next year's tourist traffic.

St. John, New Brunswick.—Efforts are being made to secure the use of the powerful wireless plant at Newcastle, which never has been used since it was erected 10 years ago, for the purpose of establishing a broadcasting station for wireless telephony. Only the most powerful receiving sets can be depended upon to secure satisfactory results from the stations in the United States and the St. John Commercial Club is undertaking to promote the establishment of the station in this province.

SEVERAL IMPROVEMENTS TO BE MADE TO HARBOR

Mr. M. P. Fennell, general manager of the Port of Montreal, has announced a programme of extension in improvements which will be taken up at once by the Montreal Harbour Commissioners. This calls for the developing of the Jacques Cartier Pier, the high level shore wharves for sections 27 to 30 inclusive, and on the wharf at section 101 leased by the Imperial Oil Co. The first work to be undertaken will be the Jacques Cartier Pier. Improvements were commenced by the commissioners in 1919 owing to the inadequacy of the existing pier to accommodate the larger type of vessels visiting the port, and by the end of last year the addition had been brought up to the low level elevation.

Specifications for the work now to be undertaken call for the raising of the addition to high level, in order that the sheds on the old portion of pier may be extended to cover the new addition. It is expected that the work will take two or three months to complete. During the season 1921, over 637 feet of low level wharfage was completed, extending from that section known as 27, to section 30, below the old Montreal jail. The proposals for 1922 are to raise these low level wharves to the high level, incorporating such work as foundation for sheds which will ultimately be erected thereon.

The work which is to be undertaken for the extension of the Imperial Oil Company's wharf will provide additional berthage of 500 feet in length, and 30 feet in depth at extreme low water. The lower portion will be in the form of a pier 50 feet wide, to provide 300 feet of berthage with a depth of 20 feet at low water on the inside face, for the accommodation of lake craft.

COPPER OUTPUT IN 1921

The world's output of copper for 1921, according to the American Bureau of Metal Statistics, was 583,832 short tons, or 1,167,000,000 pounds compared with 1,072,674 tons, or 2,145,000,000 pounds in 1913, and a record of 1,579,545 tons, or 3,159,000,000 pounds in 1917. Stocks of refined copper in hands of American producers at the end of 1921 were 482,000,000 pounds compared with 90,000,000 in 1913 and 105,000,000 in 1912. United States consumption was 633,000,000 pounds, compared with 668,000,000 in 1913 and 705,000,000 in 1921. British consumption is estimated at 157,000,000 in 1921 against 272,000,000 in 1913 and 286,000,000 in 1912. French consumption is placed at 101,000,000 pounds in 1913, and 215,000,000 in 1912, and Japanese consumption at 126,000,000 in 1921 against 54,000,000 in 1913 and 52,000,000 in 1912.

The Prentiss Vise Co., of New York, has just issued a new illustrated catalogue and price list on their complete line of bench vises and attachments.

BOOK REVIEWS

The D. Van Nostrand Co., 8 Warren St., New York, have published several interesting and instructive technical books recently, and following are reviews on subjects which will interest our readers.

"Modern Methods of Welding," by J. H Davies, Leeds Technical School and consulting engineer. This book describes the various methods of welding, including oxy-acetylene, oxy-hydrogen, hermit electric arc, electric butt, electric seam, electric spot, and mirror welding. It also touches upon lead burning, cutting of iron and steel, also the question of eye protection when welding.

There are 39 chapters, 263 pages, and 132 illustrations, also several welding tables. The author has had 18 years experience in the welding industry and has published this work in the hopes of helping both students and present welders to more thoroughly understand their business. The price is $6.00.

"The Electro-Metallurgy of Steel," by C. C. Gow, assoc. R.S.M., M.I.M.M., B. Sc. (England), deals with the historical development of electric steel furnaces, and other phases of electro-metallurgy, including power consumption, generation and control, automatic regulators, electro-metallurgical methods of melting and refining cold charges, liquid steel refining, ingot casting, application of electric furnace to foundry practice, general principles of electric furnace design, modern types of electric furnaces, lining and repairs, and other important subjects regarding the electro-metallurgical method of melting steel.

The book has a splendid introduction, and the 15 chapters cover the ground very well. There is also an appendix describing the rapid method of analysis for bath samples. There are 132 illustrations, and 351 pages, the price being $7.50.

Everyone is talking radio these days, so the Van Nostrand Company have published a book called "Radio Phone Receiving," which is termed a practical book for everybody. Several well-known writers have contributed, and following are the subjects covered.

How radio telephoning is accomplished, tuning the simple receiving circuit, receiving the waves by crystal detectors, the vacuum tube, amplifying the music or speech, regenerative and heterodyne reception, and radio telephone broadcasting.

This book is frankly addressed to the people who are not experts, but who are anxious to learn about this new art. It is well illustrated throughout and sells for $2.50.

A series motor is well adapted for variable loads, and is capable of exerting a large starting torque, with quick acceleration, the torque rapidly increasing with the load.

Introducing



J. M. BROWN

How is this for a "take me natural" photograph? Mr. Brown, who is one of the founders of the Brown-Boggs Co., Hamilton, Ont., is no admirer of photographic studios or high-backed chairs. Upon being told we were going to take his picture he simply rose from his desk, placed his hat on his head, and stood at ease when we requested him to look for the pretty birdie.

Born in Hamilton, Mr. Brown has always resided in the same place. He can tell of some wonderful changes which have taken place since 1856, the year of his birth, and shows by the detail attending such stories that he retains a splendid memory. His education consisted of public school training until thirteen, after which he started to serve his time in a small machine shop run by S. J. Moore.

By the time he was eighteen, he became a full fledged tradesman, but before finishing his apprenticeship, advanced so rapidly that they made him foreman of the shop. He remained in this position until 35 years of age, at which time Mr. Boggs and himself decided they had worked for somebody else long enough.

They started a company making sheet metal working tools, and although they opened up in a very small way, soon branched out and added to their staff. About a year after they started 7 men were employed while during the peak days 260 men were engaged at the present plant. Some idea of the development can be gleaned from this comparison.

Mr. Brown believes a great deal can be accomplished by using ordinary common sense. "A man who is honorable and meets his obligations is always bound to succeed" he remarked, and the truth of this statement is borne out by his own experience. He always treats everybody as he would like to be handled himself, and having a strong liking for boys, he helps them in every way possible. In fact he is still much of a boy himself, and when the shop men start a ball game you can invariably find J. M. Brown either at the bat, or chasing a fly ball. Sport is not his only hobby, for he has held several important public offices, including positions on the library board, and sanitorium board.

"The Engineering Enquiry," is the title of a book published by J. W. Arrowsmith Ltd., 11 Quay St., and 12 Small St., Bristol, England. This is pocket size and is prepared for the assistance of agents, contractors, engineers, extending, commercial and technical correspondents, merchants, representatives and salesmen. The author is Tomey Thompson, who is a member of the Society of Authors, assoc. mem. of I.E.E., and member of society of technical engineers, and other societies.

The object of the book is to help men in the above mentioned positions to send complete inquiries, thus avoiding delay, and several manufacturers have already said they find it useful. Under the various headings is given what you should specify in inquiry, and where additions are sometimes necessary these are also given. This is a rather unique book and should prove very useful to men who are not technical experts, and also to students who are learning their profession. The price is 7/6d.

VERTICAL TURRET LATHE

(Continued from page 24)

time in one hour. In the above instance it gave 116 productive tool minutes in 48 minutes of operation. This is at the rate of 145 minutes per hour. Concentration of productive time is the essence of economy in production. The machining of an elevator drive thread pointedly demonstrates the advantages of turret tooling in both the main head and side head. It provides an excellent example of time economy and machining efficiency in the use of the side head. The tooling and operations are shown in Fig. 5. The actual time for machining complete floor to floor is slightly over four hours. The economy is evident from the fact that this piece was previously done on an engine lathe in 36 hours.



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NEXT time you need Machinery or supplies in a hurry, phone or wire us. From the immense stocks we carry we can supply practically anything you may need at a moment's notice, and remember, your order will be carried out intelligently as well as promptly.

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HORIZONTAL BORING MACHINE

Unexcelled for Continuous Service

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ROCKFORD, ILLINOIS, U.S.A.

CLASSIFIED OPPORTUNITIES
ON PAGE 48





THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

PRECISION SPRINGS OF HIGHEST GRADE

--FOR--

ENGINES, VALVES, DIES, AND SPECIAL MACHINERY

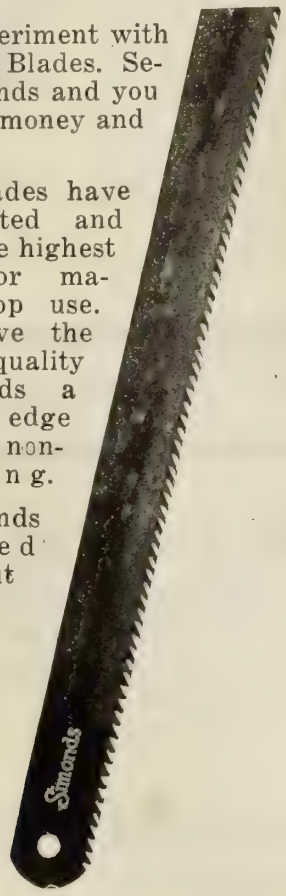
ALSO SPECIAL DESIGNS AND TYPES

SIMONDS
Hack Saws

Don't experiment with Hack Saw Blades. Select Simonds and you will save money and time.

These blades have been tested and proved the highest grade for machine shop use. They have the steel quality that holds a cutting edge and are non-breaking.

Thousands are used throughout Canada.



Simonds
Canada Saw Co., Ltd.
"The Saw Makers"
Montreal, Que.
St. John, N.B. Vancouver, B.C.

SAFETY CAMPAIGN FOR EYE PROTECTION

THE GOOD effect of the educational campaign for the reduction of eye accidents in industry is reflected in the seventh annual report of the National Committee for the Prevention of Blindness which has just been issued from the headquarters of the committee in the Russell Sage Foundation Building, New York City. "Even the most ignorant workman is learning that in refusing to wear goggles he assumes a very great responsibility, not only to himself and his family, but to the neighbor who may be injured through his carelessness," says this report.

The growing interest among industrial executives in literature concerning the conservation of vision is shown in the National Committee's report by the statement that more than 3,400 sets of industrial eye accident posters were distributed during the last year and by the fact that the second edition of the committee's bulletin No. 12, a volume of 145 pages devoted entirely to eye hazards in industrial occupations was exhausted before the close of the year. This bulletin containing reports of typical cases and recommendations for safe practice, is now being revised for publication in the Fall.

The entire subject of eye hazards in industrial occupations and means of reducing or eliminating those hazards will be thoroughly discussed and brought up to date in a revised edition of bulletin No. 12 of the National Committee for the Prevention of Blindness, it is announced at the headquarters of the committee in the Russell Sage Foundation Building, New York City. The revised edition of this bulletin, which was originally issued in 1917, and which has been out of print since the latter part of 1921 will combine in one volume practically all of the available information on the subject.

FORT WILLIAM NEWS

Fort William, Ont.—Erection of a temporary aerial power cable was completed yesterday afternoon, crossing the Kaministiquia River, Fort William, from Canadian Pacific Railway elevator D to a tower erected upon the south bank, and power from the Kaministiquia power station was again supplied to industries situated in the Mission industrial area. The cable is strung high enough to clear the tops of the masts of steamers navigating the river.

Adaline V., a steam tug, sixty by eighteen feet, composite wood and steel construction, built eight years ago at Spanish River, has been acquired by Fader interests here and has arrived at the head of the lakes. Her port of registry will be changed from Sault Ste. Marie to Fort William, and she will be used in connection with local harbor work and probably in the government light-house service.

Speaking of the districts in northwestern Ontario and their mineral possibilities, Professor W. L. Goodwin, of Toronto, who has been delivering a number of lectures in Fort William and Port Arthur to special classes of prospectors and miners, stated that the Province of Ontario possessed the world's future supply of iron ore. He predicted that the huge deposits of low-grade iron ore in Ontario would be drawn upon as the high-grade deposits of the United States became exhausted. All that was needed, he claimed, was the establishment of a plant to raise the iron content of the Ontario ores, as was now being done with inferior ores to our own in the United States.

The building of small dwellings and the renovation and repair of older houses, have resulted so far during the month of May in the issuing of fifty building permits in the City of Fort William. Substantial reductions in the cost of building material and cheaper labor are proving big incentives to home-builders who having been waiting for several years to invest their money in homes.

"There is absolutely no cause to worry regarding the industrial outlook in Canada," according to N. M. Paterson, of the Paterson Grain Co., who recently returned from the Pacific Coast where he has been spending several months. He predicted that as soon as the new crop commenced to show itself in the west, business and industrial conditions would improve all over the Dominion. "The industrial condition has a direct relativity to the spending power of the western grain growers," he added. "When they commence to buy, the wheels of industry commence turning. All indications point to the crop being a bumper one. That means the grain growers will have money and when they have money they will spend it for the implements and other supplies they need."

Mining authorities of the east are paying considerable attention to the possibilities contained in the old Empress gold mine at Jackfish. Sir Stafford Brunton, of the Canadian Pacific railway mining department, Montreal, is making an inspection of the property, in company with T. Ballantyne, divisional superintendent of the railway at Schreiber.

NEW CONCERN OPENS

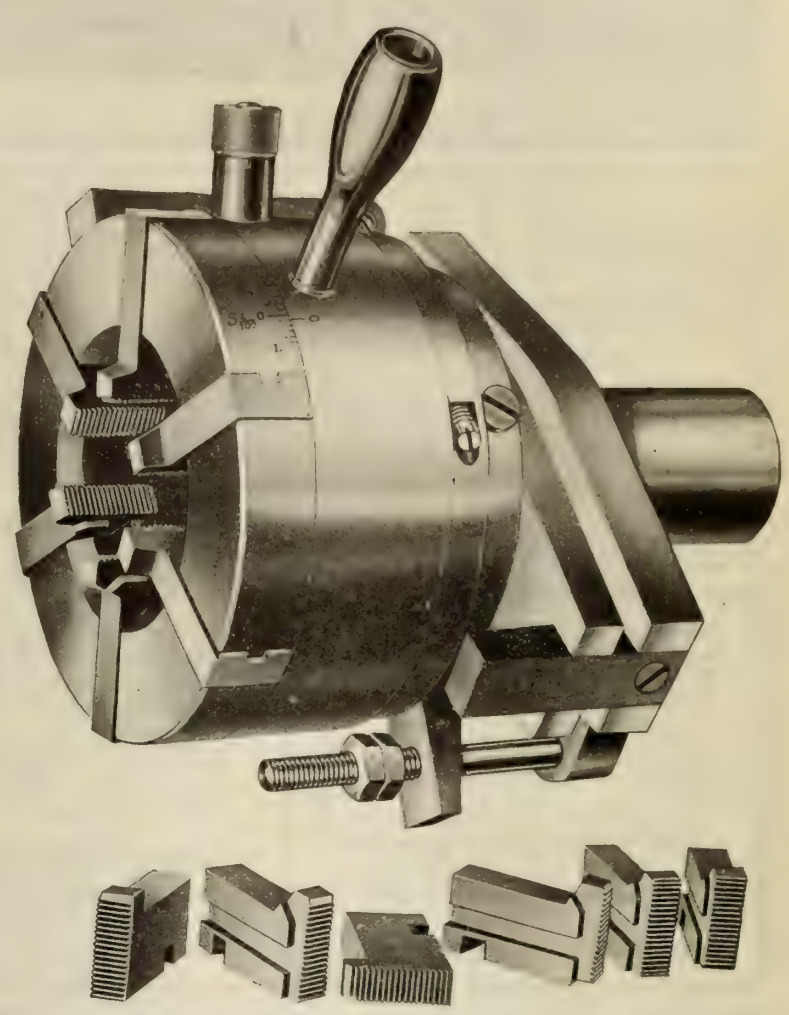
The Taylor Instrument Co. of Rochester, N. Y., have just completed negotiations for the purchase of the property at 110-112, Church St., Toronto, which has been known as the "Stevenson" Bldg., and which will be renamed the "Tycos" Bldg. Extension of manufacturing facilities will take place slowly as demand arises. Operations will commence on the repairing of all of the various instruments made by this firm, and assembling activities will be increased as occasion demands. The number of employees engaged will be added to as business increases.

DIE HEADS THAT SHOULDER THE WORK

One simple way to reduce production costs is to increase production. More and more shops are becoming 100% Geometric in their tool equipment, because they know that increased production invariably follows where Geometric Tools are used.

A Screw Thread Geometrically cut is correctly produced.

Geometric Die Heads can be fitted with Chasers for cutting close to a shoulder when required.



This Geometric Die Head is arranged for the Potter & Johnston Automatics. Note the Floating Shank, which makes close Camming unnecessary and also prevents inaccuracies caused by either forcing or holding back the Turret.

When you put a Geometric Die Head or Collapsing Tap on your Screw Machine or Turret Lathe, you put the name of the Geometric Tool Company there, and thereafter **they have a record to keep with you.**

Send in Your Specifications and Let Us Match Them With a Die Head That is Right.

The Geometric Tool Company

New Haven, Connecticut, U.S.A.

Canadian Agents:

Williams & Wilson, Ltd., Montreal. **The A. R. Williams Machinery Co., Ltd., Toronto St. John, N.B.; Halifax, N.S.; Vancouver, B.C.**

Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

The old established firm. Patents everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.
FETHERSTONHAUGH & CO.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

FOR SALE

"RICARDO" ENGINES, PETROL OR PARAFfin, excellent for marine, commercial or stationary use. Brand new. 100 h.p. 4-cylinder, 150 h.p. and 250 h.p. 6-cylinder, 300 h.p. 12-cylinder, Thirty shillings per horse-power sterling London. Sykes, Patching, Sussex, England.

FOR SALE:—COMPLETE EQUIPMENT FOR small machine shop, consisting of 16" Davis screw-cutting lathe, hack saw, shaper, drill, buffer, grinder, and forge. Will sell reasonably and terms to responsible party. This is a snap for someone starting in business. Would sell separately. Apply Box 811, Canadian Machinery. (C23M.)

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co. of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 152
(17)

WANTED

MACHINERY SALESMAN WANTED, SPEAKing English and French. Apply Electric Motor and Machinery Co. 417, St. James St., Montreal, Que.

SITUATIONS WANTED

DIE SINKER — THOROUGHLY PROFICIENT in all kinds of first-class work. Apply Box 812 Canadian Machinery.

MECHANICAL DRAFTSMAN AND DEsigner desires position, preferably firm where advancement and responsibility is given. Competent chief draftsman with machine shop experience, well educated. Box 810, Canadian Machinery, Toronto. (C.18M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience, 10 years general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery, (c23m)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.





$67.60 Per Year



How much time in a year do you spend soliciting business for your shop? Half an hour a day? All right! Half an hour at a 6-day week comes to 3 hours a week. 3 hours a week at 52 weeks in a year amounts to 156 hours a year.

How much is your time worth—$2.00 an hour? To make sure we'll say $1.00.

That means you spend $156.00 worth of your time each year looking for business. This page is read and considered valuable by the majority of plant superintendents, purchasing agents and managers, both large and small, all over this Dominion. A one-inch card every week with a REAL message in it will do more for you than you can do for yourself. We only charge one-half of what it would cost your business if you were to use your own time.

	Per year	
RATES:— 1 insertion $1.50	$ 1.50	[ ]
26 insertions $1.40 each (every other week)	36.40	[ ]
52 insertions $1.30 each (every week)	67.60	[ ]

Put a cross alongside the space you want to use. Attach your advertisement to it and send it in to us.



Where To Buy Your CASTINGS



The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

HANNA

M-A HANNA & Co.

M.A. HANNA & CO.

Chicago Toronto Cincinnati
Pittsburgh Buffalo Detroit
Philadelphia New York Toledo
Williamsport, Pa.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it . Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
National Electro Products Co., Ltd.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd , Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co of Can., Ltd , Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Pritain, Conn.

BABBITT METAL
Canada Metal Co., Toronto., Ont.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co , Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp , H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, DIE-CAST
Fisher Motor Co., Ltd., Orillia, Ont.

BEARINGS, JOURNAL
Fisher Motor Co., Ltd., Orillia, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
McLaren Belting Co., J. C , Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.

BELT FASTENERS
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Company, Waterbury, Conn.

BELT LACING
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd , Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co , Ltd., Hamilton, Ont
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co , Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co , Madison, Wis.

BRONZE, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.

See "Where to buy your castings" Section Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co , of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Aikenhead-Hardware Ltd., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co , Hartford, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Pritain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co , New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co , Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago, Ill.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Beardmore & Co., Ltd., Wm., Montreal, Que.
Goldie & McCulloch Co., Ltd., Galt, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co , Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N Y
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co , Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

BUSHINGS
Fisher Motor Co., Ltd., Orillia, Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.

Smooth Mfg., Co., Jersey City, N.J...

CEMENTS, IRON
CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can. Link Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can.-Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., land, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS, CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can.-Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

CRANES, TRAVELING
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa

CUTTERS, GEAR
Brown & Sharpe Mfg Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCHLIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond Stephan Co., Hamilton,
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendley Machine Co., Torrington Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton
Wheel Trueing Tool Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W. Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, COMBINATION CENTRE
Preston & Schwartz, Galt, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton,

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchner, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc. E.C., Indianapolis, I.
Norton Co., of Canada, Ltd., Hamilton

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W. Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill.

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.
National Electro Products Co., Ltd.,

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal
National Machinery Co., Tiffin, Ohio
Steel Co. of Canada, Ltd., Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES, LAPWELDED
Beardmore & Co., Ltd., Wm., Montreal, Que.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg. Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence. R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto, Ont.

CRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont
Norton Co. of Canada, Ltd., Hamilton, Ont
Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. P., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

HYDROGEN
National Electro Products, Ltd., Toronto, Ont.

HYDROGENATING PLANTS
National Electro Products, Ltd., Toronto, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can Drawn Steel Co., Hamilton, Ont
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co. E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis
McDougall Co., Ltd., R., Galt, Ont
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Perfect Machine Co., Ltd., Galt, Ont
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis
McDougall Co., Ltd., R., Galt, Ont
National Acme Co., Cleveland, O
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn
McDougall Co., Ltd., R., Galt, Ont

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N Y

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg Co., Providence, R.I.
Can Fairbanks Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Truing Tool Co., Windsor, Ont
Williams Machinery Co., A. R Toronto Ont.

MANGANESE STEEL
Can Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
Petrie, Ltd., H W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O
Kearney & Trecker Co., Milwaukee, Wis
Kempsmith Mfg Co., Milwaukee, Wis
Williams Machinery Co., A. R., Toronto

MOTORS, ELECTRIC
Can Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont

NIPPLES
Canada Metal Co., Toronto, Ont
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio

NUTS, FINISHED and SEMI-FINISHED
Galt Machine Screw Co., Galt, Ont
National Acme Co., Montreal, ue

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto.

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto
National Electro Products Co., Ltd.,

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R I

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can Fairbanks Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont
Petrie, Ltd., H W., Toronto Ont

PIPE
Canada Metal Co., Toronto, Ont
Steel Co of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont
Fittings, Limited, Oshawa, Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc. Waynesboro Pa

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can Fairbanks Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont
Morton Mfg Co., Muskegon, Mich
Williams Machinery Co., A R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont

PLATES, BOILER AND SHEET
Peardmore & Co., Ltd., Wm., Montreal, Que.

PNEUMATIC TOOLS
Beardmore & Co., Ltd., Wm Montreal

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto

POLISHING AND BUFFING MACHINES
J. R Baxter & Co., Ltd., Montreal, Q
Blount Co., J. G Everett, Mass
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N Y

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunldas, Ont.
Cleveland Twist Drill Co., Cleveland, O
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D H., Buffalo, N Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hmilton
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can Fairbanks-Morse Ltd., Montreal, Q
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd. Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, CENTRIFUGAL
Beardmore & Co., Ltd., Wm., Montreal

PUMPS, HYDRAULIC
Can Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchner
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, SEMI-ROTARY WING
Beardmore & Co., Ltd., Wm., Montreal

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Starrett Co., L. S., Athol, Mass

PUNCHES, HAND
Brown, Boggs & Co., Ltd., Hamilton,
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Pertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N.Y.

RECORDERS, TIME
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Fittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Mchinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundaas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q
High Speed Hammer Co., Rochester, N.Y
Parmenter & Bulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Manteral, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E.C., Indianapolis.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Manteral, Q

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q
Starrett Co., L. S., Athol, Mass.

SAWS, MILLING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Islnad, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Islnad, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, One.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Moutreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SECTIONS, SHIP AND BOILER
Beardmore & Co., Ltd., Wm., Montreal, Que.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS, HAND
Can. Blower & Forge Co., Ltd., Kitchener.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Pertrams, Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

SHEETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B.A. AND BLUE ANNEALED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Bisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
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Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

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Parmenter & Bulloch Co., Gananoque, Ont.

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British Empire Steel Co., Montreal, Q.

STEEL AND IRON BARS
Steel Co of Canada, Ltd., Hamilton.

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British Empire Steel Co., Montreal, Q

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
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STEEL CASTINGS
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United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

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Steel Co., of Can., Ltd., Hamilton, Ont.
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Williams & Co., J. H., Brooklyn, N.Y.

STUDS
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BUYERS' DIRECTORY

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Geometric Tool Co., New Haven, Conn

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Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Lufkin Rule Co., Windsor, Ont.

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Geometric Tool Co., New Haven, Conn.
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National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
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Starrett Co., L. S., Athol, Mass.

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Morse Twist Drill & Machine Co., New Bedford, Mass.
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Cook Co., Asa S., Hartford, Conn
Gisholt Machine Co., Madison, Wis
National Acme Co., Cleveland, Ohio
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Canada Foundries & Forgings Co., Weland, Ont.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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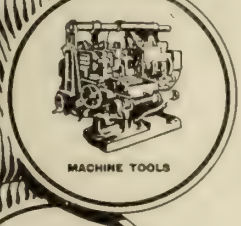


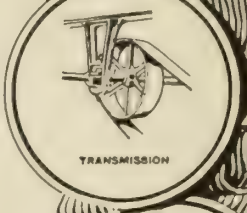


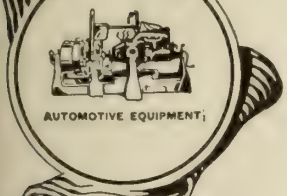


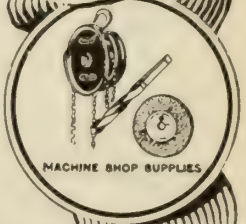






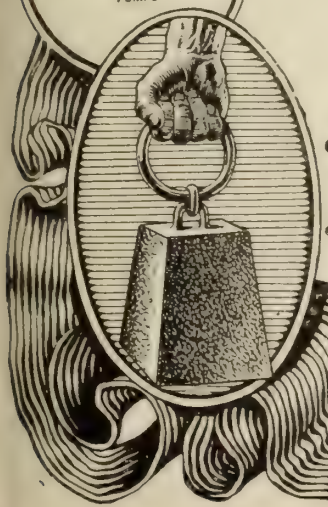












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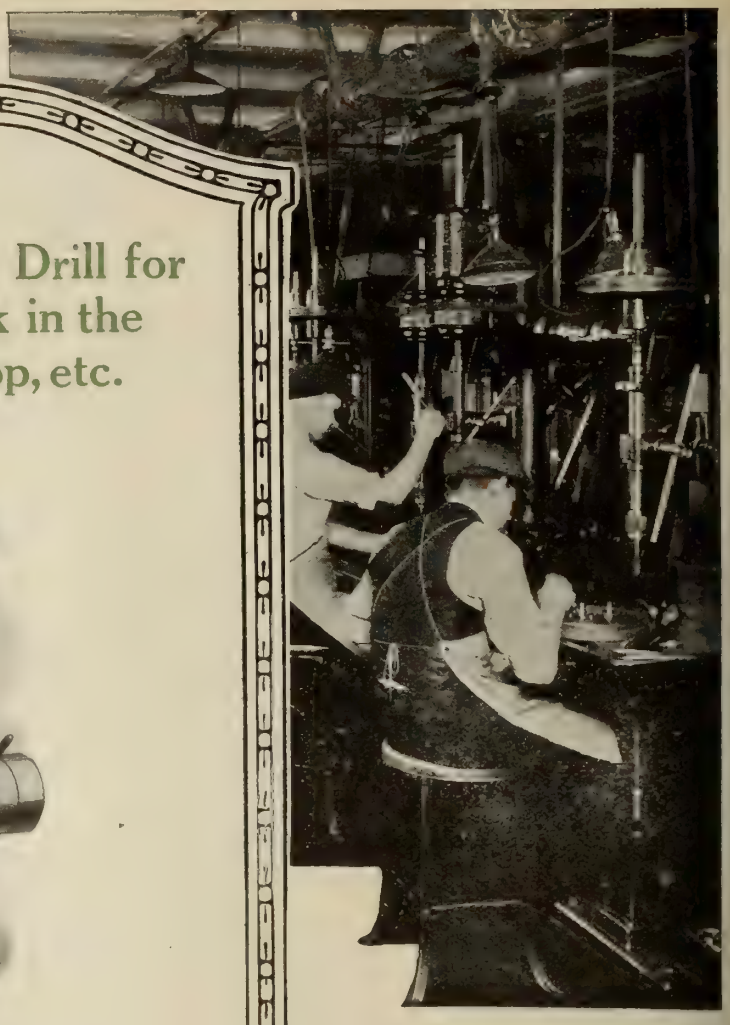
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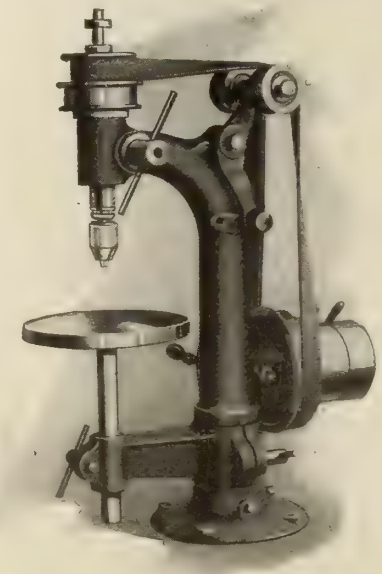
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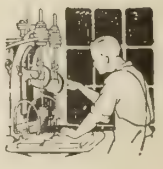
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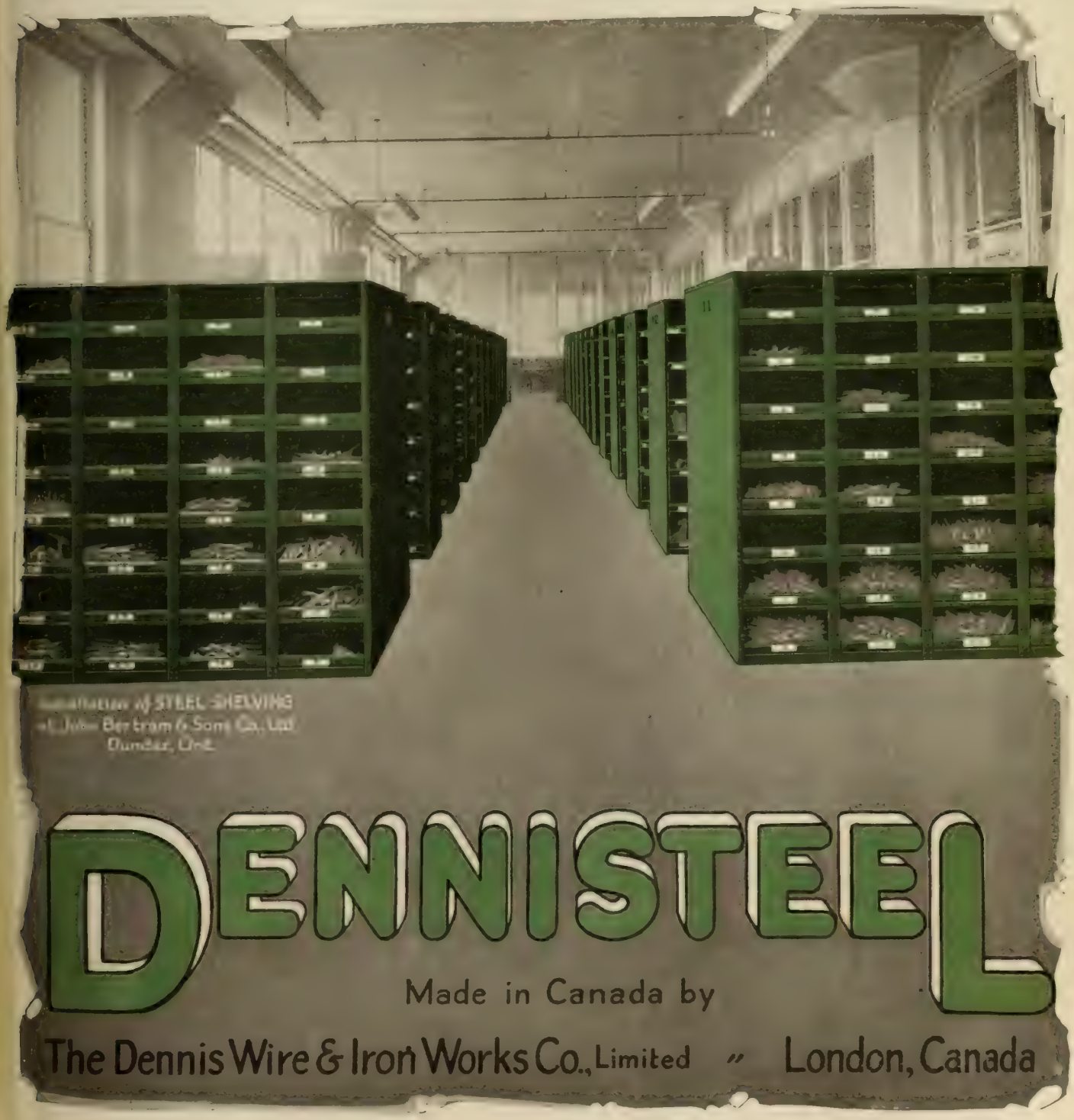
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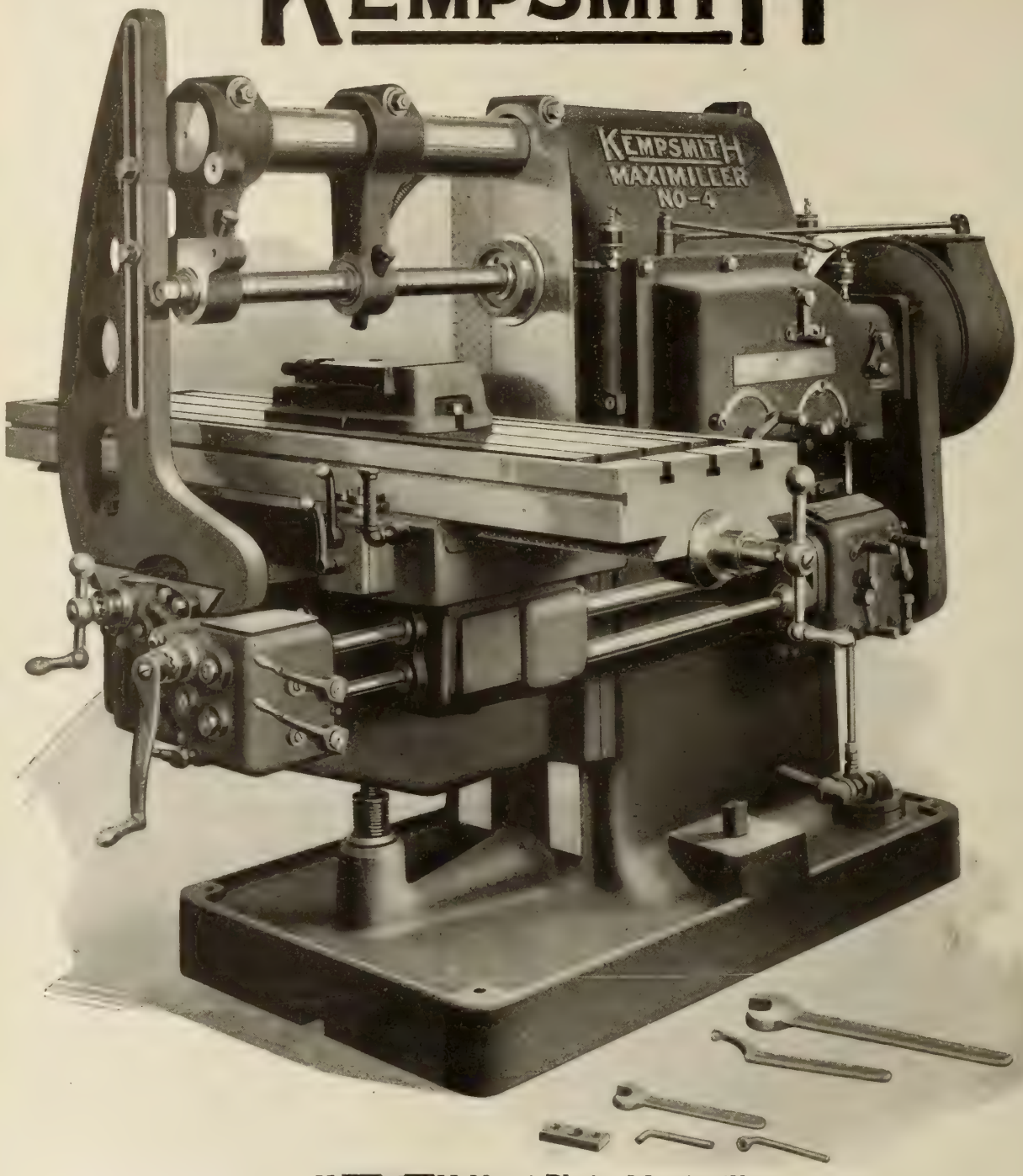
CANADIAN MACHINERY AND MANUFACTURING NEWS

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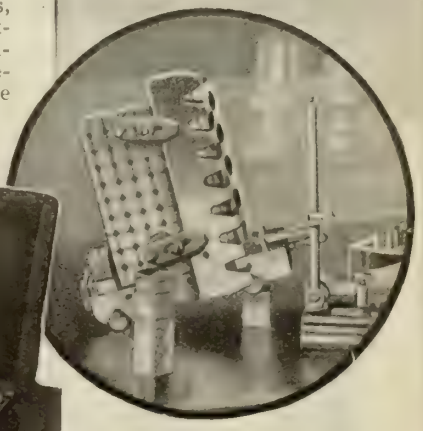
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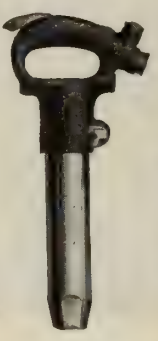
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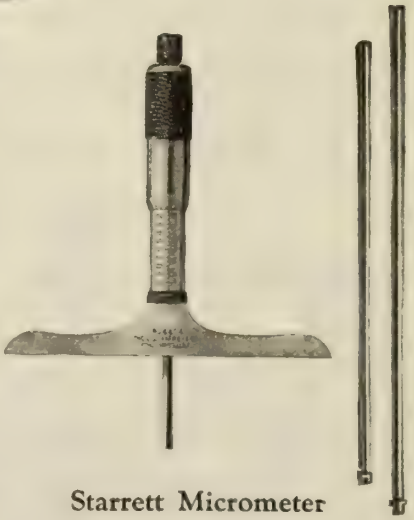
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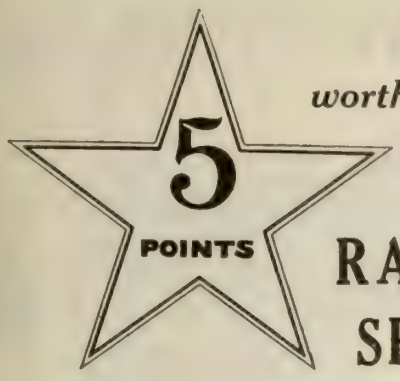
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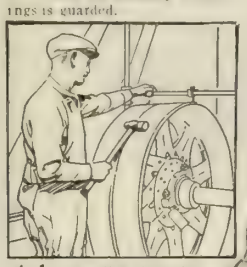
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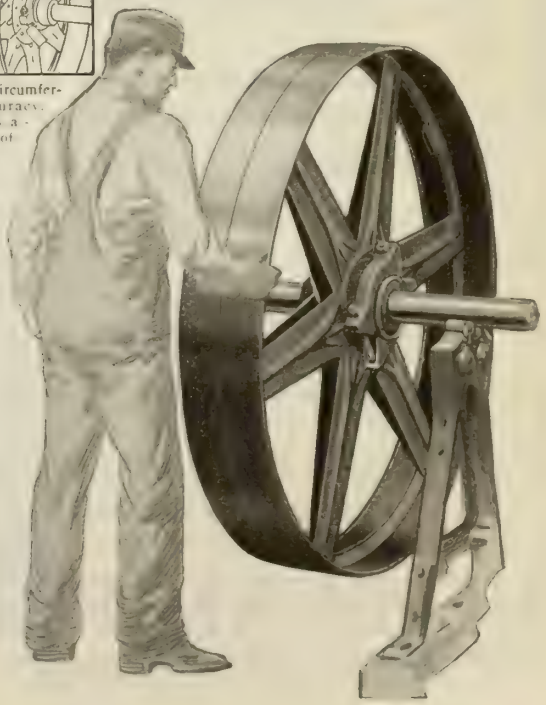
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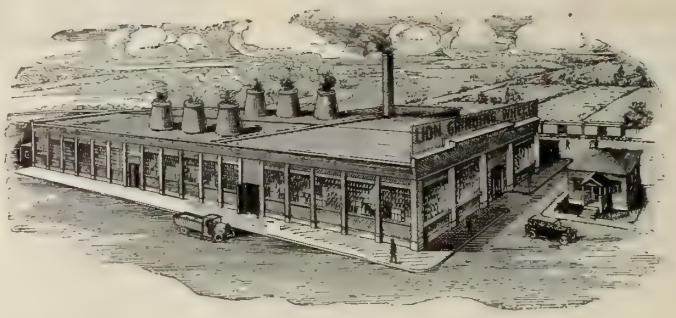


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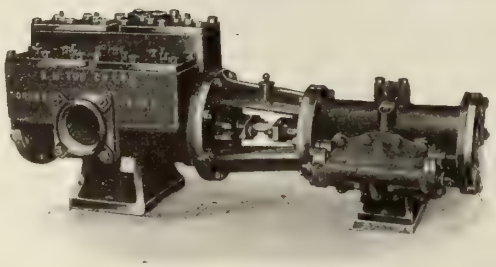
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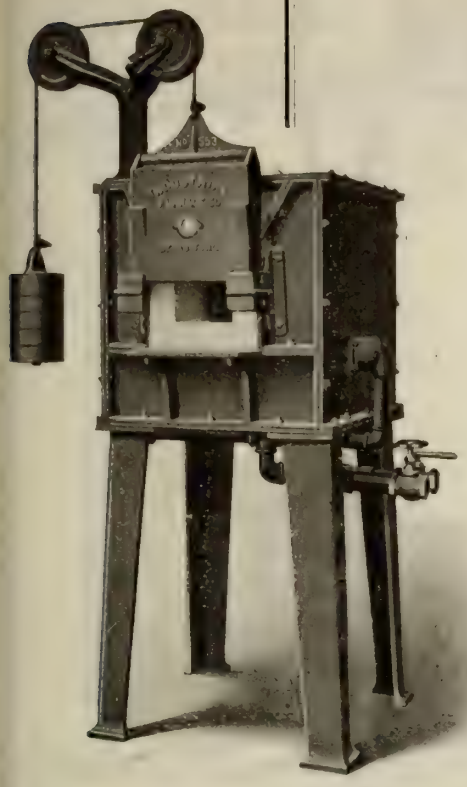
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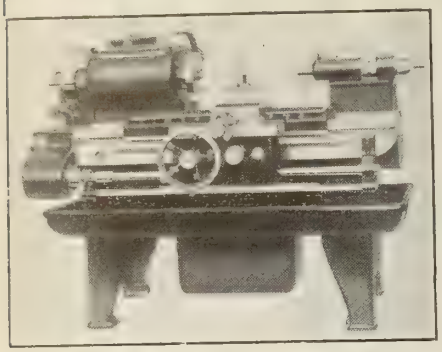
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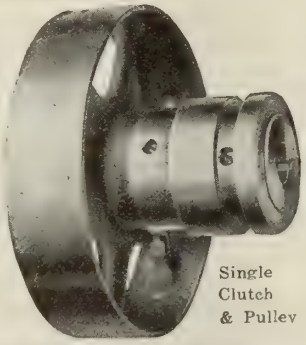
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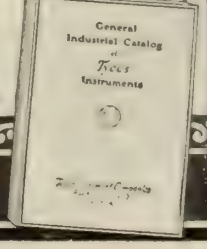




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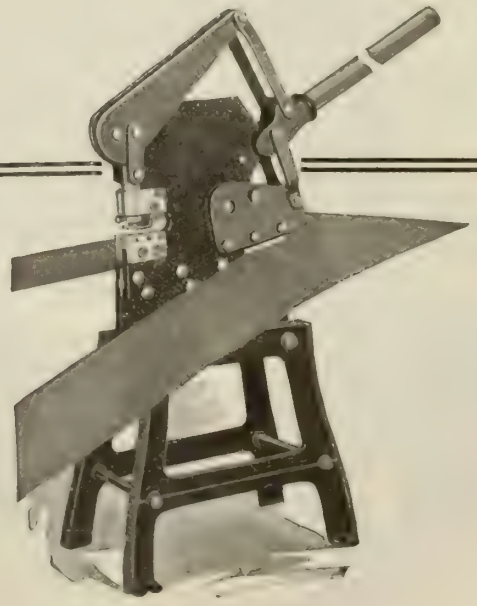
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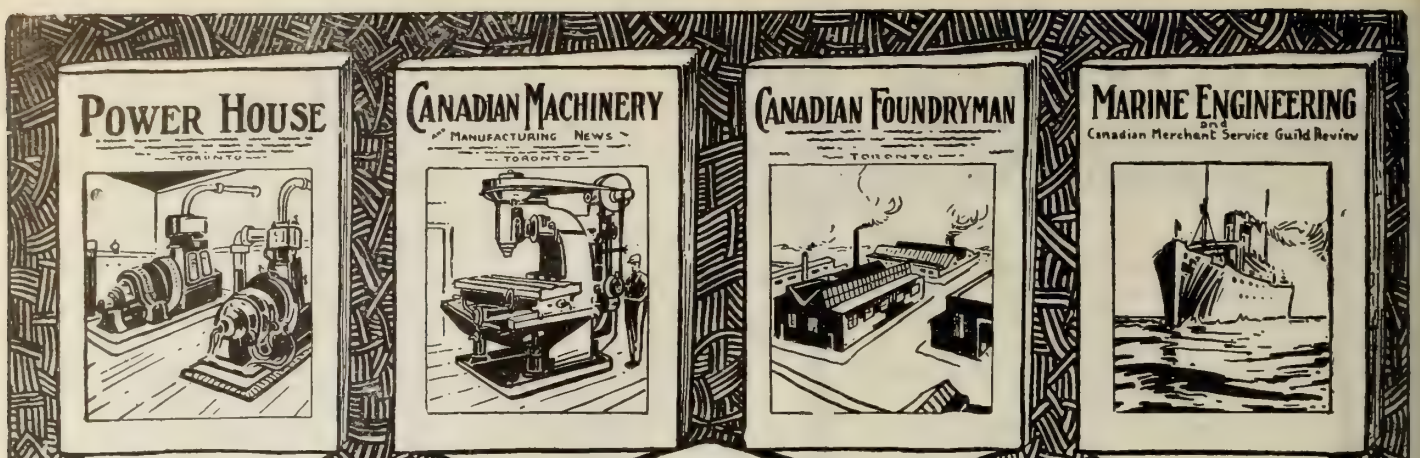
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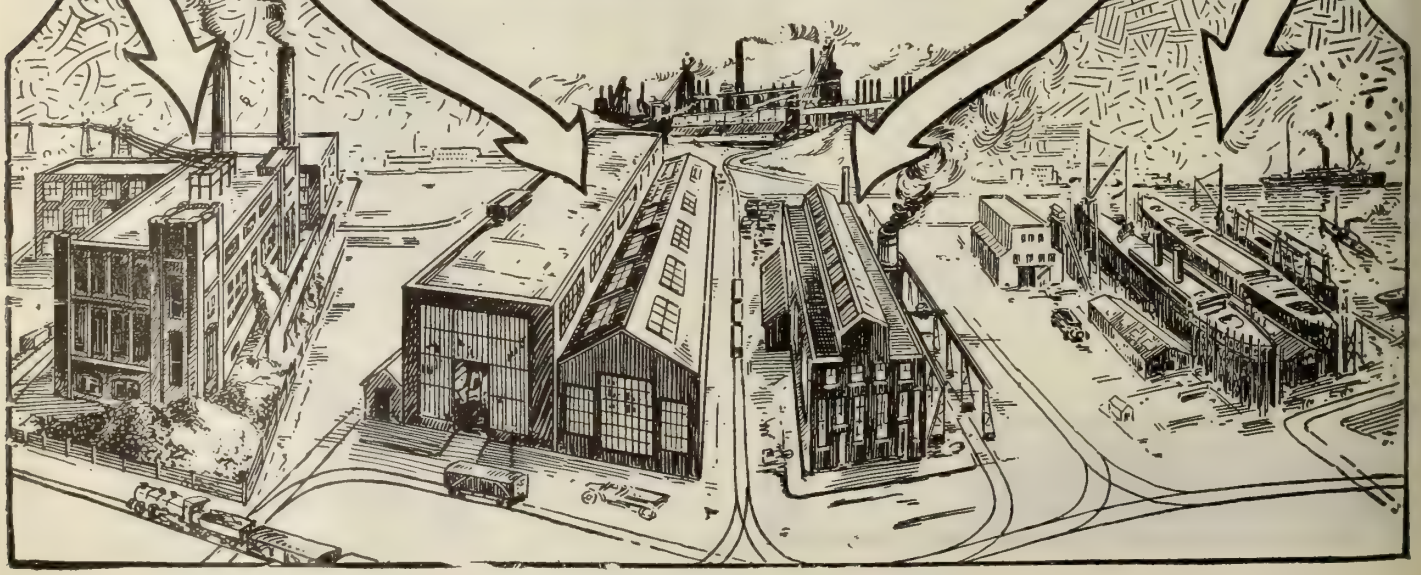
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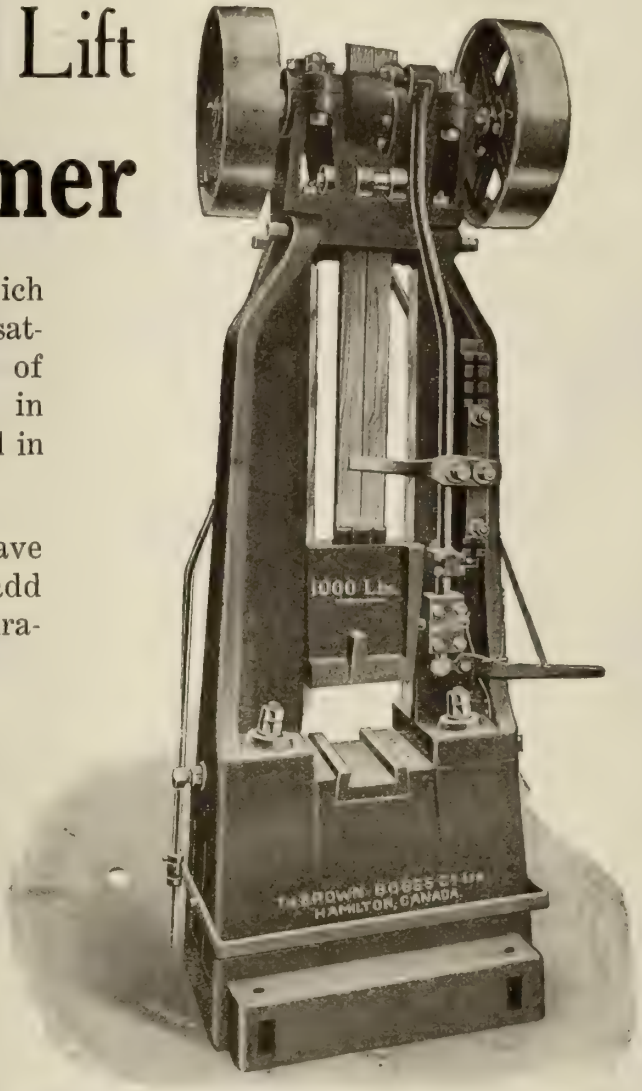
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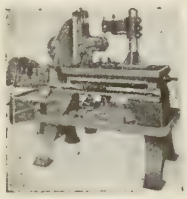
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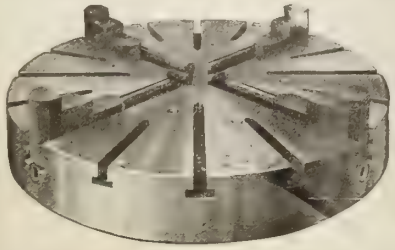
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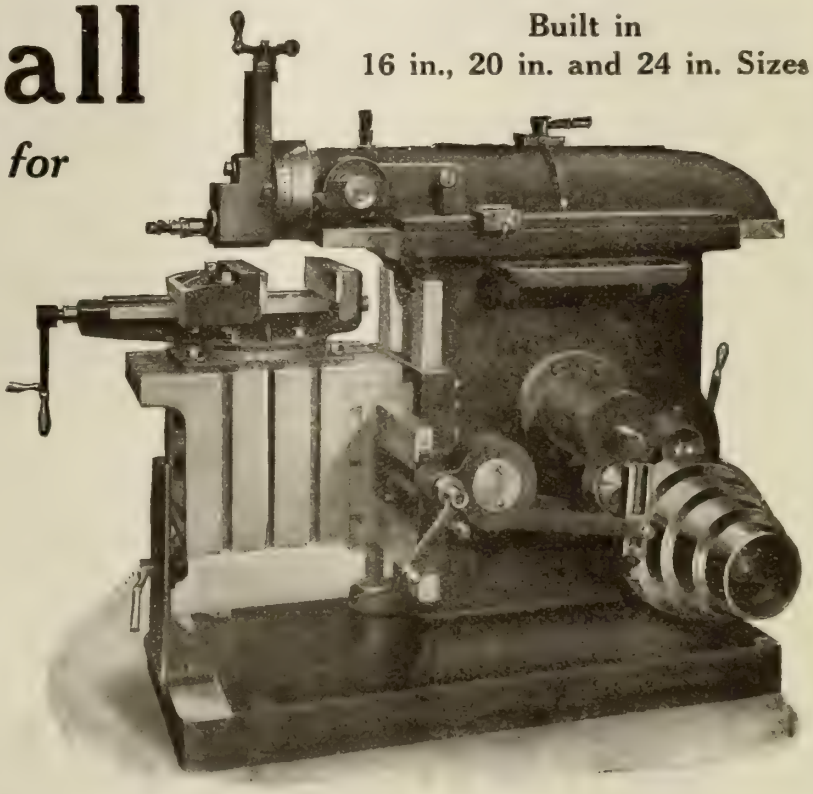
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MANUFACTURING NEWS

Vol. XXVII. No. 24 JUNE 15, 1922

Overcoming Heavy Costs of Belt Maintenance

Transmission Problems Should be in Charge of Competent Man —Inspection Should be Made Regularly—Importance of Proper Alignment—Lacing of Joints Should Be Carefully Performed

By J. H. RODGERS

ECONOMICAL production under modern competitive conditions is largely a matter of getting the most out of plant and equipment. Machinery, tools and appliances are for the most part carefully purchased and industriously kept in good working order after installation, yet in mills where the greatest care is exercised in the constant maintenance of machinery, little or no attention is paid to the upkeep of transmission belting. The result is a loss in power and production so serious that it frequently causes a very appreciable loss in profits. Satisfactory operation of any system of mechanical power transmission depends upon the care with which the belting equipment is selected and cared for after installation. Yet so general is the efficiency in most mills that the extent of loss in production through this item is seldom realized.

Saving Wasted Power

The power that is produced is that actually delivered to the machine pulley—and the power that is costly is that which is lost somewhere between the boiler and the belt on the driven pulley. Much of this wasted power can easily be saved by constant, careful attention to the upkeep of the transmission system. A good share of power loss is caused by neglecting to keep belting in first-class condition; by failure to tighten loose belts, to dress dry belts and to repair worn-out belts. Part of this failure is due to the fact that the loss is not often recognized by mill superintendents and master mechanics. The greater part, however, is due to the fact that anyone in the average mill looks after the belts on his own machine or in his own room.

Supervision of Belting

No one would think of running a mill without a competent man to take charge of and repair machinery. Why then expect the belting on which those same machines are directly dependent to operate with little or no skilled attention? The first move to cut down transmission costs, reduce power losses and eliminate break-downs should be the placing of one man (on each shift, if necessary) in complete charge of all transmission equipment—shafting, pulleys, hangers and belting. Put him in absolute control and hold him to the responsibility. Allow no installation changes, repairs, or dressings except by him or under his direction. This arrangement is advisable for two reasons. First it insures the equipment of constant attention so that repairs are made when needed and not two weeks later as is often the case. A stitch in time is particularly true in the case of belting. Then second, it ensures, so far as may be, uniform treatment of the belting—a very desirable factor in increasing belt-life and in lessening the chances of breakdowns and lost production.

Experienced Supervisors Necessary

When possible, it is desirable to put an experienced man on the job, but where this is impossible, a man should be selected and given a short course of training in a belt factory, where he will learn how to make laps, take up belts, repair and dress belts, etc. A week or ten days in any good belt shop will go a great way toward transmission efficiency in the mill. Most belt manufacturers are glad to allow a man to spend this time in the factory, learning the rudiments of belt making. A mill should be provided with the necessary equipment for doing all ordinary

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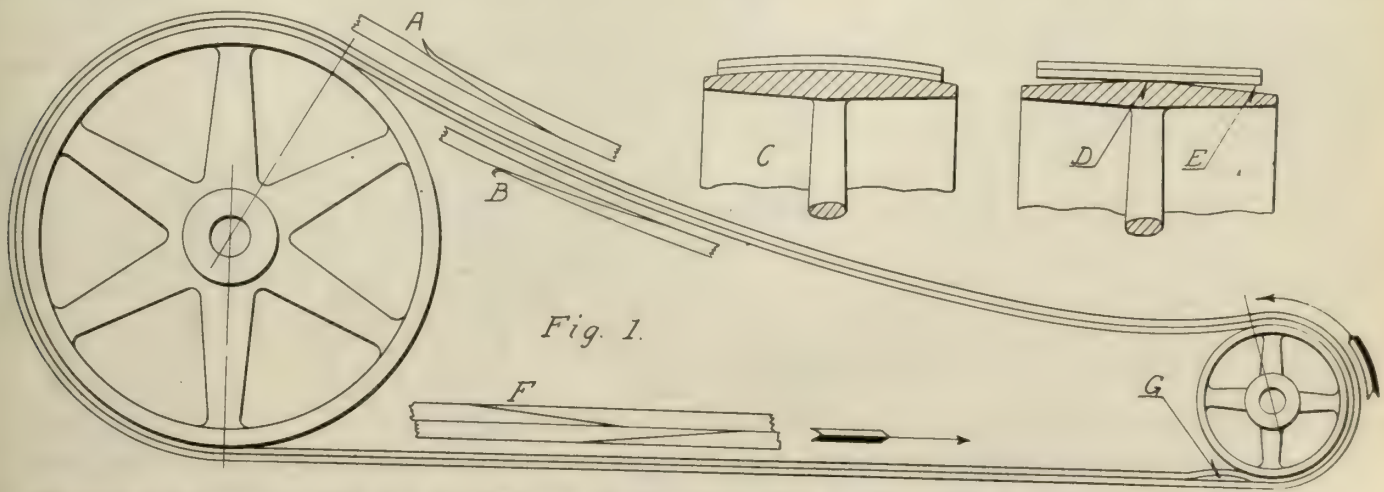


Fig. 1.

Fig. 1.—A, thin edge of lap curling from air pressure. B, curl from pulley contact. C, proper method of crowning pulley. D, avoid sharp crown. G, ply lifting due to creep.

belt work—breakdowns and tie-ups are too frequent and too expensive to depend on outside repairs. The tools ordinarily required are clamps and rods (for holding belt when cementing endless), belt scraper, belt shave, slicker, spoke shave, hand punch (for lacing holes), cement, brush, and kettle for melting the glue. These tools can be supplied for a reasonable amount from any mill supply dealer or belt manufacturer.

Regular Inspections Needed

After placing your belt man in charge, see that he makes a regular inspection of every belt in the mill at least every two weeks. This systematic inspection should cover such points as general conditions of belt, need of dressing or of cleaning, tension, condition of laps and joints, amount of belt slip, amount of wear, etc. Pulleys and shafting should be carefully watched to see that they are in strict alignment. In many mills it has been the practice to have regular reports made of such inspection—but this does not always pay, except in the case of large mills with hundreds of drives. Experience has proved that constant, systematic inspection of all shafts, belts and pulleys, by a competent man, followed up by prompt attention to all necessary repairs, will reduce belting bills from 10 to 20 per cent. while practically eliminating any unexpected delay through faulty power transmission. All trouble with the belting in the plant should be immediately reported to the belt man, and he should be held responsible for the continuous operations of every machine in the mill.

The second point in economical operation of a power transmission system is the standardization of belting for each drive. This merely means that for every drive there is one type, brand, ply, width and weight that will work out most efficiently. Find out as nearly as possible what that belt is—and order it for that drive when necessary. The standardizing if applied with a fair measure of common sense and not carried to extremes, will amply repay the time and effort on it.

Belting should be purchased with the due regard to the mechanical and physical condition of the drive. The main things to keep in mind when ordering belting are; diameters, faces and speeds of pulleys, type of drive (open, crossed, vertical, etc.,) centre distance between pulleys, load to be carried, and the atmospheric conditions (dust, steam, fumes, etc). Pulley diameters control the weight or thickness of the belt to be used; belt speed controls the power that can be transmitted by the belt; load to be carried determines belt width; type of drive and physical condition determine the type of belting best suited.

Nor is it always necessary to specify first-quality belting of any particular type. Where the work is light or the pulley large or the speed low, second quality belt can often be used with just as satisfactory results as higher priced brands. When the best type, ply, width and weight for any drive have been determined by the belt man, make a record of it for the use of the purchasing department or for the superintendent. Always specify the standard instead of "using what you have left over" from other work—it pays better.

Proper Tension

The third item to watch out for is belt tension. The tightness with which belts are put on pulleys is of prime importance. If a belt is too tight, there is a large loss of power from excessive friction at the bearings, to say nothing of the fact that the belt itself is overstrained and weakened. On the other hand, if a belt is too loose, it is liable to flop around and jump from the pulley, particularly when working where a load is suddenly thrown on or off. If too loose, there is sure to be unnecessary slip and loss of power as well. When belts are installed and taken care of by one man, the errors of too tight and too slack belting should be avoided and a uniformity of tension will result, which could not be secured as easily in any other way.

Aligning Shafts and Pulleys

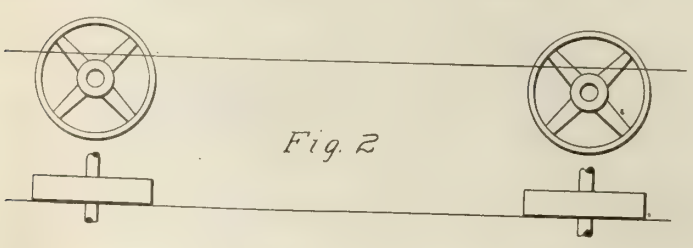
Fig. 2 shows a simple method of lining up two pulleys. The operator, with a helper, takes a piece of cord and stretches it from the outside edges of the two pulleys just above the shaft or hubs if the latter extend beyond the edge. With this method it is understood that the shafts have been lined up previously and that the pulleys run true. When using the string it is well to try the pulley in several positions to allow for any irregularity in run of the pulley.

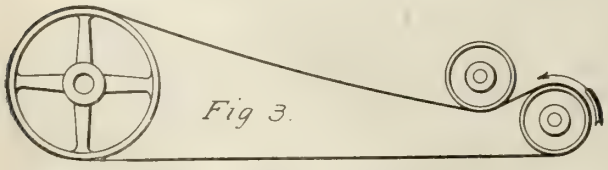
Crowning of Pulleys Important

Steady running of belt is essential to effective transmission. For continuous drives, belts are generally run on pulleys that are very little wider than the belt, and to maintain its position in the centre, the pulleys are invariably crowned. This crowning usually consists of two straight tapers meeting at the centre of the pulley face. The amount of the taper varies from ⅛ to ¼ inch per foot; that is, a pulley 12 inches wide would be about 1-16 inch larger in diameter in the centre than it would be at either edge. In a straight taper crown, however, it will be seen that the apex D, Fig. 1, forms a definite or pronounced breaking point; nothing very serious possibly, but with a tendency, especially in new and heavy belts, to provide an air space at the edges E. A better plan of pulley crowning is that shown at C, where the surface forms an arc; this method equalizes the bending stresses throughout the width of the belt and makes the surface contact more uniform.

Preparing Belt For Lacing

One of the essential factors of a belt joint is that the ends should be perfectly square with the run of the belt, to assure its smooth running. When cutting a belt the use of a try square, as shown at A, Fig. 7, is always advisable. Without such a tool the tendency is to make an angular cut as at the right, so that when the joint is made it has the appearance as illustrated at B. When passing over a pulley the belt develops a tendency to oscillate, and such a condition is very much aggravated when the belt is running a little loose. To prevent it jumping off, a stick is frequently secured to some rigid support and extended down at the side of the pulley.





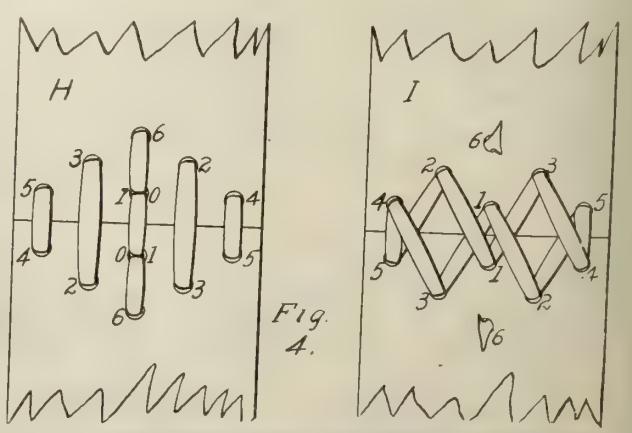


Fig. 2.—Aligning pulleys with string. Fig. 3.—Position of idler. Fig. 4.—Showing effective method of lacing belt, straight lacing on pulley side.

This, however, provides only a temporary remedy for a previous fault, as the weakest portion of the belt—the laced joint—is continually brought into violent contact with this "guide" and eventually the efficiency of the drive is destroyed.

Making a Laced Joint

In making a joint it is advisable to use a thin lace in preference to a thick one. This coincides with what has been said on belt contact, as it is clear that the thicker a lace is the less will the contact be when the joint is passing around the pulley, and in addition the jar will be all the more pronounced. When making a joint the straight lacing should be made on the pulley side. Owing to the different widths of belts no fixed rule can be applied for lacing, but in general the method may be the same for every case. Holes should not be closer to the edge or end than one-half inch, with centre holes spaced accordingly. The best practice is to commence at the centre and work out and back on each side. As a guide the illustration Fig. 4 is given. Starting at 0 and 1 the order is as follows: 2, 3, 4, 5, 4, 3, 2, 1 or 0, both sides of the centre being identical; the locking is performed by passing the free end through a small hole 6, and cutting a short slit to form a hook that will prevent the lace from coming out. This lock should be on the outside of the belt. After the joint is made it may be lightly hammered down with a wooden mallet.

Use Small Lace Holes

It must not be taken for granted, however, that all one has to do is to cut off a piece, punch a few holes and secure again with a lace, to obtain an effective drive. The fundamental details of a properly made joint may often seem of little import, but the subsequent operation of the belt may depend, very

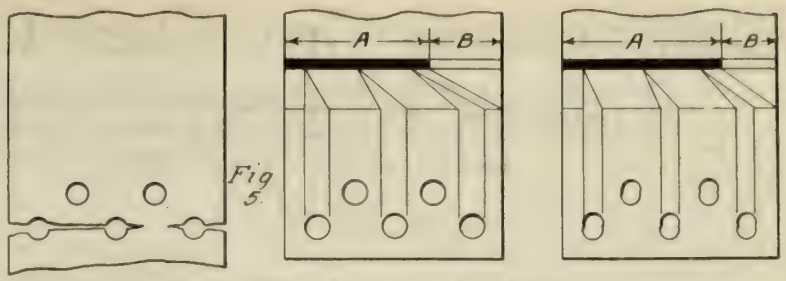


Fig. 5.—Effect of having lace holes too large.

largely on the consideration given to these apparently insignificant matters. When making a repair to a belt the beginner will usually make the lace holes of large size as indicated at centre of Fig. 5. The inevitable consequence of such practice will be that shown below at the left. With very few exceptions, a belt will tear across the lace holes and seldom will fail in a direction parallel to the belt length. For this reason it is imperative that the amount of the leather cut be kept as low as possible, consistent with the size of the belt and the thickness and width of the lace. Where it is necessary to enlarge the holes it should be done as shown at the right. This is obvious when comparing the resultant efficiency of the belt in each case. The short light space indicates the portion of the width cut away by the holes and the dark portion the effective section of the belt.

The best side of the belt to run upon the pulley appears to be a debatable question, as many favor the hair or smooth side, while others prefer the reverse. However, as the efficiency of a belt drive relies on the frictional contact between the surfaces it would seem practical that the smooth side would have the preference. Another factor in its favor is that of the recognized fact that the portion of the belt best suited for tensile strength is near the flesh or rough side, and the hardest side best adapted for the compression action; these features being quite evident when belts are operating on small pulleys.

It is evident that the slacker a belt can be run, up to a certain point, and do its work satisfactorily, the greater the economy. In installing belting and in taking it up, consideration must be given to the fact that certain kinds of belting are affected by atmospheric conditions, lengthening and shortening according to the amounts of moisture in the air. Water-proof leather belting, properly made, does not stretch much even when working in most air for a long period. The best tension at which to operate a belt is that at which the belt will carry its load easily without straining and with a minimum of journal friction. Operate all belts just as slack as possible without slipping. When it is necessary to operate a leather belt tight on a drive to carry the load, that is a sure indication that there is something wrong with the drive which should be investigated and remedied.

High Tension

With an intermittent load, or one which varies greatly, it may be necessary to instal and operate belts at high tension. Bearings and shafting of course play a part in the amount of tension which can economically be used. For example, a belt can be installed with a greater tension on a self-aligning bearing than on a rigid pillow-block bearing. Again, a belt can be installed at a greater tension of a 23/16 in. shaft than on a 15/16 in. shaft. Belts which operate under a heavy load or which are travelling at high speed, usually require taking up every six months or so. Failure to do this means great waste of power through belt slip. When a belt runs suddenly to one side, after running straight for some time, it may be laid to sudden overload, or belt too loose. It may be necessary to reduce the load and tighten the belt. Where the required tension cannot be secured normally, idlers are used, both to increase the arc of contact, and to increase the tension. See Fig. 3.

Fourth: Eliminate injurious dressings and use a little good dressing sparingly. This is perhaps the most neglected item in the care of belting—and one of the most important. Belt dressing is necessary either when a belt is slipping badly for no apparent reason or when in the case of leather belting the natural oils have dried out of the leather, leaving the belt dry and harsh.

(To be continued)

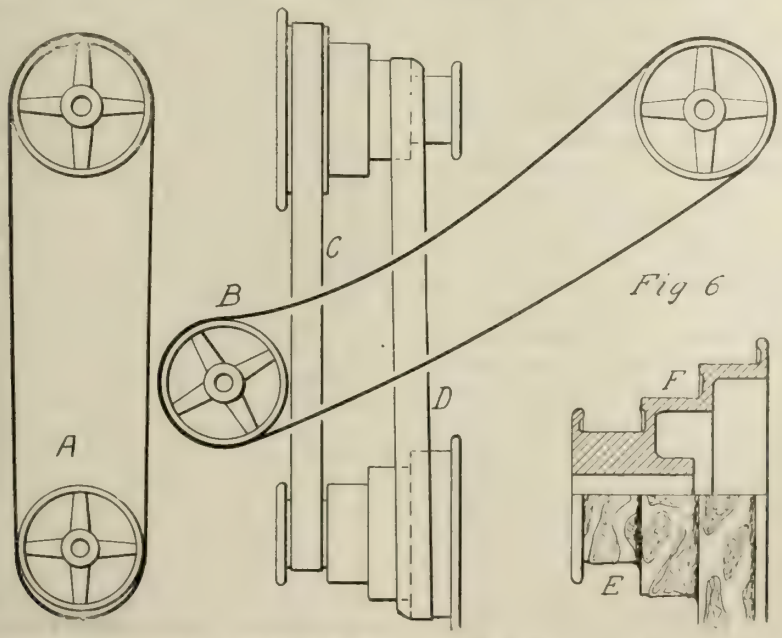


Fig. 6.—Vertical belts must be kept tight. D shows a serious fault on cone drive. E shows abnormal use of belt dressing.

Manufacturers Give Their Views on New Tax

Consensus of Opinion Seems to Be Sales Tax Will Not Make Much Difference—Stamp Tax is Not in Favor—One Plant Owner Does Not Like Value Basing of German Money.

"WE DO NOT BELIEVE the tariff sales tax will make much difference to our business," writes George A. True, president of Northern Crane Works, Walkerville, Ont. He continues: "We think all of us here are much in favor of the sales tax, as compared with the profits tax. The taxes have to be raised some way and it seems to us that the sales tax, if intelligently levied, is the best possible tax. We do not believe it will interfere with Canadian business at all, nor do we think it will cause an increase in importations compting with the Canadian manufacturers.

"We cannot say so much about the proposed stamp tax. We think it is unwise in the first place to increase the stamp tax and we think the method of levying it is open to decided criticism. There should be a reasonable limit and we cannot see the consistency of increasing this tax and applying it in a manner in which it is proposed to apply, especially to transfers of stocks, shares, etc.

"The exchange of these securities is just as legitimate in a line of business as exchange of material or commodities. There is perhaps justification for some reasonable stamp tax thereon, but as drawn we think you will find with its practice a great many absurdities. We have not forgotten the fiasco in reference to the 'marking act' put into effect last year. We predict there will have to be similar 'modifications' in the stamp act."

A. T. Enlow, president of the Dominion Sheet Metal Corporation, Hamilton, says: "The change will, of course, affect our business as every other business, but in our estimation it is fair and equitable and while a good portion of it will be passed on to the consumer, we as consumers will also stand our share and we do not believe that Canada will ever struggle out from under her war debt unless all contribute in fair proportion to the payment thereof.

"In our estimation there is no better way of reaching all the people in proportion to their means and their purchases than by a sales tax, and while we are not enthusiastic about any kind of a tax, we have not been able to conceive of any plan which would be in the end less injurious or more beneficial. It is true that certain classes as producers properly receive exemption, and we believe that there is no reason why as consumers they should hesitate to pay their share of the tax burden.

"Not only in this connection but throughout the whole budget, we believe that the Minister of Finance has been prompted by not only good motives but wise experience, and from our viewpoint good times which are coming back will not be impeded in the least."

"We cannot say at the moment that the new sales tax will have any striking effect on our business," says P. H. Cooke, sales engineer for the Norton Co. of Canada, Hamilton, Ont. "While it is a law which will increase the cost of our commodity to our customers by the amount of increase of the tax," continues Mr. Cooke, "at the same time it is a law which will affect our customers in selling their own commodities. Once understood and correctly interpreted by everybody, we do not see that in itself there will be any tendency to add or subtract from our sales volume.

"We find, however, that there are several interpretations of the law. The thing most desired is to understand it properly and apply it as it is intended. In this way there should be no cause for any difficulty."

A. J. Oliver, secretary and manager for the R. M. McDougall Co., Galt, says:

"We cannot see why the new sales tax will make any material difference in business. It appears to us," he continues, "that this way of raising money is just about the easiest way that the government could take. The only thing that we could see would be better would be a general sales tax which would require to be as heavy as the present excise tax. The money has got to be raised, and with the sales tax we all help to pay it and it is certainly a very simple tax to collect for if a person does not pay to-day they are liable to do so the day after to-morrow, as no doubt auditors put in periodical appearances."

F. E. Mutton of the International Business Machines Co., Toronto, takes a different view of the matter. He says: "One outstanding feature in the recent budget is the government's apparent decision to allow German goods into Canada, basing the duty value on the present market value of German money. This to the writer is a very serious situation. It means that the duty value of the German imports would be less than half of the factory cost of the article, for the reason that the German mark at present is worth about only one third of a cent and if the government do not change their attitude it must certainly mean the putting out of business of many important industries in this country. We, of course, do not know at present writing just how serious this would be to us, but it could become very serious."

F. J. Lavery of Brown Boggs Co., Hamilton, states: "It is a little early yet to say just how the sales tax will work out as there is some indecision on the part of the manufacturers regarding same. It will take a little while to know where we are at," continues Mr. Lavery, "but, of course, on the whole, it is the same old story, that the consumer has to pay the piper. The country has got to have revenue, and apparently this is about as easy a way of distributing it among us all, as any they can devise. We do not think the extra amount of tax is going to have any bad effect on business in general, as the small addition will not deter any one from buying, who actually requires the goods, and with the outlook for a good crop this year, the Canadian people are becoming a little more optimistic."

"There is no sales tax on either raw sugar coming into Canada being sold to us, or on sales made by us of refined sugar," says John D. Lowry, of the Atlantic Sugar Refineries, Montreal.

"There is however, an increase in the tax on certain supplies used by us, such as bags, etc., and this will tend to make it a little more expensive for us to turn out our finished product," concludes Mr. Lowry.

"In the writer's opinion," says T. P. Howard, of the Howard Smith Paper Mills, "the new tariff sales tax will not make very much difference, as we simply have to pass it on to our customers and will, undoubtedly, be handed down until eventually it is paid by the consumer as is the case in all such taxes. We do think, however, that the stamp tax on cheques should be on a flat basis; that is for example—3c on all cheques up to $100.00 and a sufficient tax above to realize the necessary revenue."

"We have had quite a number of complaints from our customers on the new sales tax," remarks E. M. Jones, general sales manager for W. H. Banfield and Sons, Toronto, "and there seems to be a feeling that the manufacturer should reduce his price in order to compensate the middle-man for the tax. On some of our lines we have a certain resale price and we intend to increase the resale so as to be able to compensate the middleman for the difference. On some of our lines, unfortunately, we cannot do this. The situation is so new that we have hardly anything we can say on the subject at this time."

A. E. La Belle, vice president of the St. Lawrence Flour Mills, says: "I have personally been right along in favor of a sales tax which is the most equitable way of reaching everybody. We know that we have a heavy debt to pay and by a sales tax, those that buy much pay more, and those who buy little pay less."

C. W. Sherman, president of the Dominion Foundries and Steel Co., Hamilton, Ont., says that they rather favor the sales tax as a means of getting revenue for the government. It is a mat-

(Continued on next page)

How Do You Issue Drawings to the Plant

Conditions Will Determine the Most Effective Method—Choice of the Detail or Assembly Drawing—Single Operation Sheet Has Many Good Points—Use of Data Cards

By HUBERT BENTLEY, A.M.I., Mech.E.

AT ONE time or another, the question of "the best method of issuing drawings to the works?" has no doubt been asked in the majority of engineering works, both large and small. The answer depends on a variety of circumstances. Unfortunately the efforts of the drawing office to introduce a new system are too frequently turned down, while expenditure on works equipment is on a lavish scale. Where the question of reducing production costs has been seriously considered and where in recent years specialized quantity production has been the basis of manufacture, the issue of the necessary drawings to the works has come in for more consideration and deservedly so. Up-to-date methods in the issue of the works drawings are essential to success in both drawing office and the works. While the majority of firms nowadays issue drawings in some form or other to their workmen, very frequently, these are of such a nature as to cause a serious waste of time in seeking explanations and additional information. Many firms have adopted the single operation drawing which is described later, and its effectiveness for assisting successful manufacture has been repeated y proved.

Methods Usually Adopted

The three principal ways in which the drawing may be issued to the works may be described as (1) the assembled detail drawing, (2) the tabulated drawing, (3) the single-operation drawing. The first of these is the oldest and most common method, and the drawing is usually issued in the form of a blueprint or photoprint. It would comprise an assembled drawing of some unit of the machine—in the case of a milling machine, say, the gearbox or the table, and may give, in addition to two or three views of the assembled unit, one or two parts in separate detai ; but all on the same sheet, and fully dimensioned. The tabulated drawing has been adopted by many firms engaged on small repetition work. It comprises the drawing of a single detail which, while made in a range of sizes, does not differ in design. Instead of inserting figured dimensions in the drawing, letters are used, and a suitable table placed under the drawing gives the sizes corresponding to a given letter, and for each size of machine built. These tabulated drawings are generally in the form of blueprints or photoprints, and frequently mounted on cardboard, and being smaller than the assembled detail drawings, are much more convenient to handle. The single operation sheet, the latest innovation, is clearly a product of specialization. It gives the drawing of a separate detail, with just the necessary dimensions and information to enable the operator to produce speedily. The single operation sheets may also be issued as blueprints or photoprints, but more frequently these drawings are issued on cards convenient for filing.

Which is the Best?

The character of the work, of course, should be the deciding factor in choosing any of these methods. Where only one or two machines are to be produced at a time, or in the case of some special attachment that is being built, the assembled detail drawing would be the most economical. But when the parts are to be produced in bulk, the extra time spent in the preparation of either tabulated drawings or single operation drawings will be more than justified; the latter being the ideal arrangement, and the one which we are to describe more fully. While pointing to the large amount of time taken up in the preparation of the initial drawings for the single operation cards, those firms who have recently introduced same are more than satisfied with the smoothness of working that follows in the shop. The great advantage of the separate drawing is its tendency to minimise mistakes and time wasting. The workman has the information before him that he requires for turning out the job. He has not, as in the assembled drawing, to sort out the detail he is machining, with a consequent wait for the charge-hand to make something clear, nor has he even to read figures from the columns of a table, both of which methods are conducive to mistakes if the operator is not careful. Where a limit system is being worked, a separate drawing lends itself much better for the indication of the various degrees of finish required. The fact that separate drawing can be worked well in combination with a costing system is another point in its favour.

Specification Cards

In various works the writer has in mind, in which the machines are built on a quantity basis, these separate drawings, are issued on small white cards. The card has the following printed headings; type of machine, size of machine, operation, quantity required. The information required by these headings is filled in by hand. When issued to the works this card is enclosed in a transparent envelope, and each machine is provided with a conveniently placed stand for holding the card, and so preventing unnecessary handling. The sectional charge-hand gives out the card for the next job in good time, and when ready for commencing, the turner, planer, or whatever operator it may be, takes the card to the works office and receives a suitable time card, on which the clerk has filled in the printed information from the drawing card, as well as the name of operator and number of machine. A time recorder is employed for booking the time of commencing. On completion, both the cards would be taken to the works office and the time recorded on the time card. Suitable reference data is taken from the time card and re-entered on various cards in the works office, each colour of card indicating a type of machine manufactured, and facilitating quick reference. On handing in his cards for the completion of a job, the operator will also have his card for commencing the next.

While methods similar to this described, are in vogue in the large works, where quantity production is normally the usual routine, in the writer's belief, it has not yet been seriously considere by the vast array of medium-sized engineering works, whose stock orders may be no more than one or two dozen. That in such cases as these the separate drawing can be efficiently employed, and considerably assist output, there is no reason to doubt.

Editors Note:—As considerable cost is involved in this department of engineering work, we would like to have the opinions of those readers who have had experience of this nature. Mr. Bentley, as well as the questioner, would appreciate the views of other production engineers.

MANUFACTURERS' VIEWS ON NEW TAX

(Continued from previous page)

ter that we have not given a great deal of thought to but it seems that the government must have revenue and this spreads it out in an equitable way."

M. R. Meldrum, president of the Herbert Morris Crane and Hoist Co., Niagara Falls, remarks as follows: "So far as I can see this tax will apply equally to all people in our trade, and while it may have the general effect of discouraging fresh business to some slight extent, I do not see that it will hurt any individual manufacturer adversely. While constitutionally opposed to any form of tax, we must recognize that the affairs of the country are to be carried out, and to do this money must be raised.

"On the other hand, very serious objections are evident in connection with the tax on checks, and I hope that the government will be prevailed upon to withdraw this portion of their taxation proposals for the benefit of the trading community at large."

Steel For System, Safety and Sanitation

Metal Shelving, Cabinets, Racks and Other Furniture Being Used Extensively in Factory and Office—How This Equipment is Being Employed in Bertram Plant—Superior for Many Purposes.

By S. S. MOORE

"THE AGE of steel seems to have arrived," was the observation of a visitor while being "shown through" by the manager of a manufacturing plant. They were inspecting what appeared to be the storage and stockrooms. The racks, cabinets, desks and lockers were all of metal—or furniture steel all done in one color, and presenting an appearance that immediately suggested system, as well as cleanliness. "As far as we are concerned, it has arrived, and I will tell you why without saying a word," replied the manager, and he took from his wallet a newspaper clipping and handed it to the visitor. It read thus:

"A fire in the stockrooms of Blank and Blank, caused considerable damage, not so much to the building as to contents of storage racks and cabinets. There are conflicting theories as to the origin. It may have been caused by a match or a cigarette in a wastepaper basket, but the nightwatchman claims there was no evidence of fire when he passed through the room about one hour before. Wooden wall racks, containing stationery stock and advertising matter, were destroyed. The books of the main storeroom had fortunately been placed in a steel cabinet and escaped damage."

Fire Taught a Lesson

"There you have it," continued the manager. "You know, when that fire occurred, I was a member of the firm of Blank and Blank. Where the newspaper got the cigarette theory I don't know, because smoking, while not prohibited, was certainly not encouraged. However, there is no accounting for human frailty, and whatever the cause, the fire taught us several things that had no particular relation to fire risk.

"In the first place, those old wooden cabinets and other equipment such as desks and racks, had been there for years. They were ill-adapted to modern purposes. We found that in some respects they were used as catch-alls for all kinds of useless junk. They didn't look tidy, and they were no good when system was essential. To make a long story short that fire enabled us to go in for a housecleaning that had been long overdue. If you visit that warehouse today you will find steel, where once was wood. There are steel cabinets with adjustable shelves. These are built in sections, and are adaptable to any kind of system or space. Cabinets with doors contain more important documents, and this plan is also adapted for advertising matter. I have seen a whole publicity campaign laid out in one section of cabinet so regularly, and with such system, that the advertising man's secretary could operate the whole series in conjunction with their newspaper campaign.

Steel in Draughting Room

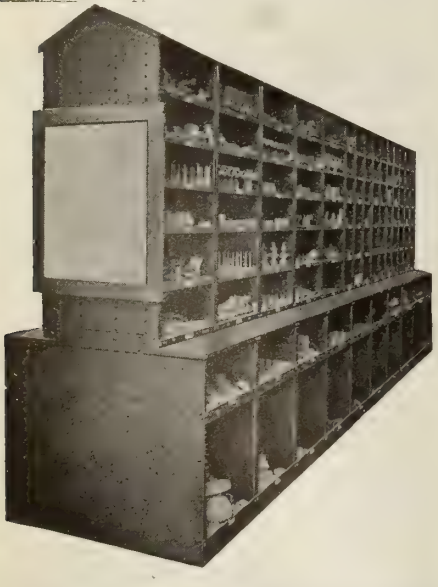
"Then, for blueprints, you will find the same arrangement there as here. A cabinet with a series of large flat drawers in which an index system may be employed. We have a draughting room in which the entire equipment is of steel—that is as much of it as can be. This steel equipment, racks, cabinets, desks, safes and tables presents to me, as compared with the old Blank and Blank equipment, all the difference that there is between a company of well-trained soldiers and a gang of hoboes.

"In the matter of safety, I consider that furniture steel is the armour of better business. When I left Blank and Blank's and considered equipment for this plant, I decided what was necessary for safety, system and sanitation, and here it is. A fire is generally considered to be a remote proposition, but it is wonderful how little precautions sometimes prevent serious accidents. Had the waste paper basket, and the desk and cabinet near which it stood at Blanks', all been of steel, there would have been no fire. On the other hand, you may argue that it sometimes requires fire to make some people aware of the chances they are taking."

The above story is not fiction. There is some such circumstance as that described at the back of most instances where the triple "S" in business is being linked with steel, even in places where one would least expect to find it. System would hardly seem to be complete when it did not take the other two into consideration, and so the three may be said to interlock or be dependent upon each other.

Fire, of course, is not the only danger. The chance of valuable tools, parts, or quantities of valuable materials being mislaid or stolen, or turning up missing

Cuts and information through courtesy of Dennis Wire & Iron Works, London, Ont.



Steel bins for miscellaneous parts and small castings.



Systematic Layout of Steel Store Bins

is always present and probably there are cases where they are quite as difficult to guard against.

For the Large Plant

During the war, the impression of system and safety was strongly emphasized, and steel equipment stood up to all requirements. Today it will be found that many large machine shops



Small steel office safe

and manufacturing plants have adopted, or are gradually introducing, this material throughout their entire plants and offices. One instance that is quite mentionable here is the plant of John Bertram & Sons Co., Dundas, manufacturers of machine tools. They have a system of steel factory shelving, used for storing small tools, also bolts, screws, nuts and small machine parts. The wood shelving formerly used had its disadvantages. Tools thus stored represented a large amount of money, and it was desirable to reduce fire chances to a minimum. Then, wood did not have the carrying or wearing capacity. The steel shelving is partitioned in such a way, and is so adjustable, that the stalls can be arranged in a unit system that is particularly useful. Bin fronts are used



Neat arrangement of steel clothes lockers

in some cases to better accommodate quantities. The draughting room is also steel-equipped throughout.

Adapted to Many Uses

What has been done in the plant of this large Dundas industry is also apparent in other plants according to requirements. For example, a large phonograph concern has installed a series of steel bins or cabinets for the storage of record discs. Golf clubs are installing wardrobe locker systems of steel, enamelled to suit club house decorations. Storage warehouses have steel stairways, balconies, lockers, cages, doors, window sash, etc. Steel and more ornamented metals are being used by banks and large business offices. Large vaults are of course fitted with steel shelving, and movable racks; steel is specified in much modern sanitary equipment, and lavatory compartments of metal are being frequently installed.

The very fine finish that is possible in furniture steel makes it adaptable to private and public offices for safes, cabinets, filing racks, lockers, desks, tables, guards, railways and partitions, while for hospital equipment, it seems to be the last word for purposes of utility and sanitation. It is, moreover, adaptable in all cases, to ornamental effect.

The advertising man is finding steel exceedingly useful, not only in plain name signs, but also in working out striking effects in electrical publicity. There is no quarrel with wood. It will always be preferred for certain purposes but the age of steel is developing a headway that seems to work in admirably with the requirements of the triple "S"—Safety, System and Sanitation.

Introducing



W. A. BOWIE

"Where is Bill?" If you hear this remark inside, or within shouting distance of the Ford-Smith Machine Co. plant at Hamilton, Ontario, you can almost feel sure it is the above pictured gentleman they are asking for. His real name is William, but if somebody were to use this dignified form of speech, ten chances to one, Bill would think they were talking to somebody else.

He is one of the happy-go-lucky type, has travelled extensively and learned much en route. Since his birth in 1882 at Glasgow, Scotland, he has been a searcher after knowledge, and although only able to secure a public school training, he made the most of his opportunities.

After finishing school, he went to John Lang and Sons', machine tool builders in Glasgow, and served a 5 years' apprenticeship. Six months after his time was out, he came to Canada and started work as a fitter in John Bertram & Sons, Dundas. He stayed there about 4 years, when the wanderlust became evident once more, so off he went to the Brandon Machine Works, Brandon, Manitoba. He tackled bench work for a year and also worked for the Manitoba Pump Works, then back he came to the London Machine Too Co., at Hamilton, as general fitter.

Later, he took charge of the heavy work at this plant, and also acted as outside man, going on the road and setting up various installations. Then the Canada Machinery Co., Galt, purchased the London Machine Tool factory, but Bill stayed on under the new management.

After they broke up their Hamilton plant, he moved to Galt, and altogether was about 12 years with both companies.

In his time he has built many special machines including brake lathes for the International Nickel Co. and was up at North Bay, Winnipeg, and other points, installing air hoists, brake lathes, and varied equipment including an 8 ft. long boring mill at Sherbrooke, Que. He has even been on the road selling machines, so knows both ends of the business.

He went to Ford-Smith's in 1917, and started to work on the bench. During the war, Mr. Ford-Smith had to open two additional plants, and Bill took charge of one of the new sections. After the sudden rush had disappeared, he came back to the newly-built plant as assistant foreman and later was made superintendent, which position he still holds.

The best quality about Bill is that he knows a lot, but does not attempt to impress you with this fact. He is a good mixer, knows his men personally and after working hours you'll usually find him driving his automobile along the Toronto-Hamilton highway, sitting well back in the seat with a smile on his face as much as to say, "Worry—what does the word mean?" and yet, in spite of the smile more than likely he is planning some scheme to overcome a problem at the factory.

BOOKLETS

The Canadian Ingersoll-Rand Co. has just issued a revised treatise, in the form of a booklet, on the Lubrication of Air Compressors. The matter is a reprint of an article prepared by H. V. Conrad, M.E., former secretary of the Compressed Air Society of New York.

Correct Lighting Dependent on Proper Diffusion

Getting the Most from Natural Daylight—Modern Plants Constructed With That Object in View—Coating Walls With Light-Reflecting Colors—Better Lighting Systems.

WE HEAR a great deal these days about more light, about lumens, foot candles, light intensities, light utilization, etc., but there is one thing about which we do not hear so much and of which we should hear more, and that is proper light diffusion. For example, a battery of closely-spaced automobile headlights suspended from the ceiling of a building would certainly emit enough light. There would be sufficient lumens, foot candles, light intensity, etc. (more than enough, in fact). But no work could be done under such a torrent of concentrated light rays, the light not being properly distributed or diffused. Such light would be too strong for eyes directly in its path, and it would throw such decided shadows that everything else would be dark by contrast.

Correct lighting, then, is as much a matter of correct light diffusion as candle-power. A room in which foot candle readings would give a value of 6-foot candle in one section, and ½ foot-candle in another section not 20 feet away, could hardly be said to be well lighted. Because, while 6 foot-candles is probably almost sufficient light for the most particular work, ½ foot-candle is hardly enough for an auditorium or for the aisles and passageways in an ordinary building.

Artificial Light vs Daylight

It is true that this difficulty can, to a very large extent, be remedied by the proper placing and selection of the right kind of electric light units for this purpose. But the point that must always be borne in mind is that artificial light first of all represents an expense in installation and maintenance, and second, that however desirable, it is never as good as daylight. This fact is so well recognized that in some countries, as for example, Holland, legislation forbids the employment of women and children in workrooms from which daylight is excluded. There is a reason why.

Extract from an article in Building Maintenance issued by the Truscon Laboratories.

Daylight, as Sir Isaac Newton pointed out, is not a basic or elementary light color, but a combination of colors so mixed (let us say) as to give an impression to the eye of what is commonly referred to as "white light." A ray of sunshine, on being passed through a glass prism, is broken up into many rays representing all the colors of the rainbow. These various colors of their individual specific intensities and volumes make up what is known as daylight. No form of artificial light so far devised, on being broken down or analyzed by the spectrum, shows this same record of component parts as natural daylight.

Superiority of Daylight

It, therefore, follows that artificial light cannot be the equivalent of daylight, since in the history of our race the sustained use of artificial light and the intensive application of the eyes under artificial lighting is but a comparatively recent innovation—the development of the visual organ having evolved under the stimulus of natural daylight.

We must admit, however, that wonderful strides have been made in the perfection of artificial illumination and its proper use, and we do not wish to detract from such genuine accomplishment. But the fact still remains, and we must recognize it, that artificial light at its present stage, is but a poor approximation of daylight, a makeshift. It is but an attempt to imitate the standard represented by daylight.

It is evident, therefore, that the more favorably we arrange the construction of our industrial plants, office buildings and homes, so as to enable us to take the fullest possible advantage of daylight, the better the quality of light we will obtain. Hence the popularity in the last decade of what is known as "daylight construction," especially among industrial plants, as exemplified in steel sash walls, sawtooth roof construction, etc.

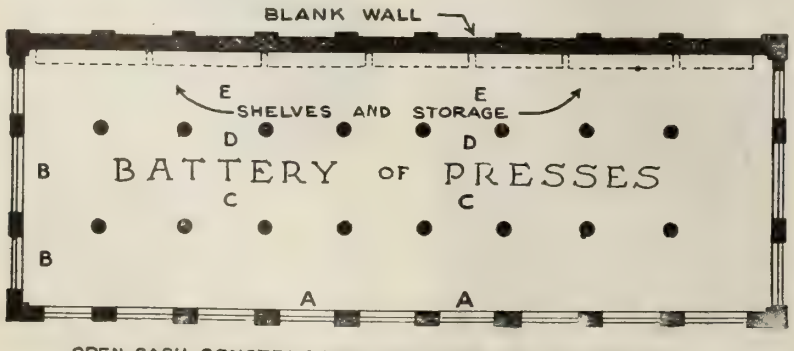
All of which holds a strong brief in favor of the utilization of natural light—sunlight. It will immediately be pointed out that sunlight in some of our industrial centres at certain periods of the year is doled out in a very parsimonious fashion. It then becomes a matter of utilizing this artificial illumination so as to get the maximum benefit out of it. Similarly, we are equally concerned with getting the maximum use out of whatever daylight with which we may happen to be favored. Luckily, in this effort, we are assisted by certain characteristics of light, namely, its faculty of absorption and reflection from surfaces.

Absorption and Reflection

All opaque surfaces absorb light. Some opaque surfaces absorb more light than others; what they don't absorb they reflect. Objects are seen by the light they reflect. Colors are distinguishable by the light they reflect. A piece of red fabric has the ability to reflect chiefly the red rays of the visible spectrum. Consequently, when white light falls upon the red fabric, only the red rays are reflected while the remaining visible rays are absorbed. By this process of absorption and reflection, the colors of pigments and most of the colors in nature are produced. But also by the same process much light is lost. What is absorbed is lost—in illuminating value, that is evident.

Absorbed Light is Wasted Light

This point is of real significance in the lighting of the interiors of buildings, because no matter how powerful and adequate the source of light we use may be (artificial or natural) that source of light is robbed of its effectiveness if the character of its surroundings is such as to absorb too much light. It is like a locomotive with a burst steam pipe. The source and quantity of



OPEN SASH CONSTRUCTION THIS SIDE AND END WALLS

Fig. 1.—General ground plan of a printing plant.

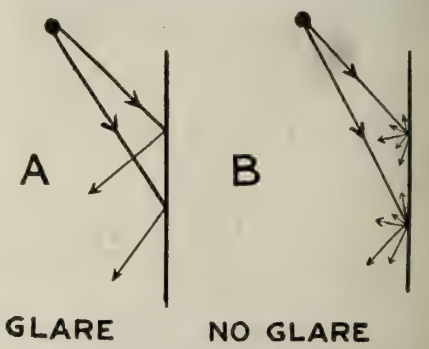


Fig. 4.—"A" represents direct reflection from a polished surface, such as a mirror or enamel surface. B represents diffused reflection, as from a flat, unpolished surface. The quantity of light reflected from both these surfaces may be the same, but in the case of A it is more intense and results in a glare, whereas in B there is no glare, but a soft, eye-restful light.

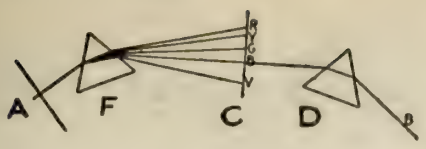


Fig. 2.—Newton's Experiment. A ray of daylight from the source (A), on passing through the prism (F) is broken down into its component colors; red, yellow, green, blue, violet, at (C). That each of these colors is not capable of further decomposition is proven by passing one—blue, let us say—through the prism (D). It is still refracted as blue.

steam is adequate, no doubt, but the steam cannot be put to effective work.

Similarly, a room painted a deep red or a dark gray will not seem as bright as another room painted a lighter color, lighting conditions being equal. Photometric readings in both these rooms will disclose a decided difference in the light distribution and intensity, especially in those sections away from the windows. Why? Because the walls of a dark red color absorb from 85 to 90 per cent of the light entering the room, while the walls and ceilings of the proper color will absorb only 15 to 25 per cent.

Here then we put our fingers on one of the greatest sources of waste ever discovered, the waste of light. Truly may it be said: "What does it profit a man to instal the best artificial lighting system that engineers can devise, if four-fifths of the light so obtained is to be consumed by murky walls?" Why employ daylight sash construction if the interior of each floor is to be overshadowed with dull, gloomy light-absorbing ceilings and columns?

An Example

An example of this comes very forcibly to mind in the case of a large printing plant where engineers were called in for consultation on their lighting problem. A ground plan of one of the floors of this printing plant is shown in Fig. 1. Observe that this floor, with a width of only 50 feet, had daylight sash construction on three sides. Surely the owners made sufficient provision for light to satisfy the most exacting requirements. Yet, they were not satisfied. Nor would any one who entered the building have been satisfied.

On a bright, clear day, at 2 p.m., the foot-candle reading on the floor, at street level, three feet from the window, at the points marked A, was only 3 (sufficient light for ordinary operations, but poor considering nearness of location to window). At the points marked B (the south or sunny side of the building) the reading was higher—5½ f.c. —but in the interior of the plant, at points marked C, D, and E, the readings ranged from ½ to 2. On this same floor was a battery of large, flat-bed presses. The feeders engaged at work on these presses stand on platforms, which bring their shoulders within four feet of the ceiling. Foot-candle readings here in the middle of the afternoon of a bright day in October gave values of from ½ to 1, necessitating the continued use of shaded electric light.

Four weeks later, after the recommendations of the light engineers had been put into effect, the foot-candle readings on no part of this floor were less than 4½ (without artificial light) with 6 to 8 as a general average except near the windows, where the reading ran up to ten. This was still further improved by removing rust and encrusted dirt from the ribbed glass windows.

A curious fact, however, is that white paint tinted with ever so small a quantity of black, drops down considerably in its lighting efficiency—as much as 15 to 20 per cent. This means that the grays are, in comparison with white, relatively poor light-reflecting colors. This phenomena explains why plain, gray



Fig. 3.—Recomposition of white light. That the colors resulting from Newton's experiment, illustrated in Figure 2, are not produced by refraction, but represent the actual mingling of these colors to form white light, is proven by placing a second prism, identical with the first, in the position (D) (above). (S) in this case is the beam of light which is decomposed into the spectral colors by the first prism and recombined into a beam of white light at E.

concrete walls and ceilings darken a room—why soiled and grimy walls of any kind are an enemy to lighting efficiency as well as to health and sanitation. Their light-reflecting value is often as low as 25 to 30 per cent. They absorb light—they waste it—just as surely as a burst steampipe on a locomotive wastes power.

Another curious fact brought out by these experiments is that a dull or flat white surface has a higher light-reflecting co-efficient than a gloss white. Heretofore, it has always been taken for granted that the gloss, on account of its brilliant finish, must have a higher reflecting value than a dead flat white. However, this is a feature of interior illumination that we will take up in greater detail a little later.

Lighting Efficiency

No lighting system can be efficient if it has to put up with drab and murky surroundings. True enough, the system may provide sufficient light. But this is no criterion. The unalterable physical fact still remains that dull walls, ceilings and columns absorb light. And the lighting system has to be made powerful enough to overcome this enormous wastage, to provide sufficient illumination, notwithstanding.

If the source of wastage could be materially diminished, it would very soon be seen that the lighting system under the new conditions is too powerful. In other words, a proper consideration of the illuminating problem from the standpoint of light-reflection from its surroundings, saves money on illumination units and illumination maintenance.

Spreads the Sunshine Inside

It is because of this generally recognized fact that the method of applying a white coating to interior walls and ceilings in manufacturing plants, warehouses, auditoriums, etc., has become so much the vogue. Various materials can be used for this purpose—whitewash, kalsomine, oil paints—anything white, one might say, but this is not true; as many other factors besides whiteness must be taken into consideration.

Disadvantages of Cold Water Paints

A coating must be selected with a due regard for its fitness to its surroundings. Whitewash, for instance, could never be used in a pure food plant—the whitewash would be continually flaking off and dropping into the manufactured product. Nor could kalsomine or a



Fig. 5.—A difference as of between day and night. The section of the photograph at the right shows the appearance of the interior of a new tire plant. The walls were not black—they were simply normal concrete grey color. But the camera shows how much light was lost in this plant by the dark appearance of the photograph. The section of the illustration at the left has been retouched to give an idea of what the same interior would look like if walls, ceilings and supports had been coated with a white, light-reflecting materiel.

cold water paint be used in such a place. Coldwater paint is an organic product composed principally of casein, glue, dextrin and such materials which offer nutriment to the growth of fungi and molds, and which naturally contribute to an unsanitary condition.

Both these materials, on account of the porous nature of their film, absorb a considerable quantity of dust and dirt, and darken quickly. They are not washable. In a word, they are hardly worth the cost of application. As a matter of fact, they are a decided detriment, because, should the owner afterwards decide to use a good oil paint, he would be forced to go to the expense of removing all this old coating from the surface.

White Oil Paint the Ideal Coating

In conformity with the latest developments in the art of interior decoration, coatings should be of a character to offer a hard, non-absorbent surface, which does not readily collect dust, which is non-poisonous, which offers no possible nutriment to bacteria, and which, if desired, can be washed freely and kept clean. And—the coating should be light-reflecting—white being invariably the most efficient shade.

White oil paints, therefore, are most suitable for this purpose, especially oil paints which are free from white lead and poisonous ingredients. Such oil paints are generally known as mill whites. They are obtainable as flat coatings (usually used as the undercoating), enamel or gloss coatings, and coatings which produce a finish between the flat and gloss, known as "eggshell."

Requirements of a White Oil Paint

The development of mill white paints in the past ten years has been extraordinary. Consider the requirements that such a paint must fulfill. It must have all the qualities of a high-grade, durable paint, of maximum light-reflecting value, and yet be procurable at a price to justify its being used over enormous areas of interior wall surface. But that is not all. White paints have a peculiar tendency of turning yellow, especially when not exposed to much daylight. Naturally, the darkening of such a coating would in time considerably diminish its light-reflecting value.

What Constitutes a Good Mill White?

In a market flooded with materials intended for increasing the lighting efficiency of plant and office interiors, it is probably confusing to one who is not familiar with paint values, to determine just which material is best suited to one's purpose. Under such circumstances, we believe it would clarify the situation at this time to discuss the requirements that an efficient interior white should measure up to, and how the value of these various requirements can be measured so as to form a basis for comparison.

The basis that we recommend for determining the merits of various mill whites is a competitive test conducted by the building owner, under his own supervision, so he will be in a position to judge at first hand the relative merits of the material offered for his attention. Such a test naturally, in order to be fair, and to form a correct basis for comparison, presupposes that all materials should be applied by the same painter over similar surfaces, and subjected to the same uniform conditions of test throughout.

Suggestions for Test

The suggestions as we present them are prompted by our experience with interior white paints, as a result of which we are able to judge a paint accurately on its various chief merits. These chief merits on which we should judge an interior light-reflecting coating are five in number, as follows:

No. 1—Whiteness or light-reflecting value.

No. 2—Permanence of whiteness.

No. 3—Covering capacity per gallon.

No. 4—Opaqueness, or masking value.

No. 5—Ease of brushing and labor cost.

(To be continued.)

Replacing Hand-Made Parts By Suitable Forge Machines

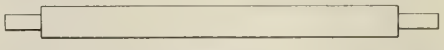
By WM. JAYNES

AFTER many years of experience in connection with forge work of a varied character, the writer is considerably surprised to learn that ship builders do not make more extended use of bolt-heading and rivet-making machines. In the yard where I am now employed, and from which a number of steel vessels have been launched, there is no sign of a bulldozer or rivet machine. Take as an example, the writer has operated machines for the making of rivets at a cost of 30c per 1,000, and where over 500,000 rivets are used in the construction of one vessel, it seems that it would pay to install equipment for this work.

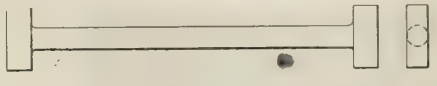
Take another case, that of the making of ladders and gratings—would a man and helper shear 250 rings and forge both ends in 9 hours on the anvil? The writer has made over 5,000 bolts a day on a bolt machine. Would it not be possible to have a collar pressed on each end similar to the sketch below?



With a production of from 2,000 to 3,000 per day. Or the ends could be swaged, like the piece here shown, in a bolt machine. Figure the saving on four ships, for all the ladders and gratings needed.



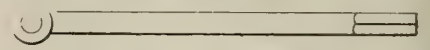
Take shackle making in a bolt machine and compare it with anvil work. Take staunchions like this:



How long does it take to split these ends, throw back and finish up? The anvil method does not make a satisfactory job, and the work could easily be accomplished in one heat on a suitable forging machine.

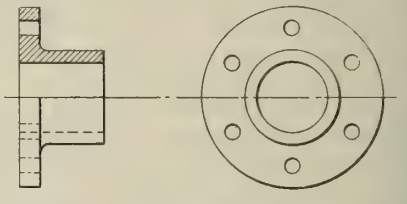
Take ladder handles, with a ball on one end and an eye on the other—how easy these could be made on a bolt machine.

For staunchions on gangways a ball could be pressed, flattened, punched and rounded in one heat.



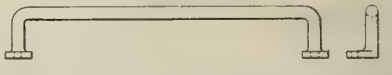
Compare this to splitting the stock, opening the eye and other detail operations a blacksmith would require to do in performing this work.

Another job that might appear to be out of the usual range of the forging machine is the pipe flanges used on ships. The making of these under the steam hammer is a slow job. The flanges could be successfully made in one heat on a suitable machine. The



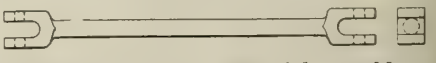
sketch herewith is of a flange with a 3 in. hole, the collar being upset from 3in. stock and punched clean off from the bar, and the latter is ready for the next heat.

Take ladder irons with an eye on each end, such as here shown.



What a lot of drawing and swaging under the hammer—these can be upset, punched and bent in one heat on a forging machine.

Another common job is the making of stay rods, used to support staunchions to deck; a sketch of the stay being produced here.



Machine work on this job would reduce production cost by about 75 per cent. Many other cases of work that are now done by hand could be economically produced in suitable forging equipment.

News From the Welding Field

Some Problems of the Job Welding Shop

Work Almost Entirely Repairs—Preparation, Welding and Finishing—Experience the Chief Guide—Welder Must Have Good Memory and Keen Observation—Customer's Needs Must Be Considered.

By S. W. MILLER

BY A JOB SHOP is meant one which takes in any kind of work which is brought to it. The work may be large or small, easy or difficult, and there may be much of one kind or there may be no two jobs alike. The job welding shop comes under this specification but has an additional difference. The work is almost entirely repair work. In repair work of any nature the objects are to have the repaired part strong enough to stand the service required of it, and to do it at a price as low as possible, consistent with good workmanship and a fair profit. There are many difficulties in accomplishing this result in a job welding shop.

In considering these difficulties, we will confine our attention to repair work because in production work the difficulties can be overcome in the course of a short time, and after this has been done, the rest of the work is comparatively easy. The difficulties in a job welding shop may be classified as follows:

First, the work itself. Second, the varied natures of metals that are of the same general type. Third, financial problems. Fourth, guarantees on the work.

Work

The first head may be subdivided into the following:

"A"—Preparation.

"B"—Welding.

"C"—Finishing.

The preparation of the work involves the making of the V, the method of lining up the work, and the arranging for and taking care of the expansion and contraction.

The welding covers the decision as to whether gas or electric welding be employed, and upon this decision somewhat depends the preparation. The method of pre-heating really should be considered in connection with the welding, although it is important enough in some cases to be considered separately.

The method of finishing the work, if finishing be necessary, as do all the other operations, depends on the facilities on hand. It is difficult to lay down general rules for any of these matters and it is probably best to consider what has been done in individual cases.

Varied Nature of Metals of Same General Type

Under the second heading, it should be remembered that in a production job the material used can be specified so that uniformity can be obtained, which enables the welder to use the same methods and practices at all times. In repair work, however, not only are the materials, for instance, cast iron, not uniform, but in many cases it is impossible to determine before the welding is started how the material is going to act during the welding process, and sometimes changes in methods have to be made in order to overcome difficulties of this nature that could not be anticipated.

The only thing that will guide a welder under such adverse conditions is experience, and to use this experience the welder's memory must be good and his observation keen.

The job shop is called on to handle all metals and it is seldom that one finds a welder who is able to do all of them well and still rarer to find one who is capable of doing all-round welding with both gas torch and electric arc.

It is sometimes difficult to distinguish between cast iron, malleable iron and cast steel. It is frequently impossible to distinguish between the various brass and bronze alloys and many failures have occurred because of these troubles. Similar difficulties exist with other metals, so that the job shop, to be successful, must have a wider knowledge of metals and their characteristics than any other kind of a shop.

Financial Problems

Third, the majority of job shops do not have any real knowledge of their costs, and it is frequently the case that where there are a number of competitors in the same city, prices will be cut and recut until the work is being done at an actual loss by everybody. Such a condition is bad for the welding industry, but it will not be overcome until such shops see the importance of knowing what the work costs them. To do this is not so difficult, but does require a proper system of bookkeeping and a simple accounting method. Any good accountant will, at small expense, instal a suitable system, but he must bear in mind the character of the average job shop, which is not competent to understand or to use complicated methods, and which do not have time to spend in using elaborate blanks, slips, tickets, etc.

The nature of the system installed depends upon the work being done, and it is impossible to give any specific data. It will be enough to say that all the time put on the work must be accounted for and that an approximate idea of the gases or current consumed must be known. Allowance must be made in the gas cost for gas that is not used from the tanks, especially in the case of acetylene, where quite a little of it cannot be used especially in cold weather.

On the other hand, too much time must not be occupied in collecting accounting data, because if this be done it may cost more to get the information than is saved by getting it.

The items that are most frequently overlooked are those that are usually called overhead expenses, such as insurance, taxes, repairs of apparatus and advertising. I do not mean that these expenses are not paid, but that they are not included in the charges made for the work in an intelligent way. Of course if the real cost of the work being done is not known, it is impossible to say what the charges should be, and charges must include a profit over all expenses, or else the business will fail.

In connection with the financial end of the business, the treatment of the customer is of vital importance. A satisfied customer is the biggest asset of the business. Of course a customer cannot be satisfied unless the work is done properly, and at a reasonable price. The most essential thing, however, is to do the work properly, even if in some cases it has to be done at a loss, and as a matter of policy, I believe it is wrong to do cheap work; that is, work that is deliberately so done, even with the understanding that first-class work is not needed. Of course, if the best work is not really necessary, it is wrong to spend more money on it, but it is a frequent occurrence to have customers ask

Material prepared by the author for presentation at a recent meeting of the American Welding Society.

for a cheap job in order, for instance, that they may dispose of an automobile, their idea being as soon as it is off their hands they are not responsible any further. But a moment's thought should convince us that such a policy is unfavorable to the welding shop, for if the part fails, no excuse on the part of the welder will remove from the mind of the owner of the car the idea that he has been injured and that welding is of no value. It is far better policy to refuse to do work of this character. Further, it is much easier to explain to the customer that good work has been done and to collect the money for it, than it is to explain an unsatisfactory job.

Inasmuch as many customers are entirely unfamiliar with welding, it is frequently necessary to go into detail as to the reasons for doing certain things. The customers frequently cannot understand why an intricate casting has to be pre-heated and slowly cooled, but if the matter is explained to him in a careful and thorough manner, he is usually willing to accept the explanation. If he is not willing and can not be made to see that a certain procedure is necessary, it is far better to let the work go than to do it in a way which the welder knows will be unsatisfactory. On the other hand, if the welder is so unfortunate as to do a piece of work badly, the best policy is to honestly admit and explain why. There are so many jobs that come to the welding shop that have never been done before that it is no wonder that failures sometimes occur, and honesty in this, as in all other cases, is the best policy. I speak of these things in some detail because they are many times overlooked or not understood or appreciated.

Guarantees

A welding shop is frequently asked if it guarantees its work, and such shops frequently advertise that they guarantee all jobs. A general statement to the effect that all work is guaranteed in reality means nothing and there should be some specific form of guarantee covering all usual cases.

It is also well known that, in all probability, a general statement as to any guarantee is not legally effective unless it is specifically called to the attention of the customer before the work is undertaken, and if it is not intended to guarantee the work, the customer should be advised of this at the time the work is taken in, and in important cases the further precaution of notifying him in writing should be taken.

Again, a guarantee is of no greater value than the ability and willingness of the welding shop to fulfill it. It may be that the financial strength of the welding shop is not sufficient to properly guarantee some important work. In such a case the safe course to pursue is to have the work done by some larger shop in order to avoid financial loss.

Whatever is done in the way of guarantees should be done as a matter of principle, and the policy should be followed strictly and altered only as experience indicates that changes may be safely made.

Precautions

As in all other work, welding has its tragical and humorous sides. The tragical may be well represented by the accidents that have occurred either through lack of knowledge or pure carelessness, as when tanks that have contained oil, gasoline or other explosives, have been worked on with a cutting or welding torch. It is equally dangerous to work on them with the electric arc. Explosions have occurred even after a tank has been washed out with water, or steamed out, so that the only safe way is to keep the tank as full of water as possible while the work is being done. It should first be filled entirely, care being taken to see that all pockets are filled. The water can then be let out just enough so that the welding can be done.

It is a good rule to keep visitors out of the welding shop unless they are accompanied by someone who can take care of them. It is also a good rule to keep beyond possible range of the torch flame. Some welders have a habit, which is a bad one, of turning the torch flame toward their shoulder in order to look at the work, and I know of one case where a man who was standing back of the welder had the torch flame turned in his face.

The dangers of looking at the electric arc are well known to you, and in all cases precautions should be taken so that even side flashes from the arc may not get to anyone's eyes. It may sound incredible, but there is one instance on record where a welder endeavored to stop a leak on an acetylene generator by welding with, of course, fatal results. In my own experience I had a welder, whom I employed temporarily, build a small charcoal fire on top of a Prest-o-Lite tank during cold weather, in order, he said, to thaw out the acetylene regulator. Fortunately, in this case the fusible plugs operated, and while the flame shot twenty feet in the air, no damage was done.

There are many humorous questions asked by customers; that is, they are humorous to us. One of these questions is quite frequent, that is, whether cast iron can be welded. Courtesy and tact demand that we should not smile under such conditions, but that a careful explanation of the principles of fusion-welding be given, so that the customer may understand that all metals may be joined together by these processes. Then his idea of welding will be broadened and his confidence in it increased. It is even sometimes necessary to demonstrate to the customer that metals can actually be melted together. As a matter of fact, we can all be asked questions in connection with welding which we are unable to answer, and people that live in glass houses should be careful about throwing stones.

£10,000 FOR RESEARCH

The name of Parsons is known all the world over in connection with the invention of the steam turbine which has made possible the cheap production of electricity in large quantities and the development of high speeds by large ships. In addition to inventing the turbine Sir Charles Parsons has rendered great service to the progress of science and the latest sign of his interest in the field is the gift of ten thousand pounds to the British Association for the Advancement of Science. Since it was founded in 1831, the Association has made grants of over eighty thousand pounds towards scientific research. Sir Charles' latest gift will enable the Association to maintain its important work of scientific investigation. In connection with the speed of ships it is interesting to note that the fastest ship afloat is a British vessel, the "Mauretania," and during a recent voyage from the United States to Great Britain she maintained an average speed of 25.14 knots, and at one stage she attained 27.5 knots. This was the fastest trans-atlantic cruise made since the war, and it is faster than the same vessel had ever attained.

BOOK REVIEW

The Penton Publishing Co. of Cleveland, Ohio, have just issued a Foundrymen's Handbook, in which has been compiled the "data sheets" that have been appearing in Foundry for many years. This book is a complete and up-to-date reference on all foundry problems. It comprises all necessary knowledge from the estimating of the price to the cleaning of the finished casting. Section II, contains the formulas for computing the weights of castings of all shapes and sizes in any kind of metal; Section IV, gives the compositions and physical properties of every known non-ferrous mixture, data on fluxes, deoxidizers, pickling solutions, melting points, strengths of metals and alloys with the effect of different brass additions, and suggests to the brass foundryman the proper choice of metal for given requirements. Section V, gives the standard specifications for gray iron castings, cast iron pipe, cylinders, special castings, scrap metals, case hardening and annealing; Section VI, gives miscellaneous tables of every-day use in the foundry, such as gross and net ton equivalents, tables for conversion of weights and measures from U. S. to metric system and vice versa, etc., etc. The book is 6 x 9 in. and contains 309 pages. Price $5.00 postpaid.

The White Star-Dominion Line have had the freighter "Irishman," which was formerly on the New York run, diverted to Montreal. She arrived in that port June 6th and loaded one thousand head of cattle for Avonmouth. This is the largest cattle cargo ever shipped from Montreal. The steamer is a twin screw boat of 21,000 tons, being the largest freighter that ever docked at Montreal.

Practical Ideas From Practical Men

HOW MUCH POWER IS THAT BELT TRANSMITTING

(A method that gives the answer without the use of complicated instruments.)

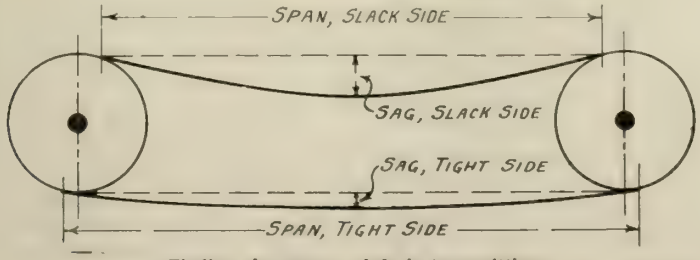
By W. F. Schaphorst

When a horizontal belt is in operation, and most important drive belts are horizontal or nearly so, it is a well known fact that no matter how great the load that is being transmitted there is a sag in the "tight" side of the belt as well as in the slack side. It is impossible to make the pull so great that the tight side will be perfectly horizontal, or a perfect straight line. There will always be a sag. The greater the load, the less the sag on the tight side and the more the sag on the slack side.

In view of the fact that this sag on both sides varies with the load being transmitted and in view of the further fact that the tension in a belt can be accurately computed when the sag and span are known, it becomes possible to compute the power being transmitted by any horizontal belt. To assist in these computations the writer has prepared a table which is reproduced herewith. It is a simple matter to measure the sag and the span with an ordinary yardstick. Four other measurements are necessary—the width and thickness of the belt; the outside diameter of one of the pulleys; and the revolutions per minute of that same pulley. These measurements may all be taken with the same yard stick and with an ordinary watch.

To determine the horsepower being transmitted by a given leather belt of any width and thickness, measure the span of the slack side as indicated on the sketch. This span is NOT the distance from center to center of the shaft but is the distance between the points where the belt leaves one pulley and touches the other. Then measure the sag. The sag is the greatest vertical distance between the belt and a straight line connecting the contact points as shown on the sketch. Next, measure the span and sag of the tight side again, observing the points of "making and breaking contact" as explained above. It makes no difference whether the belt is a "bottom pull" or "top pull" belt, this method will give the horse power transmitted in either case. Then, referring to the table, find the tension corresponding to the span and sag of the slack side, which we will call A. Then find the tension corresponding to the span and sag of the tight side, which we will call B. Subtract A from B. Then multiply by the width of the belt in inches. Then multiply by the thickness of the belt in inches. Then multiply by the outside diameter of one of the pulleys in inches. Then multiply by the revolutions per minute made by that same pulley. Then multiply by .000007933. The answer is the horse power being transmitted by the belt at the same time of measurement.

In case the sag is less than one inch, which may often be the case where pulleys are close together, this same table can be used by simply shifting the decimal point to the right. Thus if the span is 10 ft. and the sag is 0.6 in. instead of 6 in. the tension would be 105 lbs. instead of 10.5. If the span is 12 ft. and the sag 0.1 inch, the tension would be 907 pounds instead of 90.7. In case the actual span of the belt does not agree with the span given in the table it is a simple matter to "estimate" the tension from the table. For example if the span is 8 ft. 6 inches and the sag is 1 inch. The tension would be midway between 40.3 and 51. To find this midpoint add the two figures together and divide by two. The answer is 45.65. Another way is to subtract the two members (50—40.3) which gives a difference of 10.7 in. Then divide this by two (10.7÷2) and we get 5.35. Lastly, add this to the smaller number (40.3+5.35) and we get the same answer:—45.65 pounds per square inch.

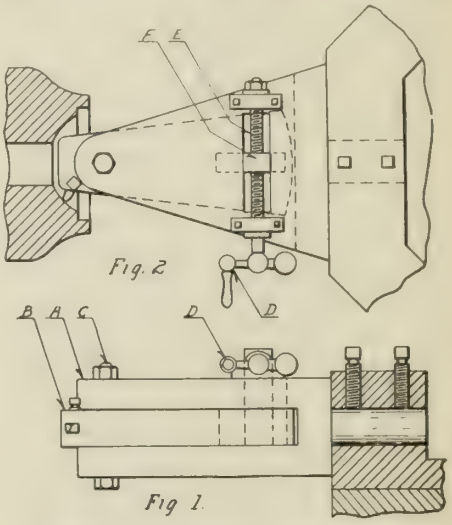


Finding the power a belt is transmitting

FIXTURE FOR MACHINING SPHERICAL SEAT

By H. Alton

In the modern paper machine there are a large number of steam joints in the piping system used for supplying steam to the drier and other rolls. There are many places where a spherical seat is required to take care of the above and other conditions met with in these pipe lines. A rather unusual little fixture was designed in the shops of the Dominion Engineering Works at Lachine, P.Q., to machine this type of seat. The castings are ordinarily machined on a turret lathe and to facilitate matters the above mentioned fixture was mounted on the turret. Fig. 1 shows an elevation of the fixture. As shown at the right the frame has been turned to fit the hole in the turret. The projecting part of the frame A is slotted to receive the block B that carries the tool. The block B is held in place by, and is permitted to rotate about, the pin C. The circular motion of the tool block B is controlled by the ball crank handle D. This handle is keyed to the feed screw E, and operates the brass nut F. This nut slides in a transverse slot in the frame and in a longitudinal slot in the block.



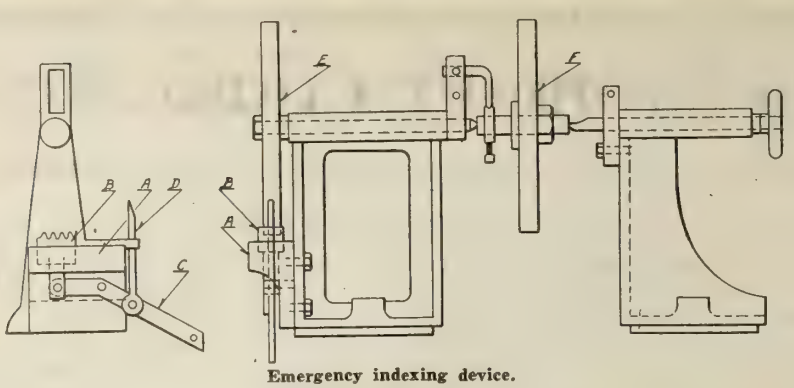
Fixture for machining spherical seat.

When using the tool the turret is advanced along the ways of the machine to bring the tool in contact with the work. The tool is fed by hand in either direction by operating the handle. The pitch of the screw is small and in feeding the ball handle is turned at about thirty to forty revolutions per minute. A very smooth and regular finish is obtained. The tool is ruggedly constructed and in spite of the apparent excessive overhang, the entire fixture is very rigid. As the cutting is rather light, a seat that is practically perfect, is obtained.

EMERGENCY INDEX DEVICE

By J. H. Houldsworth

The accompanying sketch illustrates a device we constructed for the cutting of these sample gears at a time when the writer was engaged in a small jobbing shop. The plant had no regular facilities for accurate indexing so the idea here shown was decided on and the results obtained were entirely satisfac-



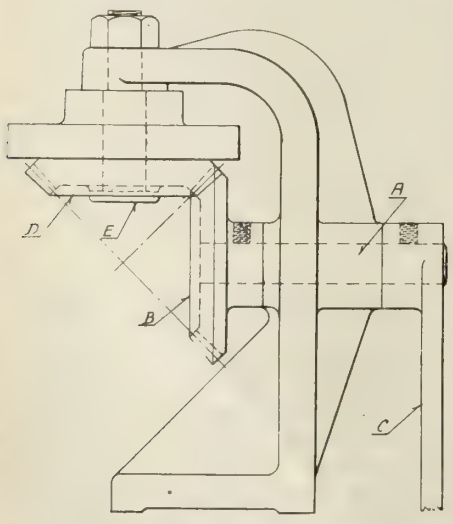
Emergency indexing device.

tory. Having a set of planer centres we removed the small casting that carried the worm and substituted the piece shown at A. This casting contained a small plunger B, the upper end of which had four teeth cut to fit those of the sample gear. The method of obtaining the pattern for the plunger was interesting. The sample gear was placed on a flat surface and blocked up, after which babbitt was poured in to get the shape of the teeth and top of the plunger. It was then cast and machined and made a good fit in the piece A. The lever C controlled the vertical movement of the plunger. This lever also operated the pusher pin D which was so adjusted as to engage in a tooth of the sample gear E on left hand end of fixture shaft. The release of the indexing teeth by the upward movement of the lever C allowed the gear to be revolved the distance of the pitch by the travel of the pin D, thus bringing the gear F to the next tooth position. This device was subsequently used for quite a number of gear cutting jobs but it necessitated a different indexing plunger with the desired tooth pitch. As a fixture for taking care of emergency work in the small shop the idea here shown was a distinct success.

TESTING FIXTURE FOR GEARS

By Robert Mawson

We use quite a number of bevel gears for transmitting the power to one of the types of machines manufactured at our plant and as these machines must operate very quietly and with the minimum amount of friction the testing fixture illustrated was designed and built to see that the gears were properly machined and the teeth accurately cut. The gears in the fixture occupy a similar relative position to that which they are on the assembled machine, so that we know if the gears run silently in the fixture they will also do so on the machine.

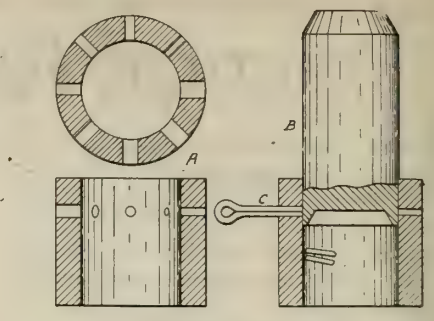


Testing Fixture for Gears

The fixture is made with a base provided with two holes that are used to hold bolts to fasten the devise to a stand or table thus holding it securely during the testing operation. The base casting has a vertical member provided with a long bearing accurately reamed to suit the shaft A. On the inner end of the shaft is fastened one of the gears to be tested marked B. On the outer end is attached a crank C and handle (not shown) the gear and crank being fastened by means of set screws. The frame extends upward to afford a horizontal member which is used to hold the other gear D to be tested, this gear being held in position by means of the stud and nut on the upper side of the fixture.

When the two gears are in the position as illustrated, the operator by revolving the crank C can easily ascertain if they are accurate or if a mistake has been made in their manufacture. If it is found that the gears are very defective it is sometimes necessary to reject them and return them to the machine shop for further machining. If the trouble be only slight, by placing an abrasive material on the teeth and revolving the gears the teeth can often be run in to operate smoothly. In fact, we have found that it is advisable on all gears to run them in, either by using emery or ground glass and oil or some grinding compound; in all cases care being taken to wash away the abrasive mixture with gasoline or kerosene after the desired smoothness has been obtained in the testing fixture.

It can be easily seen that this idea of testing fixture can be used on any pair of gears, bevel, spur, worm and worm wheel, etc., and the expense is well worth while as the shop is then positive that the driving members are what is desired as nothing detracts more from any machine than noisy gears, giving the customer the idea that the tool or machine has been poorly constructed.



Cutting split pins

CUTTING SPLIT PINS

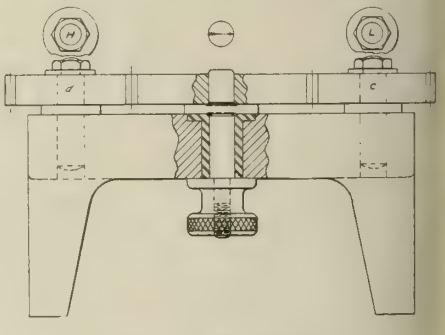
By W. J. H.

The accompanying sketch shows a handy tool for cutting short pieces off split pins and small rods. The piece A is made of 2 in. cast steel bored to about 1¼in. and having a series of different size holes drilled through the wall. These could be drilled in irregular positions if desired. The punch B is turned to fit the bore of the ring and cupped at the cutting end as shown. A light blow of a hand hammer is sufficient to cut the average split pin.

GAUGE FOR TESTING SPUR GEARS

By N. F. P.

This gauge consists of two stationary spindles (c) and (d) with standard gears thereon. Between these two spindles is an eccentric spindle so made that its amount of eccentricity will determine whether the gear to be tested is too small or too large. The end of the spindle has an arrow stamped thereon which indicates as follows: if the gear being tested revolves when pointing to (L), it indicates that the gear is too small. If the gear does not revolve when the arrow points to (H) it indicates that the gear is too large.



Gauge for Testing Gears.

New Westminster, B. C.—Announcement has been made of the incorporation of the Westminster Paper Company, with headquarters here and capitalized at $250,000. It is the company's intention to erect a plant worth $100,000 on the North Arm of the Fraser River. It is understood that the new plant will specialize in the manufacture of tissue paper, a large market for which exists in the Orient and Canada.

New Things in Shop Equipment

ADJUSTABLE ANGLE CUTTER HOLDER

An adjustable cutter holder for use on turrets has recently been offered to the trade. It is intended to eliminate uncertainty in making fine adjustments. The cutter slide is operated by means of a graduated adjusting screw. The construction of this cutter provides accurate setting for finishing cuts. The head is made of hardened steel and is sufficiently strong to maintain the same size on each piece. The tool is being placed on the market by Warner & Swasey, Cleveland, Ohio.

QUICK OPERATION VISE HANDLE

To provide quick action of the movable block on machine vises a special handle has recently been developed. Owing to the long length of the ordinary handle it is very often difficult to quickly operate the screws on such vises, and it is often necessary to remove the handle owing to the inability to get a complete turn. This new handle is so designed that two square holes are made at right angles in the end. When tightening or releasing the vise the long lever is used, but when quick action is desired the lever is placed in the other hole so that the handle revolves in a smaller circle. They are made in a range of sizes to suit ordinary commercial work. They are manufactured by Bentley & Holmgrem, Bridgeport, Conn.

BENDING, FORMING AND SHEARING MACHINE

A machine for bending, forming and shearing metal has recently been developed and placed on the market. The machine is made in three sizes and is operated by hand, the smaller size being intended for bench use, and the two larger sizes for operating on the floor. All sizes of stock can be handled on the machine without extra dies, and the stock is so handled that no slip takes place. Holes are provided in the table for setting attachments to any desired position. By removing the forming and shearing plates all sorts of bending work of a heavy character can be taken care of. A 90 deg. angle can be accurately formed without the use of a gauge. The larger machine has an approximate weight of 840 lbs. They are manufactured by the Buffel Machine Co., El Paso, Texas.

DRILLING MACHINE VISE

A vise particularly designed for quickly securing all parts in drilling machines has recently been offered to the trade. All parts formerly requiring special jigs can now be handled economically in this vise. Lugs are provided on the base for securing to the drilling machine table. The handle of the tapping screw is swivelled to the end so that it can be operated conveniently in cramped position. The vise is made of cast iron with jaws 3in. wide, one and one-half inches deep, giving an opening four inches when full opened. The weight of the vise is 10 lbs., and it is manufactured by the J. L. Austin Mfg. Company, Milwaukee, Wis.

PORTABLE ELECTRIC GRINDER

A portable electric grinder of the squirrel-cage type has recently been placed on the market. A special treatment has been given to the asbestos insulation so as to bind the fibres into a tough, flexible mass, capable of withstanding a red heat indefinitely. The three-quarter horse power motor provided, quickly regains speed after slowing down due to heavy loads. The bearings are self-lubricating and of metal graphite type, the spindle operating at a normal speed of 3,600 r. p. m. A grounded wire is used to prevent the possibility of electric shocks to the operator. This protective wire adds little to the weight of these machines and can be attached to a water pipe or some permanent ground while the tool is in use. This portable grinder is manufactured by Forbes & Myers, Worcester, Mass.

HEAVY DUTY MOTOR GRINDER

There has recently been placed on the market a heavy duty motor grinder which is driven with a five h. p. alternating current motor. Ball bearings are provided and wheels 18 x 3 x 1½in. or 16 x 3 x 1½in. are used. The whole design shows that it has been built for heavy duty. The spindle is made of 45-point carbon steel. The end shields are of cast iron, turned with a recess and bolted directly to the motor frame. They are further secured in a position by supports clamped around the end shield hub, and then bolted to each side of the head casting. The end shield castings are turned and threaded into the ends of the shields. The flanges are turned all over and are recessed on the inside. Wheel guards are furnished, either plain or of the exhaust type, and are adjustable. Removable covers enclose the sides of the wheels, flanges, nuts, etc., for safety protection. The work supports are so mounted that their positions are adjustable. The starting switch is of the safety type, mounted within the column on a separate panel. This panel is easily removed from the rear of the machine without disconnecting the switch. The switch protects both operator and machine against unexpected restarting or accidental starting of the motor. It cannot be held closed on an overload. The standard machine is furnished as follows: 5 h. p., 220 volts, 60 cycle, 2 or 3 phase, or 550 volts, 60 cycle, 3 phase. The weight is approximately 1,200 pounds. The machine is manufactured by the J. G. Blount Co., of Everett, Mass.

TRIPLE COMBINATION PUNCHING AND SHEARING MACHINE

Recently there has been placed on the market a combination punching and shearing machine which is very economical in floor space and can be adapted to different types of work without the necessity of changing tools. The operator's side of the machine is clear of encumbrances such as fly wheels and driving gears. The plate shear has long knives, and behind these knives is ample room to ensure that no binding of plates will occur. The punch is arranged so that webs and flanges can be punched. The height of the throat is designed to handle broad flanged shapes. A lowering device is provided for the punch so that the centre mark can be ascertained. The frame is of cast steel. The slides are also made of steel and are adjustable. The covers of the slides are attached to the body by pin bolts so that they cannot work loose. The bearings are large, are bronze bushed, and are provided with ring lubrication. The machine is manufactured in a range of sizes by Amplex Inc., of New York City, and is marketed under the name Oeking.

SMALL ELECTRIC HOIST

A speed-reducing geared electric hoist has recently been placed on the market. The gearing consists of three internal ring gears, three planatory pinions, and a high-speed pinion that is mounted on the motor shaft. The outer gears of the internal set are housed in the frame so that they do not rotate. The middle gear which is keyed to the chain sheave has one more tooth than the outer gears. Long faces are provided on the planatory pinions to give ample bearing for the three internal gears. A speed reduction of from 100 to 1 and 350 to 1 is obtainable. Owing to the large speed reduction a high speed motor can be provided. As the mechanism is not reversible, no breaking facilities are necessary. The speed reduction gearing can be operated from the motor end only and no loads can be applied at the sheave that will cause the gears to rotate and thus lower the load. Roller bearings are provided and the motor shaft is subjected to driving torque only. Machine cut gears are used throughout and these are heat-

treated steel, with the exception of those used in the smaller hoist, which are made of cast iron. Either rope or chain lifts can be provided. These hoists are manufactured by the Joslyn Mfg. & Supply Co., Chicago, Ill.

AUTOMATIC DRILLING MACHINE

An automatic duplex drilling machine intended for high speed drilling, reaming, polishing and similar operations, has recently been placed on the market. Two spindles are mounted on the face of the column, each being rotated in a square guide block. Power is transmitted from the drive pulley to the spindles by means of noiseless bearings. A 3in. pulley is provided for the guide of the spindle, while a five-step pulley is provided for the feed and the operation of the chucks. The counter shaft which is mounted at the rear end of this machine carries two pairs of pulleys, one for each chucking unit. The construction of the machine gives a uniform downward movement to the spindle. It also provides a quick return on the upward stroke. The work-holding fixtures are made with four pockets so that special jigs can be provided for other work. The heads work alternately and are locked in position while the drilling is being performed. Feed is provided for each head separately. The machine has a capacity for drills or reamers up to 5⅛in. in size. These machines are manufactured by H. Ebsil Barr, Erie, Pa.

ELECTRIC PENCIL ETCHING OUTFIT

There has recently been placed on the market an electric pencil etching outfit which consists of two major units, a magnetic table and the pencil itself. It has been designed for the following uses: etching or writing on hardened steel, demagnetizing steel, annealing and soldering. By use of the magnetic table, work that has been placed on a magnetic chuck, can easily be demagnetized. To accomplish this it is merely necessary to pass the piece across the table while the current is turned on. In a similar way tools or bars may be magnetized. A file or other tool may be magnetized and used for removing chips from holes or for holding screws or other small pieces in place. To magnetize a tool for this purpose it is merely necessary to lay the tool on the table, turn on the switch, then turn off the switch and remove the tool. The etching pencil is used for marking sizes, numbers, and any necessary inscriptions on hardened steel tools or pieces. The cord of the etching pencil is attached to the table. When the current is turned on, it is possible to mark the work, with no more pressure than is required for ordinary writing. When used as an annealing point the cord of the pencil is attached to a second connection on the side of the table. The point is then replaced by one made of carbon, and the work is placed on the table of the intrument. When the current is turned on and the point of carbon held on the work, the point of contact begins to glow with heat. In this way a small spot can be heated without affecting the rest of the work. The carbon point may be employed in the same manner for soldering, being held in contact with the work to heat it and cause the solder to flow. The outfit is operated from an ordinary lighting circuit of 110-volt, 60 cycle, alternating current. The manufacturers are the Luma Electric Equipment Co., of Toledo, Ohio.

ARMATURE TESTING DEVICE

An armature testing device has just been placed on the market. It is intended as a production instrument for making simultaneous and instantaneous commercial tests for all electrical defects and their locations in armatures and bare commutator in distinction to the present step by step methods which frequently involves hundreds of distinct



tests on the same armature. It is claimed that the armeter will indicate whether an armature is o.k. or if not will reveal such defects as: open circuits and where; bad joints (on coarse windings) and where; short circuits between sections and which; short circuited windings and where; mixed connections and how mixed; irregular number of turns and whether high or low; grounds; tests made at substantial potential, not micro voltages usually used; also instantaneous tests of all sections of a bare commutator for both short circuits and grounds.

Its tests are claimed to be superior tests for it is said to indicate defects that only show up in bad behaviour after running a while. To test an armature its commutator is slipped into the circle of contact fingers in the centre whereupon the circle of small lamps one for each section which are used for indicators will on normal armatures burn as with half voltage, on short circuits light up more or less bright, on open circuits extinguish. Bad joints (on coarse windings) and excess turns are indicated by dimness, other defects by other irregularities. A ground detector operates simultaneously. Lamps are used for indicators as their indications command attention better than eye straining needles. A pilot lamp indicates their correct reading. The entire device is said to be strong and durable and to have no delicate parts and no moving parts except contact fingers. It is a production instrument not adjustable, but will also indicate shorts in higher voltage winding and open circuits on lower voltage windings at equal speed. It is manufactured by P. E. Chapman, St. Louis, Mo.

SAW SHARPENING MACHINE

A saw sharpening machine intended for sharpening circular saws from one and one half to 8in. in diameter has been placed on the market recently. It is particularly adapted to sharpening circular metal saws, screw slotting cutters and jewellers' saws. Saws up to 5/32in. thick and having holes from ⅜ to 1in. can be handled. The indexing is accomplished by means of the saw itself. The machine will likewise take care of saws with broken teeth. The grinding wheel is 4½in. in dia. by ⅜in. thick. Adjustment for wear is provided in the grinding spindles by means of a tapered bearing. The net weight of the machine is about 135 pounds and is manufactured by George Sherr, 126 Liberty St., New York.

JACKS, BLOCKS AND T-SLOT NUT

A recent development in small machine tool jacks has recently been placed on the market. These jacks are made in sections so that any required height can be obtained. They have a small point at one end and are flat on the other so that either end may be placed against the work as desired. The screw portion has a movement of ⅜in. and the pitch is fine enough to prevent it from running down under the pressure of the work. The height adjustment of the jack is obtained by means of tubular extension blocks. The tubing is made of 2⅜in. diameter stock and ranges in length from 1, 2¼, 4¾ and 9¼ inches. Another development of this firm is in the form of a T-slot nut, especially designed for putting additional clamps on machine work while on the table. The nut can be slid along the slot to the desired position and the stud or bolt with its clamp can be inserted from above. In this way additional bolts can be applied without disturbing the work. In this way clamping equipment can be reduced by the fact that bolts of any length can be inserted in the nut. These nuts can be furnished in any size desired Both jacks and T-slot nuts are manufactured by the Marvin & Caster Co., Canastota, N. Y.

BOOKLET

The Canadian Ingersoll-Rand Co., Montreal, has recently issued a new catalogue phamphlet on air receivers pressure tanks, moisture traps and aftercoolers. It is listed as Form K310-A.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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Keep The Standard High

OUR REMARKS in the May 25 issue regarding the proposed Engineers' Bill have been taken in some quarters to indicate lack of sympathy on our part with the suggested measure. Such is far from being a correct interpretation of our ideas. Our criticism of the suggested measure was based solely upon our desire, in the interests of the engineering profession, to ensure that such a measure should be workable and of such a character that no reasonable person could with justice raise any objection to it. The fact that objections were raised immediately upon the bill's introduction shows that careful consideration was necessary. The bill has now been passed, but minus the clauses we already referred to.

Both for the protection of the public and in the interests of the engineering profession, it is highly desirable that the latter be given a status which would be a guarantee that a duly registered member was competent to perform work entrusted to him; but to load the bill with penal clauses which might conceivably result in a thoroughly competent man being heavily fined and forced out of business because for some reason or other he might not see his way to become a member of the official organization, is hardly fair or wise.

A proposition of a nature still more detrimental to the interests of those proposing it, has just been launched by the plumbers of Montreal, who, professedly in the interests of the public, ask the city authorities to increase the master plumber's fee from $5 to $200 per annum. This they claim would eliminate the non-competent men from the craft. The weakness of this argument is apparent from the very fact that the men referred to would be in no way debarred from continuing their careers of incompetency provided they could raise the sum of $200, and also when it is seen that no matter how competent a man might be it would be impossible for him to obtain a license to carry on his trade if he could not find that sum. If incompetent men are giving the trade a bad name the obvious remedy is to make the examination they are called upon to pass more severe.

It is a laudable desire on the part of any trade or profession to raise the ability of its members to as high a standard as possible, but this object can not be attained by enacting penal measures which might inflict injustice upon fully competent persons legally engaged in that line.

Let the engineers organize, making their examination as rigid as they wish. They could then issue a certificate of merit to those found competent, which certificate would serve as a guarantee of proficiency to anyone engaging their services. The maintenance by the organization of a high standard of efficiency for its members would inevitably result in eventually weeding out all those who were inefficient, for the knowledge that membership was regarded by the public as a certificate of competency would soon induce all good men to become members.

How Will Improved Demand Affect Prices?

IN A RECENT editorial we referred to the distinct signs of improvement in the outlook for business generally which have lately been in evidence throughout the country. There are not lacking indications for an improved demand for all kinds of manufactured goods, and in some quarters it is taken for granted that with improved demand will come a rise in prices. It is worth while considering how far this anticipation is justified.

In discussing price fluctuations reference is frequently made to the so-called law of supply and demand and it is assumed that prices vary upwards or downwards as the demand increases or decreases. This assumption however presupposes a stable level of prices. When production is steady and prices have only fluctuated within narow limits for a considerable period as was the case in 1913, an increase in demand which necessitates the employment of fresh capital, the extension of manufacturing plants, and the employment of extra labor, will probably result in a rise in prices, at any rate temporarily. On the other hand, a lessening demand resulting in the closing down of works and the accumulation of stocks will produce a contrary effect.

At the present time however we must bear in mind the important fact that it is not yet established that industrial prices have yet reached a stable level. They are roughly speaking on an average some fifty per cent. higher than they were in 1913, and therefore it is quite possible and even probable that they have not yet done so, but that there is a further drop in store for them before stability is reached. There are to-day many factories and plants which are not working at anything like capacity, unemployment to a more or less extent is prevalent in most lines, and till demand increases is likely to remain so.

Under these circumstances a revival in demand is not likely to cause a general increase in prices. The idle plant and machinery is at hand to increase output in response to the new demand for goods when it comes; and therefore increased demand simply means a fuller employment of labor and a more complete utilization of materials, plant and machinery. Supply will be kept equal to demand at the same price. It is even possible that increased output might result in decreased overhead costs and competition might bring about reduced prices if such reductions were thought likely to attract buyers.

The point we wish to emphasize then is that a revival in demand and an improvement in conditions generally, although of course it might cause temporary fluctuations, does not necessarily imply increased prices.

Among the articles scheduled for coming issues are: Hints to the Operator in Setting Up Planer Work, June 22; Value of Keeping a Product Clean, June 29.

Several Lines Show Advancement In Prices

Steel Market Firm and Business Moving at Good Rate—Pig Iron Quiet—Non-Ferrous Metals Slightly Stronger—Machine Tools Show No Change—Supplies Improve in Demand.

STEEL PRICES GO UP IN SOME LINES

THE Canadian iron and steel market shows good strength. Several advances in prices have taken place in the Toronto field this week. Bars now range between 2.90c to 3.00c in place of 2.75c and sheets, including blue annealed, black and galvanized, have all gone up a little. Black sheets were $4.40 and are now $5.00; blue annealed were $3.75 and are now $4.00; galvanized were $5.60 and are now $6.00. Added strength, recent advances in the States, and steady demand are factors in these increases.

Cotton twine has also advanced 3 cents per pound.

Pig iron remains steady and the demand has not changed over the week.

Some non-ferrous metals show added strength, copper featuring. Prices are firmer and consumers seem to be taking more interest in the market, especially in Toronto locality.

Scrap metals are holding their own showing a little added strength in some lines. Cast iron is strongest.

The demand for small tools and supplies is slightly improved over last week. According to figures secured up to date of writing, June sales will be ahead of last month. Enquiries are better in these lines.

Machine tools are selling at about the same rate. Competition is still keen and dealers follow up everything that looks like an order very thoroughly. Enquiries are encouraging and while the amount of sales closed has not been very large, dealers are by no means discouraged. They feel an improvement is under way.

Oils and waste are in good demand, while steel pipe is very firm. Prices in the latter mentioned line are strong and deliveries extended. Boiler tubes are rather quiet and prices remain unchanged.

The official report of steel production in the United States in 1921, has now been issued and following are some of the chief points of interest. Steel ingot production was less than half the figure existing in 1916, 1917, 1918 or 1920. In fact, with the exception of 1908 it was the lowest rate since 1904.

Structural shapes showed a sharp decline the tonnage being the smallest since 1908. Black sheets, 13 gauge and lighter did fairly well, the production being greater than any year prior to 1910. Steel castings showed quite a reduction, viz. 559,713 tons against 1,251-542 tons in 1920.

Production of steel ingots was about 37 per cent. of capacity or 44 per cent. of record figures. However, large additions to capacity have been made since 1917 for in 1912-13, about 30,000,000 tons was capacity against approximately 55,000,000 at the present time.

Steel ingot production in May, 1922, showed an increase over the April, 1922 figures. The mills seem well fortified for a continuance of present rate, with exception of July and August, which are usually dull. Although the turnover is lighter, the steel market is very strong.

First sales of Lake Superior iron for season of 1922 have occurred, the price being 50 cents lower than 1921 schedule. The pig iron market remains stagnant.

Toronto

June 14

SEVERAL interesting developments have taken place during the past seven days. We warned our readers last week, that the price on iron and steel bars would be firm at 2.90c in place of 2.75c and the truth of our remarks is very evident when we can now report a firm market in bars at between 2.90c and 3.00c. Those who took our advice and purchased their metal at 2.75c, the old figure obtainable last week, are that much to the good.

Steel has also advanced in price, the new quotations being shown in the tables below. All these increases have been threatening for some time, because the steel market in the United States has been very firm. Canadian markets always reflect conditions over there, and these changes would have occurred before, had not competition been so keen.

Iron and Steel— In all iron and steel lines, the demand is firm. Building activity keeps up, therefore the demand for reinforcing bars, hardware, sheets, and other kindred lines used in construction work, is still good. Nothing is featued but the tone is good and prices firm. When we stated previously that quotations on iron and steel bars range from 2.90c to 3.00c, we infer that the fairly large user can get the lower figure, while the ordinary consumer usually pays the 3.00c price. However, if you are in the habit of placing all your business with one house, you have a chance at the lower figure. Band steel, of course, automatically goes up with bars.

Iron bars	2 90	3 00
Steel bars	2 90	3 00
Reinforcing bars	2 90	3 00
Steel hops		4 00
Tire steel		3 15
Spring steel		6 00
Band steel, No. 10 gauge and 3-16 in base		3 50
Small shapes		3 00
Sheets, black, No. 28		5 00
Sheets, blue ann., No. 10		4 00
Canada plates, dull, 52 sheets		6 00
Canada plates, all bright		
Galvanized Sheets, No. 28		6 00

Pig Iron.—There is no change in this field. The price is still $27.15 and the demand is as steady as can be expected, considering present foundry activity.

Non-Ferrous Metals— Copper shows more life than at any time during this year. Consumers are at last realizing this market is low, with a possibility of higher prices and are displaying more interest at present quotations. However, there seems to be lots of metal on the market and prices while firm, have not advanced as yet.

Red brass also shows strength, but not the same as in the copper field. The demand is not so strong but prices are fairly firm. Yellow brass is a little stronger owing to enquiries from the United States, but it has a long way to go yet. Following are quotations:—

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	6 75
Aluminum	26 00

Scrap Metals—Yellow brass turnings are in fair demand, while cast iron scrap is firm. Steel has receded a little, but turnings of both the above mentioned metals are in fairly good demand. Prices are steady.

Copper, light, per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	4 85
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	11 00
Axles (wrought iron)	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	15 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools—There is no change in the demand for machine tools. Any orders being closed are for small amounts, but the total of sales is by no means discouraging. Every dealer displays confidence and feels that although the present improvement is slow, it is bound to come stronger after a while. In the meantime they are going after everything that looks like an order in a very thorough manner. Enquiries are better and keen competition still exists.

Small Tools and Supplies— Business has been fairly good over the week, and an improvement over our last report. One merchant has taken another line, this being reported in the industrial news section on another page of this is-

sue. The demand is coming from all quarters and is very varied. The total sales for June should be well ahead of May, according to reports received up to date of writing.

Oils and Waste—Oils are unchanged in price and demand. Waste is selling at a steady rate, and cotton twine has advanced 3 cents per pound. In other words, 4 ply cotton twine sold in cones was 36c and is now 39c. This change took effect June 12. All other plys went up in the same proportion. Following are quotations:

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	0 20
Palacine	0 23
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	10 80
Pure turp., single bbls. gal.	1 40
Linseed oil, raw, single bbls.	1 15

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	13
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	18	Dark colored	18
Mixed colored	14		

Steel Pipes—A very firm market still holds good. Deliveries are getting slower all the time and prices are decidedly strong. Boiler tubes are still the same, existing figures being shown on the quotation pages.

Montreal

June 14

BUSINESS in the iron and steel lines for the past week has been without any outstanding features. The volume of trade is quite as large as that of the previous week, and in some instances it shows an increase. Announcements from one or two of the larger manufacturing concerns of plans for increased activity in the near future, has created a little more optimism in some lines. The building activity is still very marked. Few large contracts have been let lately but there appears to be no diminishing in the numbers of smaller jobs. This work creates a demand for varied small lines of steel.

No prices have been changed during the past week. Pig iron is steady at $31.80. Machine tools are very sluggish, while supplies are moving about the same as usual. Non-ferrous metals are firm, while the sales keep moving at about the same level. The scrap metal market is quiet.

Iron and Steel— Local jobbers state business has been slightly better than last week. The base price of steel is quoted as $2.90, but it is felt that attractive business can obtain a lower figure. The mills are quoting the jobber and the large consumer $2.50 and $2.30 base, respectively.

Galvanized sheets are moving fairly strong. Black and blue annealed sheets are also in demand. The large amount of building is to a certain extent responsible for this demand and screws, bolts and other small steel products, are also being required in fair quantities for the same reason. Merchant bars and plates are very quiet locally. Structural steel is called for in small quantities. There is no indication from the railways as to their probable entry into the market for rails and other steel products.

Keen competition is in evidence, as all orders are very aggressively sought. Even large jobbers go after the smallest orders. Quotations are:

Iron bars	2 90
Steel bars	2 90
Reinforcing bars	2 90
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron—The quiet tone of the pig iron market for the last two weeks remains unchanged. No. 1 iron remains at $31.80. The fact that Summerlee iron is still making its appearance in small quantities is creating a great deal of attention from Canadian producers. Just what effect this will have is not known. Sales are very small as foundries are only purchasing enough to take care of their immediate needs. For that reason it not thought that the matter is being as seriously considered, as if business were normal.

Machine Tools—The sales reported for the week are all for small machines. Several dealers state that there has been a very decided increase in the number of inquiries received. One dealer has a prospect for a couple of large machines, and wood working tools are in a little better demand than the iron working machines. No recent price changes have been made. Sales for 1922 are slightly in excess of sales for 1921.

Machine Shop Supplies—A large number of the shops are engaged in jobbing and contract lines are working nearly to capacity. Railway shops are working a number of men, and thus, the small tool trade keeps up very good. Business is somewhat spotty, but is generally improving.

Non-Ferrous Metals—A firmer tone is evident in the non-ferrous metal market especially in the case of copper. There is only a nominal improvement in sales and nearly all the firmness can be traced to foreign markets. Local dealers are disappointed in the volume of sales and stocks of metals are down rather low compared even with pre-war stocks. The demand is so light that dealers have not considered it profitable to carry large stocks. Local quotations are:—

Lake Copper	17 50
Electric Copper	17 25
Castings, Copper	17 00
Tin	35.50
Lead	6 75
Spelter	7 75
Antimony	6 50
Aluminum	23 00

Scrap Metals—Quotations on scrap metals are up rather high owing to the increasing demand in Pittsburg and New England areas. Business is improving to a slight extent but the foundries are still very quiet and until they commence to operate at a greater capacity, little business will be done. The holdings of local dealers are small. Prices quoted are:

Copper, light per 100 lbs.	9 50
Copper, Crucible	13 00
Copper, heavy	13 00
Copper Wire	13 00
No. 1 composition	10 00
New brass cuttings	7 50
Red brass turnings	8 00
Yellow brass turnings	5 25
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	13 50
Boiler plate, per gross ton.	9 00
Heavy melting steel	12 00
Axles (wrought iron)	20 00
Rails (scrap)	12 00
Malleable	10 00
No. 1 machine cast iron	23 00
Pipe, wrought	7 00
Car wheel	17 00
Steel axes	19 00
Mach. shop turnings	4 00
Stove plate	19 00
Cast boring	3 50

Pittsburg

June 14

THE official report of steel production in 1921, issued in the past week, shows steel ingot production to have been 19,184,084 gross tons, or just a shade under the estimate given in this correspondence at the close of the year. The production was less than half the amount in 1916, 1917, 1918 and 1920, while with the exception of 1908, it was the smallest since 1904.

Production of finished rolled steel was 14,228,329 gross tons, or 74 per cent of the ingot tonnage, the usual proportion being 75 or 76 per cent. The lower figure was presumably due to there being a smaller percentage than usual of heavy rolled products, which involve less scrap in their manufacture. The loss between ingot and finished rolled steel is chiefly in scale, which goes back to the blast furnace for reworking, and scrap, which goes to the open-hearth furnace.

Structural Shapes.—The greatest set back in production was in structural shapes, the 1,272,624 tons being the smallest since 1908. The trade had been prepared for this by the reports during the year, showing that lettings of fabricated steel contracts represented only 35 per cent. of fabricating sop capacity. Black sheets, 13 gauge and lighter, did relatively well, the 1,367,688 tons produced being greater than in any year prior to 1910.

Production of steel castings in 1921 was 559,713 tons, against 1,551,407 tons in 1917, the record year, and 1,251,542 tons in 1920. Production of steel ingots in 1921 was 44 per cent of the record production, made in 1917, while it was about 37 per cent. of capacity. There have been large additions to capacity since 1917, as even the production of that year did not represent capacity. There were plenty of orders, but there was physical disability, including shortage of transportation, and shortage of labor. In fact, the steel industry has been under a new alignment with in-

dustrial and general conditions in the country since November, 1916, for prior to that time, with the exception of the winter of 1902-3, when there was railroad congestion, the steel industry was always able to operate at capacity when it had the orders, while since then it has never operated at capacity, though at times it had plenty of orders, there being labor shortage, strikes, insufficiency of transportation, etc.

It is time to recognize this new alignment and consider the consequences. Seeing that in 1912 and 1913 the industry made about 30,000,000 tons of ingots, and in only one previous year as much as 25,000,000 tons, the industry of late, with a capacity about half-way between 50,000,000 and 55,000,000 tons, has seemed altogether too big. It appeared that orders for such tonnage of steel would be difficult, if not impossible, to secure. The broader view is that the industry is so large, by comparison with the size of the country, for the census returns showed only 9 per cent. increase in the number of persons "gainfully occupied" from 1910 to 1920, that there are several possible limitations to its operation, including the matters of orders, supplies of raw material, transportation, and labor available.

Just now the limiting factor to operation that is visible is the coal strike, but if the coal strike were suddenly terminated the industry would hardly be able to secure enough labor for full operation, and it is rather probable that the railroads would be unable to haul all the freight offered. To consume a tonnage of steel equal to the steel industry's capacity would also be impossible, for while the requirements might possibly be gathered up, men could not be found to do the requisite work in fabricating or using the steel. In other words, the country can be very busy, with everybody employed, and the railroads fully occupied, without the steel industry running at its capacity, and so the much quoted steel making capacity is largely a dead letter.

The important point which will affect steel prices, is which will get busy up to the limit first, the steel producers or steel consumers. Dependent upon this fact, we will have a sellers', or buyers' market. Of late there has been a sellers' market, and so far this condition continues.

Steel ingot production in May was at about 38,250,000 tons a year, showing a further increase over the 35,000,000 ton rate obtained April 1, when the coal strike began. The steel mills seem well fortified for a continuance of their present rate of production, except for the usual decrease that occurs in July and August on account of weather conditions.

The coal strike, both regular union, and nonunion part, in the Connellsville region, Westmoreland County, etc., has gone along without incident until a few days ago, when the Pittsburgh district operators sent another invitation to the miners' local organization for a wage scale conference, the invitation being promptly refused. The operators insist that they will not again make a four-state agreement, while the miners insist they will negotiate for nothing else. The presumption is that the Pittsburgh operators renewed their formal offer for the purpose of putting the miners on record again, preparatory to the operators making an effort to operate some of the mines, and important developments may occur in the next week or two.

The steel market is very strong, although the turnover is lighter than in April, mills being comfortably sold up, while most buyers are well covered. A few buyers are not, and there are new wants arising, so that some business is done. This shows the market to be in even stronger position than two or three weeks ago, and in several products there is a range of prices, mills having the lowest prices being willing to sell only to regular customers, and only when the steel is for a specific job. Other buyers must go elsewhere and pay higher prices.

The market is quotable as follows: Bars, shapes and plates, 1.60c to 1.80c; hoops and bands, 2.25c; to 2.50c; blue annealed sheets, 2.40c to 2.50c; black sheets, 3.15c to 3.40c; galvanized sheets, 4.15c to 4.40c; automobile sheets, 4.50c to 4.75c; standard steel pipe, 71 per cent basing discount; wire nails, $2.40 to $2.50; tin plate, $4.75

First sales of Lake Superior iron ore for the season of 1922 occurred June 9, establishing a market, f. o. b. Lake Erie docks, 50 cents below the 1921 schedule, which by a reduction of $1, had represented a return to 1919 prices. The new quotations are: Old range Bessemer, $5.95; non-Bessemer, $5.20; Mesabi Bessemer, $5.70; Mesabi non-Bessemer, $5.05. Prices are based on 55 per cent. iron content in Bessemer ores and 51½ per cent. in non-Bessemer ores. Naming of prices was delayed this year, by the slowness of inquiry and by waiting in the Interstate Commerce Commission to settle the upper lake rail case, where the ore interests requested a reduction of 25 cents. It is assumed that the reduction will be made, and as the lake vessel rate has been reduced 10 cents from 1921, making it 84 cents from the head of the lakes (including the 14-cent dock charge) there is left 15 cents for the ore interests to absorb in the total reduction of 50 cents at Lake Erie docks.

The pig iron market remains stagnant, quotable prices, now largely nominal, continuing at $25 for Bessemer and basic and $24 to $25 for foundry, f. o. b. valley furnaces.

PROPER LIGHTING OF WORKSHOPS

So important is proper lighting in connection with industrial plants that the widespread negligence still observable is a reproach to intelligence. In some cases the remedy attempted is an aggravation of the evil, local or individual lighting, for instance, being so placed that its dazzling effect injures the worker and handicaps the output. Bad lighting is a visible sign of bad management, because it creates a manifest and needless loss. This is a matter not of theory but of close investigation by competent observers, whose conclusions agree with what one may term the common-sense view of the case. In many cases it has been found that a simple yet effective improvement has produced better lighting at a lower cost than the faulty original. Good lighting has the power to stimulate, and stimulation in the workshop is doubly useful by increasing production and lessening error.

LARGE FRICTION WINCH

There was recently built in Great Britain, and for one of the British Dominions, a steam winch of unusual power. This winch has three drums and is designed to hoist a total load of six tons at a speed of 200 ft. per minute. It has three barrels mounted loosely on shafts and engaging with them through friction clutches. The load may be hoisted on any one of the barrels or distributed among the three barrels. Further, while one or two of the barrels are in use for hoisting purposes, the other or others may hold suspended a load up to six tons. The winch is driven by a two-cylinder engine and it will be used on a large harbour.

GREAT BRITAIN AND HYDRO-ELECTRICS

During recent years more than one of the large electrical manufacturing groups in Great Britain has organized itself to carry out hydro-electric schemes on a large scale. The latest development is the formation by one of the leading armament and engineering firms of a special department to deal with complete water power development schemes in all their aspects, civil, mechanical, and electrical. This great firm is at present carrying out surveys, in many parts of the world, of schemes brought before it and considered by a powerful financial group with which it is working in conjunction.

IMPERIAL AIRSHIP SCHEME

Strong support is being given by industrial interests in Great Britain to the scheme for establishing a commercial airship service between Britain, India, and Australia. It is confidently expected that the British Air Ministry will recommend the Government to assist this enterprise, for which detailed and promising estimates have been drawn up. Meanwhile the speed of British air services to and from France is increasing. Recently a record was established by a British machine on which four successive single trips between London and Paris were made in the interval between 6.55 a.m. and 5.40 p.m. Out of 10¾ hours between the first ascent and the last descent 8 hours, 52 minutes were actually spent in the air. The total distance covered was about one thousand miles.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 90
Steel bars, base, Toronto	2 90 3 00
Iron bars, base, Montreal	2 90
Steel bars, base, Montreal	2 90
Reinforcing bars, base	2 90
Steel hoops	4 00
Tire steel	3 15
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 40 3 50
Chequered floor plate ¼" and heavier	5 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1.60
Tank plates, Pittsburgh mill price	1.60
Structural shapes, Pittsburgh mill prices	1.60
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2.38
Structural shapes	2.48
Plates	2.48
Small shapes under 3-in.	2.38

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 00
Electric copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	35 50	34 50
Spelter	7 75	7 25
Lead	6 75	6 75
Antimony	6 50	6 75
Aluminum	23 00	25 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.81	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.2"	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

Per 100 Pounds.

	Montreal	Toronto
Copper, light	$ 9 50	$ 8 50
Copper, crucible	13 00	11 00
Copper, heavy	13 00	11 00
Copper, wire	13 00	11 00
No. 1 machine composition	10 00	9 00
New brass cuttings	7 50	6 00
Red brass turnings	8 00	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	13 50	11 00

	Per Ton	Gross
Boiler plate	$9 00	$ 7 00
Heavy melting steel	12 00	10 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	12 00	11 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	23 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	19 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	19 00	14 00
Cast boring	3 50	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	70%

ROPE AND PACKING

Plumbers' oakum, per lb	0 07
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 19
New Zealand hemp	0 21

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13.55
Red dry lead, 100-lb. kegs, per cwt.	13 00
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	60
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	2[illegible]
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	4.50 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 40	$5 00
Sheets, blue ann., No. 10	3 80	4 00
Canada plates, dull, 52 sheets	5 50	6 00
Can. plates all bright	7 00	....
Galvanized sheets, No. 28	....	6 00
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's Best, No 28...	....	....
Colbornes Crown, No. 28.	....	...
Premier, No. 28, U. S.	6 45	5 35
Premier 10¾ oz	6 00	5 95
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	18.00	$
1¼ in.	20.00	
1½ in.	19.00	
1¾ in.	20.00	
2 in.	19.00	16.00
2¼ in.	22.00	19.00
2½ in.	25.00	19.00
3 in.	29.00	24.00
3½ in.	34.00	26.80
4 in.	43.00	34.25

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	20
Palacine	23
Machine oil, per gal.	33
Black oil, per gal.	17½
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	1.40
Pure turp., single bbls. gal	10.80
Linseed oil, raw, single bbls.	1 10

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets. 24 gauge and heavier, base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White 18 Dark colored 13

Mixed colored 14

This list subject to trade discount

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Copper Bars, ½ to 2 in	$29 00	$28 00
Copper wire, list plus 10..		
Plain sheets, 14 oz., 14x60 in.	30 00	28 00
Copper sheet, tinned, 14 x 60, 14 oz.	37 00	35 00
Copper sheet, planished, 16 oz. base	42 00	40 00
Braziers', in sheets, 6 x 4 base	30 00	28 00
Copper tubing, seamless		29

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 00
Sheets, 3 1-2 lbs sq. ft.	8 50	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 25	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

An electric lighting plant may soon be installed by the Chipman Flour Mills Co., Chipman, Alta.

Factory burned.—The Muskoka Wood Mfg. Co. factory and mill at Huntsville has been destroyed by fire.

Will construct dam.—The Pacific Pulp Mills Co., Ocean Falls, B.C., will possibly erect dam at cost approximately $500,000.

Will erect plant.—The Cape Breton Cold Storage Co. will erect a plant at North Sydney, N.S. The cost will be around $200,000.

May erect theatre.—Mark Rodgers, Lethbridge, Alta., is contemplating the erection of a theatre at Cranbrooke, B. C. $12,000 is the estimated cost.

It is a good plan to wash out machine bearings from time to time with gasoline as they frequently become stiff from gradual accumulation of fine particles of dust.

Montreal, Que.—Tenders have been called by the city executive committee for the construction of a filtered water reservoir at Atwater Ave. water works. The estimated cost is $500,000.

Recreation Club planned.—F. J. Gallanough, architect, 79 Albany Ave, Toronto, has plans for a recreation club for Riverdale Recreation and Athletic Club Ltd.

Addition to plant.—Stanfields Ltd., Truro, N.S., will add to present plant. Russell & MacAuley, 10 Walker St., Halifax, has the contract, and the addition will cost approximately $125,000.

Sub-contracts have not been let as yet for the following equipment in the Mount Royal Hotel, Montreal. Kitchen equipment, ice plant, refrigerators, and pneumatic tubes. Thompson Starrett & Co. are general contractors.

J. H. Grant & Co., Montreal, have been awarded contract for construction of rod rolling mill and electrical substation for Eugene F. Phillips Electrical Works, Brockville, Ont.

A transformer Sub-station for the Hydro-Electric Power Commission of Ontario will soon be erected at Chatham, Ont. E. B. Lawler, district engineer, has completed the plans.

Shawinigan Falls, Quebec.—The Belgian Industrial Company now has orders which will keep its plant running all the year at full capacity. It is stated that it is not able to fill all the orders it is receiving and it has started on a new extension to accommodate two more paper machines, one of which will be ready about January next year, the other in July.

Bridge Being Erected.—The C. P. R. bridge at Coquitlam, B.C., which was washed away by floods last year is now being replaced. The new structure will cost $172,000, and goes over the Coquitlam river.

Port Arthur, Ont.—An arena costing $7,500 will be erected in Current River Park. A public school on Prospect Ave. to cost $200,000 will also be built. Those interested can write city clerk T. F. Milne.

Industrial conditions in Peterboro show signs of improvement owing to the increased outside work now going on. Many manufacturing plants are adding to their staffs. Some mechanics have gone to Oshawa and Windsor to engage in motor factories.

New Station.—Galt will soon have a new station. M. W. Kirkwood, general manager of the G. R. R. and L. E. & N. Ry., has received revised plans for the new depot which will be erected on Main Street.

Ottawa, Ont.—W. E. Campbell, lately freight expert advising the Government Railways Department and the Railway Commission, has been appointed Chief Traffic Officer for the Dominion, succeeding the late James Hardwell.

Will build garage.—Plans are now prepared for a garage for W. H. Muckle, 88 Adelaide St., Toronto. E. J. Hunt Stanford & Sons, architects, 67 Yonge Arcade, have the plans. The estimated cost is $21,000.

P. J. Pybus, managing director of the English Electric Co., and John Sampson, of John Brown & Co., the English shipbuilders, are at present in Canada. They will inspect the plant of the English Electric Co. of Canada at St. Catharines while they are here.

Will erect hospital.—Plans have been prepared, and tenders are now being received for the erection of an hospital at Wallaceburg, Ont., which will cost about $50,000. Chester Wood, 217½ Christina Ave. N., Sarnia, Ont., is the architect.

Fire Causes Damage.—Fire on the premises of the St. John Drydock & Shipbuilding Co., N.B., destroyed the roundhouse and one locomotive, a building owned by the Bedford Construction Co., also a compression outfit owned by the Drydock company and stores valued at $20,000. The loss was $30,000.

The Engineering Equipment Co., Ltd., Montreal, have been appointed exclusive Canadian sales representatives for Schutte & Koerting Co., of Philadelphia, manufacturers of low level jet condensers and other power plant equipment.

Construction work.—Stratford, Ont.—The latest building figures are most encouraging, showing that construction work was greater in the last five months than in any entire year of the past twelve years. Forty-one permits for dwellings during May were issued, as against fourteen for the same month last year.

Addition to Factory.—The Gardner Construction Co., Welland, Ont., has been awarded contract for erection of $72,000 addition to factory of Empire Cotton Mills. When the building is completed, machinery installed and warehouses added, the total cost will be about $215,000.

Additional contracts for alterations to bank costing $35,000 for Royal Bank of Canada, at Winnipeg, Man., are: Electrical, Levy Elec. Co. Ltd., Portage Ave.; plumbing and heating, Standard Plumbing & Heating Co., Fort St.; plastering, Western Plastering Co., Confederation Life Bldg. Sutherland Construction Co., general contractors, Merchants Bank Bldg.

An analysis of the report indicates that a state of stability has been reached in the price situation, advances in one group being offset by recessions in another. The fact, however, that the average price level is now much higher than that which existed immediately prior to the war, is regarded by economists as an indication that rock-bottom has not yet been reached.

A Canadian Chapter has been formed of the American Association of Heating and Ventilating Engineers, to be known as the "Canadian Division, Ontario Chapter." The membership is at present about 35, the first meeting was held June 2, when the following officers were appointed:—M. H. Thomas, president; H. H. Angus, vice-president; A. S. Leitch, secretary, and A. J. Dickey, treasurer. Monthly meetings will be held in Toronto.

Fixed assessment.—Weston, Ont.—The Canada Cycle & Motor Co. have been granted a fixed assessment as follows:—$60,000 for the first five years; $70,000 for the second five years, and $80,000 for the third five years. There is one provision made, and that is that the company, are by a special by-law, brought within the town limits. At present the company are just located outside the town limits. Representatives of the Ford Motor Car Co. have asked the Weston council to close a portion of Rosemount avenue, between Dufferin and McDonald avenues, in the event of their locating near there. The council agreed to the closing of the specified area, if the company follow out their plans.

Quebec, Que.—It is anticipated by local shipping men that the volume of business on the harbor front this year will exceed that of the record year, 1921. Many new improvements are being made by the Harbor Commission to accommodate the new freight and passenger steamers, which have included Quebec on their calling list for the first time.

Montreal.—Mr. Arthur H. Sancton, late of Messrs. Fraser & Chalmers of Canada and consulting mechanical engineer for the Hollinger and McIntyre Gold Mines of Timmins, Ont., is in charge of the new industrial manufacturing department that is being organized at Canadian Vickers Ltd. Contracts are being negotiated for the firm to manufacture some lines of heavy machinery. These deals concern both United States and British firms.

Tenders Wanted.—Tenders are being called for several pieces of construction in Alberta by the Canadian National Railway. A connection between the Canadian Northern and the Grand Trunk Pacific at Magnolia, a distance of .83 miles; a connection between Bashaw and Battle River subdivisions, 3.47 miles long, near Camrose, and a connection at Ryley, 1.83 miles long, between the Viking and Battle River subdivisions are to be constructed. Plans and specifications may be seen at the office of the district engineer in Edmonton and the division engineer in Calgary.

Shop is busy.—Montreal, P. Q.—J. R. Parkes, general manager of the Stowell Screw Co., Longueuil, states that his firm has been able to obtain sufficient orders to keep them operating practically at normal capacity all through the period of depression. During the last two months, his ordinary business has been improving steadily, and in addition the firm has received a large number of very attractive orders for small screws to be used in the manufacture of parts for radio apparatus. The plant is very busy in an effort to keep pace with orders that are coming in daily.

Have secured contracts.—Contracts for four 54-in. pumps which are to be installed at the Sumas dam, to drain Sumas Lake, B.C., have been awarded to the Dominion Engineering Works, Ltd., Montreal, by the B. C. Land Settlement Board. The pumps, which have a capacity of 750 second ft., are driven by individual motors, which will be of approximately 600 and 1,200 h.p., two of each being installed. The contract was let through C. A. Yowill, of Vancouver, and delivery is promised for February, 1923.

Have Purchased Plant.—The Premier Paper & Power Co., recently incorporated, have purchased the H. Croix Paper & Lumber Co., acquiring the latter's watershed and 26,000 acres of pulp land. They are planning the early construction of a new paper mill and power plant to cost approximately $1,500,000, states Phil H. Moore, managing director of the new concern, whose office is at 91 Hollis St., Halifax. The mill will be 35 miles from Halifax, and will consist of two hydraulic turbines generating approximately 3,300 h.p., four water wheels to drive grinders, and one newsprint machine. Contract for construction of the mill may be let upon a cost-plus basis, although nothing definite is set as yet. Geo. F. Hardy, of New York, is consulting engineer.

Orders Will Be Placed.—The Metachewan Power Co. have announced their board of directors. Following are those interested:—President, Robert Fennell, Toronto; 1st vice-president, F. J. Westaway, Hamilton; 2nd vice-president, Col. Robert Stark, Montreal; D. W. Caldwell, Perth; Sir Henry Galway, D.S.O., London, Eng.; and H. W. Sutcliffe, New Liskeard. The completed plant will produce 13,000 h.p., and supply power to the Kirkland Lake, Elk Lake, Gowganda and Shining Tree mining camps. The company, which is capitalized at $1,000,000, has the power rights on the Indian Chutes and Big Ben, on Montreal River. Work has already commenced and orders for machinery will be placed at once.

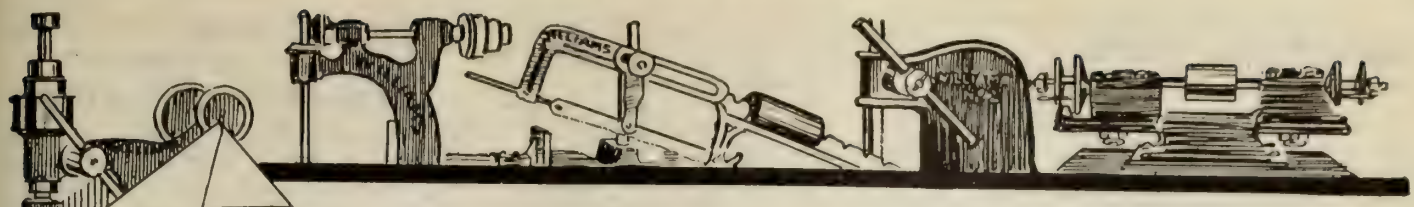
Sault Ste. Marie.—The movement of freight through the canals here during the first full month of navigation ending May 31, aggregated 3,316,645 short tons, according to a report compiled for the United States Engineer's office here. This is a decrease of 2,828,418 tons, compared with the movement in similar month a year ago. The movement of wheat, downbound, aggregated 24,662,396 bushels against 12,609,469 bushels a year ago, and that of other grains was 26,734,772 bushels, compared with 12,429,593 bushels in May last year. The movement of wheat and other grains was about normal. Iron ore, downbound, totalled 1,379,850 short tons, and copper shipments were 5,898 short tons. Ore cargoes a year ago totalled 2,647,833 tons. Coal shipments to the north were 203,988 short tons of bituminous and 2,100 short tons of anthracite. In May last year the movement of coal was 2,220,000 tons. Vessel passages numbered 1,305, compared with 1,515 a year ago.

The late Minister of Marine and Fisheries, the Hon. C. C. Ballantyne, has been elected a director and president of The National Brick Co., of Laprairie, P.Q. Although a number of the directors and large shareholders of the company desired to see Mr. Ballantyne occupy the president's chair, he was finally influenced in his decision by the wishes of T. A. Trenholme Estate. The former president of the company, Mr. H. R. Trenholme, who is also an executor of the Trenholme Estate, retired owing to private business pressure. Mr. Ballantyne is well known throughout the country, and is a director of the Royal Trust Co., Canada Cement Co., Montreal, Locomotive Works, The Canadian Explosives, Ltd., and for many years was vice-president and managing director of The Sherwin Williams Co. of Canada.

Enquiries are encouraging.—Montreal, P.Q.—Mr. P. L. Miller, general manager of Canadian Vickers Ltd., states that inquiries for the Sea Sled, the new type of motor boat the company is manufacturing under the Hickman Patents, have come not only from all over Canada, but from points as far away as South America. The number of inquiries is very encouraging, as many of the prospective purchasers plan to place the boats in commercial work. Mr. Miller confirmed the rumor that the large sea sled now being built at the plant, would likely be run up the Lachine Rapids, to test its ability to navigate in turbulent waters. The company have secured selling rights for four of the adjacent New England States, and if business warrants, will probably erect a small plant on Lake Champlain to build these boats.

Following are several companies recently incorporated:—Bouret, Ltd., with head office at Quebec, and a capital of $20,000. They will carry on a general contracting business. The United Building Corporation, with head office at Toronto, capital $60,000, to carry on a contracting business. The Heath Unit Tile Co., with head office at Toronto, with a capital of $50,000, to manufacture and deal in clay products and builders' supplies. E. O. Leahey & Co., head office at Ottawa, with capital of $150,000, to carry on the business of general contractors and to deal in building materials. Coland Construction Co. head office at Toronto, with capital of $40,000, to carry on an engineering and contracting business.

Will build iron plant.—The British Steel Corp. has undertaken to construct in Newfoundland before 1928, a plant capable of producing 100,000 tons of pig iron annually. This action is taken following an agreement between the Corporation and the Newfoundland Government, the latter having arranged to pay a royalty of 25 cents per long ton to the British Empire Steel Co. for every ton of ore that is mined in the Colony. The Steel Corp. further undertakes to erect coke ovens, and to expend $3,000,000 in Newfoundland before 1926. It has been arranged that raw materials to be used in the construction of these plants are to be admitted to the island free of duty. Both subsidiary companies of the British Empire Steel Co.—The Dominion and Scotia—are granted rights regarding tax exemptions and water power grants. The royalty of 25 cents per long ton is to continue in force until December, 1940. In the event of either company failing to carry out the construction programme agreed upon, or should they fail to expend $3,000,000 in Newfoundland before 1926, an export tax of $1 per ton will be imposed by the Newfoundland Government upon all ore mined and shipped to any part of the world except Nova Scotia.



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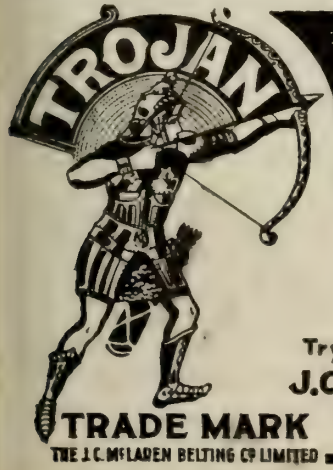
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This double back geared, quick change engine lathe brings many advantages to the tool room. High grade, accurate, small in size but extremely powerful.

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WHOLESALE PRICES SHOW SLIGHT INCREASE

The monthly report of the department of labor at Ottawa, shows a slight upturn in wholesale prices. The index number of wholesale prices of all commodities stands at 226.1, as compared with 225 for the month of April; 247.3 for the month of May, 1921; 356.6 for May, 1920; and 136.3 for May, 1914. Iron and steel have moved from 182.5 for April to 184.2 for May. Other metals are practically stationary at 140.6, compared with 140.2.

Textiles show a slight advance from 227.9 to 228.6. The coal strike has caused a jump in coal prices, as indicated by the index number of fuel, which stands at 270.7, as against 244. Fuel and lighting together have advanced from 243.2 to 258.1. A pause in the downward trend in the costs of building materials is indicated by the fact that the index number for all commodities comprising this group now stands at 254.8 compared with 253.4. Lumber and miscellaneous materials have stood firm, and higher prices for paints, oils and glass are mainly accountable for the increase in the index number for the month.

Quebec.—The barge C. C. Donahuge, loaded 200 tons of newsprint paper a few days ago, and a second barge loaded a similar quantity directly after. These loads were shipped by the all-water route to New York. Some two years ago water shipments of newsprint were made to New York owing to freight congestion existing at that time, but the reason for resumption of barge trade on newsprint at this time is high freight rates. It is stated that European pulp and papers are arriving at New York at freight rates of from $3.00 to $4.50 gross ton, whereas the rail rate from Canadian mills averages $8.50 per gross ton. To offset this great difference, many Canadian industries are endeavoring to ship by water, and hope they will be able to meet the foreign competition.

The J. A. M. Taylor Tool Co., 77 Adelaide St. W. Toronto, have taken over two important lines, viz, Walker twist drills, and Greenfield taps and dies. Both mentioned companies will place a complete stock in the Toronto office, and Mr. Taylor will act as manager of Toronto and district sales. In other words, his office will act as a distributing point. All business closed will be invoiced from the head offices of his principals, the Walker Twist Drill Co., Wakerville, Ont., and the Greenfield Tap and Die Corporation, Galt, Ont., respectively, Mr. Taylor acting only as distributor for these lines. In addition to handling this work, he will continue to carry and sell his other lines, including files, hack saw blades, grinding wheels, etc. In these latter mentioned articles he will do his own billing.

The Toronto sales office of the John Morrow Screw and Nut Co., Ingersoll, is located at 172 John St.

W. H. Crowhurst has joined the sales force of the Kayser, Ellison and Co., Montreal, and will be located in the Montreal district. He was previously with Thomas Firth and Co., serving for 13 years, and for the past four years Quebec traveller for H. A. Drury and Company.

The Canada Metal Co., Toronto, have taken over the entire washer plant of the Union Iron and Metal Co., Toronto. This equipment is very complete, and over 400 different sizes of washers will be manufactured. The washer plant has been moved to the Graham Nail Works of the Canada Metal Co., this shop being large, well lighted, and convenient to the railway siding. It may take a little time before maximum production is reached, but once things getting running smoothly, they will be well able to cope with any demands. They intend to make this a jobbers and large manufacturers proposition, and with their own selling organization, expect to develop the industry to a large extent before very long. So far, they have had very favorable comments on the washers finished under their supervision.

SELL BRITISH ROAD ROLLERS IN CANADA

H. M. Trade Commissioner at Winnipeg reports that a United Kingdom manufacturer of road rollers has been successful in securing, in competition with foreign firms, a contract for two water ballast motor road rollers for delivery in British Columbia for the Canadian National Parks.

The United Kingdom firm in question is represented in Western Canada by a resident agent in Winnipeg, and the Trade Commissioner is of the opinion that its success is to be attributed in no small measure to this fact. Calls for tenders for supplies required by the Federal and Provincial Government Departments are made locally and often at short notice, and United Kingdom firms who are without responsible resident agents in Canada have very little chance of success in securing contracts, according to the report.

MILL RUNNING TO CAPACITY

Montreal.—Reports from Price Bros. and Co. mills indicate that they are running with a production of nearly 300 tons of newsprint a day. For all of this a market is assured. This condition, it is believed, will continue for the balance of present year. In addition there is some improvenment noted in lumber business, and within the last week or so the first shipment from the province for export to England took place, and it is expected that this will be followed by other shipments. During the past winter the company cut about 25 per cent. of its normal quantity of pulpwood and will go into the woods this winter probably for a normal supply.

BELIEVES WORST IS OVER, BRITAIN WILL SOON RECOVER

WE ANNOUNCED last week that J. G. Stirk of J. Stirk & Sons, Halifax, England, would be visiting Toronto within a few days. Less than 50 hours after his arrival in Canada we had the privilege of conversing with him upon conditions in England and other matters of interest to our readers.

Speaking about the industrial situation over there, he said: "I thoroughly believe the worst is over. Conditions are much better, and it looks as if the engineering strike is close to settlement. At least that is my opinion. The road ahead may be rather uphill, but I feel sure we will make the grade without difficulty."

Commenting upon the past war and if it had made any radical changes in the design of machine tools in England, Mr. Stirk said that it had not, although it had most assuredly taught them a lesson in simplification. To illustrate this point he told us the following story:

"Our firm, for example, handled about 20 different styles of machine tools before the war. Each of these styles had numerous sizes, so that the assortment was quite varied. Many of the types carried were only used occasionally, in fact some lines would only be called for about twice a year. The money tied up in patterns and other equipment was enormous and still we felt we had to carry them all.

"Then came the war and the need of machines in a hurry. Would you believe it, that for a certain length of time we made only one size of planer, a 5 ft. by 5 ft. type and had one order alone for 110 of these machines? These tools weighed roughly 25 tons each and we were turning them out at the rate of twelve per month."

When Mr. Stirk starts to talk about planers, you have him riding his hobby horse. He knows this style of tool from the ground up and is going to give us the benefit of some of his experiences in an early issue. Readers can look forward to this with keen interest.

Discussing the finish on British machine tools, Mr. Stirk said that British builders were paying more and more attention to the exterior appearance, without lowering the quality of the workmanship on hidden parts. He claimed that in the near future we would see a vast improvement in this respect. "So far we have built machines to do the work irrespective of the exterior appearance," he remarked, "but from now on, we are keeping in mind both quality and appearance."

Speaking about the absorption of discharged army and navy men, Mr. Stirk admitted the unemployment situation was rather bad, although not so acute as it was a few months ago. "As I said before," he concluded, "I believe we are safely over the worst and from now on, a gradual and steady improvement will take place."

Tooling Up Your Engine Lathe for Turret Work

Jarvis Tappers and **Quick Change Chucks** and **Collets** are absolute necessities in to-day's production scheme.

They are developed to a high degree of perfection and the **Geometric Tool Company** recommends and furnishes them as a fitting adjunct to their line of threading tools.

Jarvis Collets convert an engine lathe into a turret lathe by simply using one of ,the **Jarvis Quick Change Chucks,** which allows the use of any number of different tools.

The Jarvis High Speed Tapping Device is superior to any other.

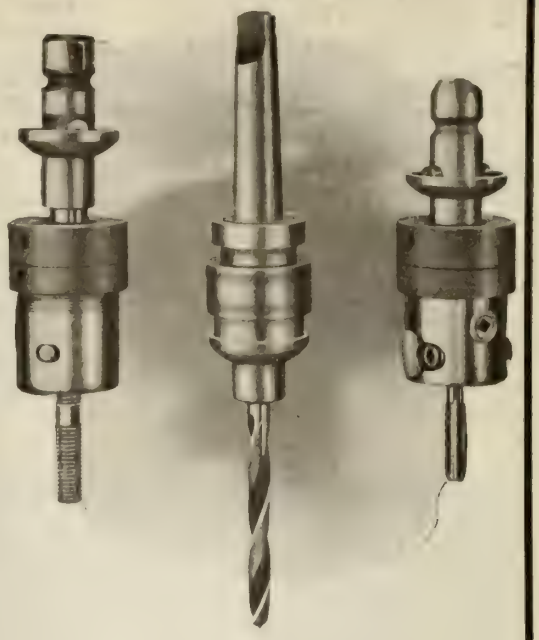
It has a ball drive and ball reverse, making easiest action, with no clinching or binding. Reverse motion faster than the drive.

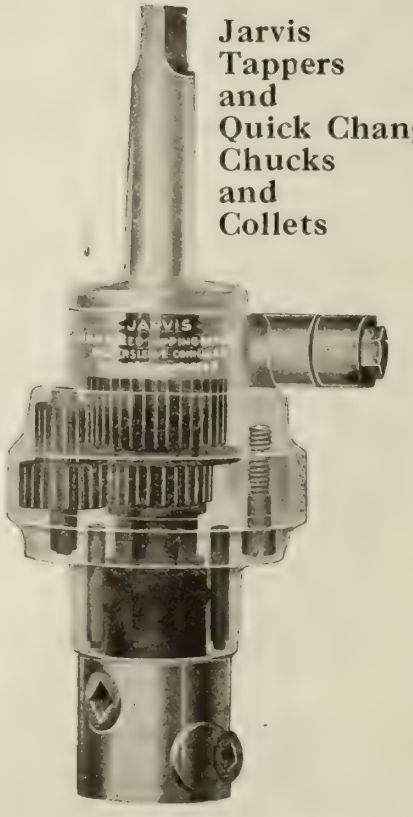
Specially designed Chucks make special taps unnecessary.

Jarvis Quick Change Chucks and Collets consist of a chuck or locking member and a sufficient assortment of collets for any job.

Where one hole is drilled, reamed, counterbored, tapped and a stud set, or any two of these operations are done with one spindle, the Jarvis Quick Change Chucks pay for themselves in a very short time. Changes are made without stopping the Drilling Machine or Lathe.

There is no burring from constant use to interfere with the easy entrance or operation of the Collet. If your product requires drilling, counterboring, tapping and stud setting, you need to know about the Jarvis. The Booklet tells the complete story.





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C.P.R. LEADS WAY IN RE-ESTABLISHING GERMAN TRADE

"We have frequently expressed the opinion that no matter what sentiment we as Canadians might individually hold regarding the Germans, trade relations would be gradually resumed," says "Financial Post" in a recent article. They continue:—

"We have stated that sentiment would not hold out against economic forces, that to try to prevent an economic readjustment would do us as much or more harm as our late enemies. We have been soundly condemned by trigger-brained patriots who can not vision a year or so ahead.

"Last week it was announced from London that the Empress of France of the Canadian Pacific Lines had arrived at Hamburg with a cargo of Canadian products. This was the first trip in the new Germano-Canadian service. And the Empress of France was MADE IN GERMANY.

"In connection with this new service between Canada and Germany, Sir George McLaren Brown, British representative of the C.P.R., declares that 'Germany, which is now exporting a considerable quantity of goods to Canada will in the not far distant future take large quantities of Canadian raw materials and food stuffs. German supplies will have to be replenished soon and when exchange improves I hope that Germany will buy largely of Canadian grain and material products.'

"As a matter of fact the exports from Canada to Germany for the last fiscal year—ending with March—amounted to $8,215,337 as compared with $610,528 in the previous year, nothing in the war years and $4,004,019 in the year ending March 1914. In previous years the figures of German purchasers in Canada were:—1911—2,028,649; 1912—3,577,847; 1913—3,049,105.

"Thus we see that in dollars our exports to Germany are almost double what they were before the war. The value of the dollar is of course an important factor but still there can be no doubt that Germany is going to buy heavily of Canadian products. And who is going to suggest that we refuse to sell?

"This development would seem to be all the more favorable in relation to the all important balance of trade when it is stated that for the same fiscal period imports "from Germany" amounted to only about $1,500,000 as compared with nearly $15,000,000 in the year of the war. It must not be supposed, however, that these figures indicate all the German goods coming into Canada. When restrictive legislation went into effect German exporters immediately established connections with agents in Holland, Switzerland, England and the United States and made their consignments as exchange favored. We are to-day probably not only buying much more from Germany than the import figures indicate but much more than we are selling. It is for this reason that Canadian capital and Canadian labor look to the government to prevent the "dumping" into Canada of German products. We must expect to buy in Germany in order to sell but manufacturers and workers in this country should be protected from the competition of underpaid labor and debased currency."

LARGE BUCKET DREDGE BUILT BY CAN. VICKERS

The Canadian Vickers Co., of Montreal, has just completed the construction of the bucket ladder dredge No. 16, this being a sister ship to the dredge "Corozal," built by Messrs. Wm. Simons & Co. of Renfrew, Scotland. The No. 16 is one of the largest dredges of its kind in the world, being 292 feet in length, 48 feet moulded breadth and 20 feet 6 inches deep, fitted with two sets of buckets, one set with capacity per bucket of 54 cu. ft. and the other 30, cu. ft. per bucket. The vessel is of the twin screw type, driven by 1400 h. p. reciprocating engines. Two Scotch boilers are installed.

The vessel is electrically lighted. The upper deck is fitted with a 5-ton steam crane to assist in handling the buckets, and the bow and stern winches are ample for the handling of the fore and aft moorings, breast moorings and ship's anchors. The dredge has a capacity of 1500 tons of soil per hour, either into scows or hopper barges alongside, or into her own hoppers, and she is capable of dredging her own way through soil at a depth of 57 feet. It is expected that the dredge will be used in the ship canal below Quebec and be in commission before the end of June.

AGREEMENT REACHED

In return for a nominal royalty of 25 cents per long ton on all iron ore mined, the British Empire Steel Corporation has undertaken to construct in Newfoundland before 1928 a plant capable of producing 100,000 tons of iron or pig iron annually, according to an agreement between the corporation and the Newfoundland Government, made public here. The corporation further undertakes to erect coke ovens and to expend $3.000 000 in Newfoundland before 1926. All materials used in construction of these plants are to be admitted to the island duty free. The companies—Dominion and Scotia—are also granted certain rights as to tax exemptions and waterpower grants. The 25 cent royalty is to continue in force until December 1940. However, should the companies fail to carry out the construction program agreed upon, or should they fail to expend $3,000,000 in Newfoundland before 1926, an export tax of $1 per ton will be imposed by the Newfoundland Government upon all ore mined and shipped to any part of the world except Nova Scotia.

THERMOMETER FOR HOT ROLLERS

In paper-making and other machines heated rollers are used and it is a matter of great importance to keep the temperature of these rollers at the right degree. Hitherto it has not been easy to make accurate measurement of the temperature of the roller, but the difficulty has been overcome by a special type of thermometer devised by a British firm. The thermometer itself is of the ordinary mercury-in-glass type, but it is carried inside a steel sheath attached to an aluminum frame fitted with three wheels. Behind the bulb is a gilded reflector which reflects on to it the heat given off by the roller or drum, and behind this gilded reflector is a nickel plated reflector which prevents heat radiated by outside bodies from touching the bulb.

A REMARKABLE SAW

In the wood-working trades it has been customary to make joints by means of mortice and tenon. Joints made in this way require some skill on the part of the operator; and the exercise of skill involves some expenditure of time. There is among both professional and amateur wood-workers a demand for an effective joint which can be made more simply and without the same degree of skill. This demand is met by the use of a joint in which one or more circular discs of three-ply wood are embedded in semi-circular recesses cut in the pieces to be connected. The making of this joint involves the cutting of an exact half-circle recess in each of the pieces to be jointed. The ordinary saw cannot cut a recess of this kind, and consequently a British inventor has been induced to devise a special type of saw in which the operation can be quickly and accurately performed. A full half-circular slot, 3 in. in diameter, can be cut by this saw in ordinary wood in just over a minute. The machine is portable and can be put to work in practically any position.

BUNDLING SCRAP

The disposal of old tins, kettles, old wire, sheet iron clippings, and other kinds of scrap metals is very much simplified if the material can be compressed into small bulk. In order to carry out this operation in the simplest possible way a British firm has devised a hydraulic press which can be operated entirely by unskilled labour and, if power is not available, by means of a hand pump. The press consists of a rectangular cast iron box with a hydraulic ram beneath it. The whole apparatus is let into the ground so as to bring the top of the box to a height convenient for throwing in the material. When the box is filled, the lid is swung over and pressure turned on. As soon as the maximum pressure is reached the operator releases the valve, swings off the cover, and the ram ejects the bale from the press.

ATKINS METAL CUTTING SAWS

Business Looking Up?

Building contracts are increasing, metal stocks are being depleted; factories are resuming; metal saws and machines must be ordered.

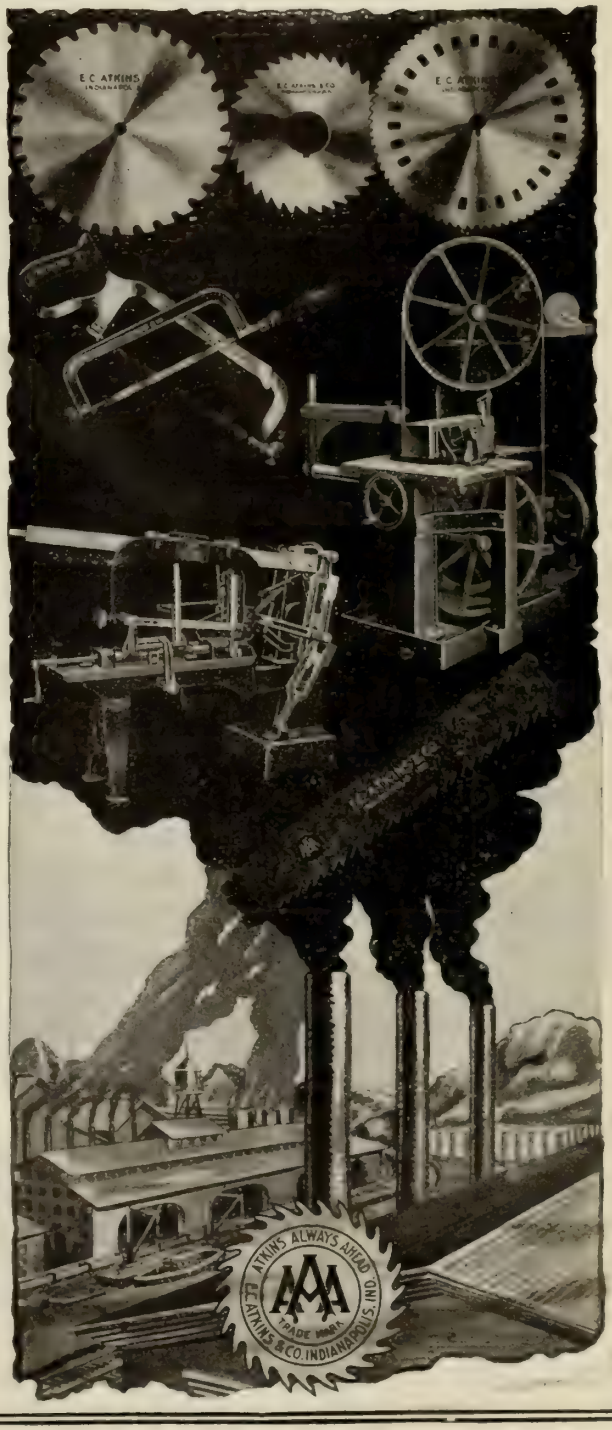
ARE YOU READY?

Put your plant in shape for a long run of good business. Write to the nearest point below for a catalog which will tell you why.

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E. C. ATKINS & CO.

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Home Office and Factory, Indianapolis, Indiana

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"Joy Shots" That Lead to Hell

By JUDGE EMILY F. MURPHY (*Janey Canuck*)

THIS IS the first of two articles in which Judge Murphy describes the menace that exists in Canada to-day in regard to the illegal traffic in narcotics. It gives actual facts from many Canadian cities and shows how the hypodermic needle is an even greater evil to combat than the opium pipe. The second of these articles will likely be in the July 15th issue.

Is Bootlegging a Passing Phase?

How common is bootlegging in Canada today? How do the members of the bootlegging profession carry on their business and what is their relationship to the officers of the law? These are two of the questions which are answered by A. Innes MacKenzie in a very colorful article describing the adventures, the fortunes and humorous rencontres of Canadian bootleggers from the Atlantic to the Pacific. Mr. MacKenzie writes whereof he knows, as he has spent several months studying this question and even associatting with many of the bootleggers themselves, in the interests of the readers of MACLEAN'S MAGAZINE.

Other Features in the

JUNE 15th MACLEAN'S

What Will Radio Do to Us?
by J. L. Rutledge.

What Shall I Do With My B.A.?
by G. E. S. Pringle.

Babs and the Manager
by Leslie Gordon Barnard.

The Golden Fleece
A long "short" story
by Bertrand W. Sinclair.

A Ruthenian Wedding
by Clara Ward.

Barnstorming on the Chautauqua
by Agnes C. Laut.

The Valley of Bleached Bones
by Madge MacBeth.

Ovington's Bank
An intensely interesting serial
by Stanley J. Weyman.

Is the Canadian Flapper a Menace?

This is a question raised by Mrs. Gertrude S. Pringle in a startling article dealing with conditions as they too frequently exist in some Canadian centres. Extraordinary conditions are described by Mrs. Pringle, who is a thorough and conservative investigator. It is only too true, evidence regretfully shows, that some Canadian flappers are very much akin to their American sister who "parks her corsets and indulges in petting parties."

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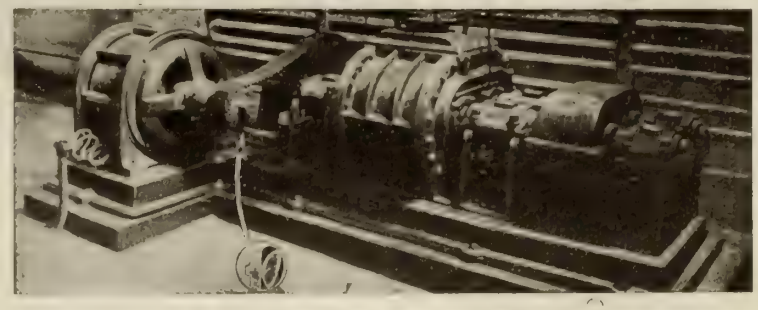
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CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

FOR SALE

"RICARDO" ENGINES, PETROL OR PARAFfin, excellent for marine, commercial or stationary use. Brand new. 100 h.p. 4-cylinder, 150 h.p. and 257 h.p. 6-cylinder, 300 h.p. 12-cylinder. Thirty shillings per horse-power sterling London. Sykes, Patching, Sussex, England.

FOR SALE:—COMPLETE EQUIPMENT FOR small machine shop, consisting of 16" Davis screw-cutting lathe, hack saw, shaper, drill, buffer, grinder, and forge. Will sell reasonably and terms to responsible party. This is a snap for someone starting in business. Would sell separately. Apply Box 811, Canadian Machinery. (C23M.)

ONE J. & J. TAYLOR SAFE, 18 INCHES deep, two feet 9 inches wide, four feet five inches high, fitted with a steel compartment. This safe is in good condition and can be bought at a price that will save considerable money to the purchaser. Price $200.00. Box 806L Canadian Machinery.

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WANTED

MACHINERY SALESMAN WANTED, SPEAKing English and French. Apply Electric Motor and Machinery Co. 417, St. James St., Montreal, Que.

CASH REGISTER WANTED—SINGLE DRAWer. Receipt printer. Must be in excellent condition. Box No. 807L Canadian Machinery.

SITUATIONS WANTED

DIE SINKER — THOROUGHLY PROFICIENT in all kinds of first-class work. Apply Box 812 Canadian Machinery.

MECHANICAL DRAFTSMAN AND DEsigner desires position, preferably firm where advancement and responsibility is given. Competent chief draftsman with machine shop experience, well educated. Box 810, Canadian Machinery, Toronto. (C.18M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience, 10 years general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium and heavy work, green and dry sand. Bench, floor and machine molding, melt by analysis, and thoroughly competent on cupola practice. Good reference. Box 804, Canadian Machinery. (C11M.)

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Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern Work. Our advice and estimates will save you money. Semi-finishing operations on Lathe or Grill on Castings supplied if required.
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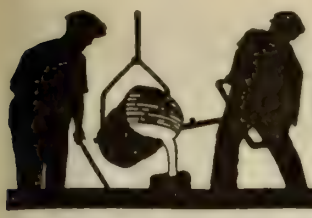
How much time in a year do you spend soliciting business for your shop? Half an hour a day? All right! Half an hour at a 6-day week comes to 3 hours a week. 3 hours a week at 52 weeks in a year amounts to 156 hours a year.

How much is your time worth—$2.00 an hour? To make sure we'll say $1.00.

That means you spend $156.00 worth of your time each year looking for business. This page is read and considered valuable by the majority of plant superintendents, purchasing agents and managers, both large and small, all over this Dominion. A one-inch card every week with a REAL message in it will do more for you than you can do for yourself. We only charge one-half of what it would cost your business if you were to use your own time.

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Put a cross alongside the space you want to use. Attach your advertisement to it and send it in to us.



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Grey Iron.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

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Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it . Let us suggest that you consult also the advertisers' index—last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names under proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
National Electro Products Co., Ltd.
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Aikins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BABBITT METAL
Canada Metal Co., Toronto., Ont.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, DIE-CAST
Fisher Motor Co., Ltd., Orillia, Ont.

BEARINGS, JOURNAL
Fisher Motor Co., Ltd., Orillia, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

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McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.

BELT FASTENERS
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Company, Waterbury, Conn.

BELT LACING
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal, Que.

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton, Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.

Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

BRONZE, Phosphor
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.

See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Aikenhead-Hardware Ltd., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago, Ill.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Beardmore & Co., Ltd., Wm., Montreal, Que.
Goldie & McCulloch Co., Ltd., Galt, Ont.

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES (See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

BUSHINGS
Fisher Motor Co., Ltd., Orillia. Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY (See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.

Smooth Mfg., Co., Jersey City, N.J...

CEMENTS, IRON

CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can. Link Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can.-Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., land, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS, CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can.-Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

CRANES, TRAVELING
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCHLIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

DIES, FORGING
Brown, Boggs & Co, Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio.
Hendley Machine Co., Torrington Conn.
Kearney & Treacker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Tool Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Son Co., Ltd, The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto, Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wis.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., td., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W. Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, COMBINATION CENTRE
Preston & Schwartz, Galt, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton,

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd, Kitchner, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc. E.C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Ltd., Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W. Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill.

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.
National Electro Products Co., Ltd.,

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES, LAPWELDED
Beardmore & Co., Ltd., Wm., Montreal, Que.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co. Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto, Ont.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto. Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.

Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. P., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

HYDROGEN
National Electro Products, Ltd., Toronto, Ont.

HYDROGENATING PLANTS
National Electro Products, Ltd., Toronto, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Brantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Drawn Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Rocklofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto.

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATES, BOILER AND SHEET
Beardmore & Co., Ltd., Wm., Montreal, Que.

PNEUMATIC TOOLS
Beardmore & Co., Ltd., Wm. Montreal.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R. Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilon.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton.
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound, Ont.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, CENTRIFUGAL
Beardmore & Co., Ltd., Wm., Montreal

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
McDougall Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchner
Can. Fairbanks-Morse Co., Ltd., Montreal
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, SEMI-ROTARY WING
Beardmore & Co., Ltd.. Wm., Montreal.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence. R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown, Boggs & Co., Ltd., Hamilton,
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Pertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Buterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N.Y.

RECORDERS, TIME
Gisholt Machine Co., Madison, Wis.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Fittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Mchinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Pulloch Co., Gananoque, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N.Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Rice Lewis & Sons, Ltd., Toronto, Ont.
Simonds Canada Saw Co., Manteral, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N.Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E.C., Indianapolis.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Manteral, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, MILLING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Islnad, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Islnad, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, One.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, Wood and Lag
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Moutreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SECTIONS, SHIP AND BOILER
Beardmore & Co., Ltd., Wm., Montreal, Que.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS, HAND
Can. Blower & Forge Co., Ltd., Kitchener.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Pertrams, Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N.Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

SHEETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B.A. AND BLUE ANNEALED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Bisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Pryibil Machine Co., P., New York City.

SPRINGS, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton,
Cleveland Wire Spring Co., Cleveland, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Q.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS, TOOL
British Empire Steel Co., Montreal, Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL CASTINGS
Beardmore & Co., Ltd., Wm., Montreal.

STEEL, CRUCIBLE, SPRING
Barnes Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

STEEL FORGINGS
Beardmore & Co., Ltd., Wm., Montreal.

SHEETS, OPEN HEARTH STEEL
Steel Co. of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Beardmore & Co., Ltd., Wm., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

STEELS, ALLOY, OPEN HEARTH AND ELECTRIC
United Alloy Steel Corp., Canton, Ohio.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm. Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co. of Can. Ltd., Hamilton, Ont.
United Alloy Steel Corp., Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont
Steel Co., of Can., Ltd., Hamilton, Ont.
Vanadium Alloys Steel, Latrobe, Pa.

STEEL, MAGNET
Vanadium Alloys Steel, Latrobe, Pa.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y

STUDS
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

STUD SETTERS, SELF-OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E.C., Indianapolis, I

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.
Toronto Iron Works, Toronto, Ont.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William I. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule, Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwart, Ltd., Galt, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die, Corp., Galt Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q
Greenfield Tap & Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Preston & Schwartz, Galt, Ont.

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Landis Machine Co., Inc., Waynesboro, Pa.

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Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp. of Can., Ltd., Brantford, Ont.

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Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

THREAD-ROLLING MACHINES
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TIE PLATES
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TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
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Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

TOOL WORK
Brown Engineering Corp. Ltd., Toronto, Ontario.

TORCHES, BLOW
National Electric Products, Ltd., Toronto, Ontario.
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., Toronto, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.

TREATED BITS
Vanadium Alloys Steel, Latrobe, Pa.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd. Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

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Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
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Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

TURRETS, TOOL POST
Gisholt Machine Co., Madison, Wis.

TYRES
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Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

VALVES
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Can. Fairbanks-Morse Ltd., Montreal, Q.
Dominion Engineering Works, Limited, Montreal, Que.

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Charles Parker Co., Meridan, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg. Co., Milwaukee, Wis.

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Charles Parker Co., Meridan, Conn.

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Philip Gies Foundry, Kitchener, Ont.
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Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

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Parmenter & Bulloch Co., Gananoque, Ontario.

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Carter Welding Co., Ltd., Toronto, Ont.
Dominon Oxygen Co., Ltd., Toronto, Ont.
National Electro Products Co., Ltd.

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Carter Metal Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd. Toronto.
Liquide Air Company, Toronto, Ont.
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Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd., Toronto, Ont.

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Hull Iron & Steel Foundries, Hull, Q
Kennedy & Sons, Wm., Owen Sound Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound Ontario.

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Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

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WIRE, COPPER AND BRASS, FINE AND HEAVY
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WIRE LEAD
Canada Metal Co., Ltd., Toronto, Ont

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Brown, Boggs & Co., Ltd., Hamilton, Ontario
Shuster Co., F. B., New Haven, Conn.

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L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products, Ltd., Toronto

WIRES, SPECIAL
Canada Metal Co., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Weland, Ont.

List of Directory of Dealers will be found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

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Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

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H. W. Petrie Ltd., Toronto, Ont.

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Garlock Machinery Ltd., Toronto.

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Yeates Machinery Co., London,

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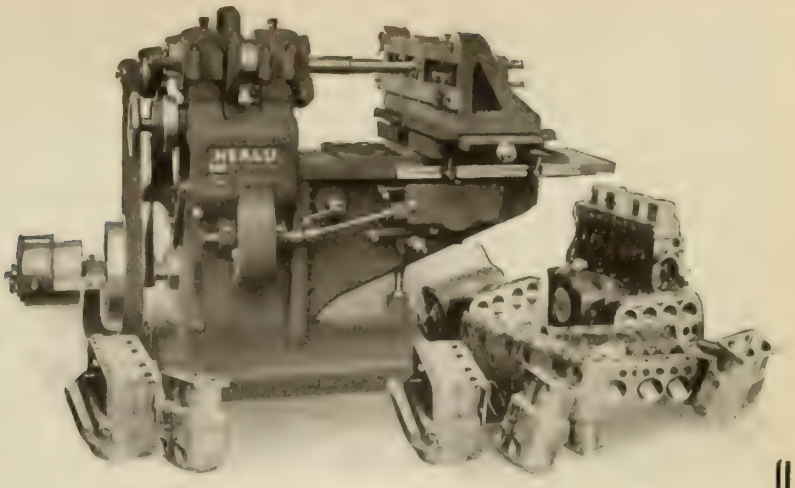
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CANADIAN MACHINERY
AND MANUFACTURING NEWS

Vol. XXVII. No. 25 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | June 22, 1922 | $4.00 a Year Subscription Price

READ AND PASS TO	Check	See Page	READ AND PASS TO	Check	See Page

Jardine Garage Equipment

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There's Money in Service—

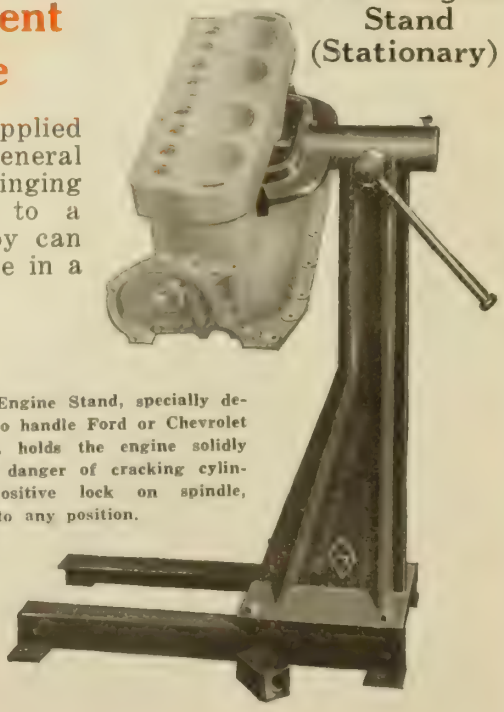
Providing the service you give is up-to-date and really worth while. Jardine Garage Equipment is designed for speed, convenience and efficiency. Behind it is the definite Jardine Guarantee—behind that guarantee is the prestige of a concern of over fifty years' standing.



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Tire Changer—For all Styles of Demountable Rims for Passenger Cars

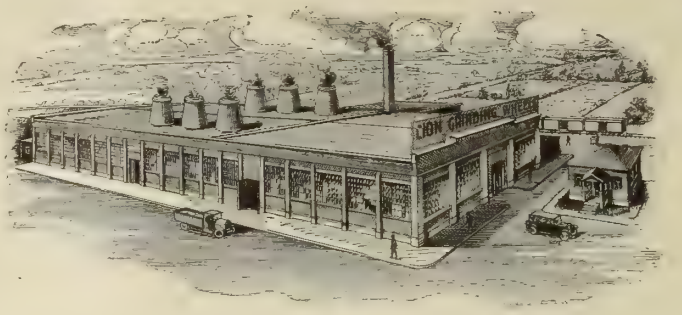
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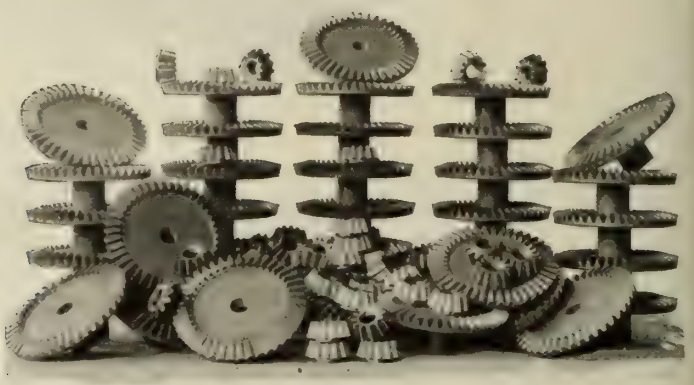


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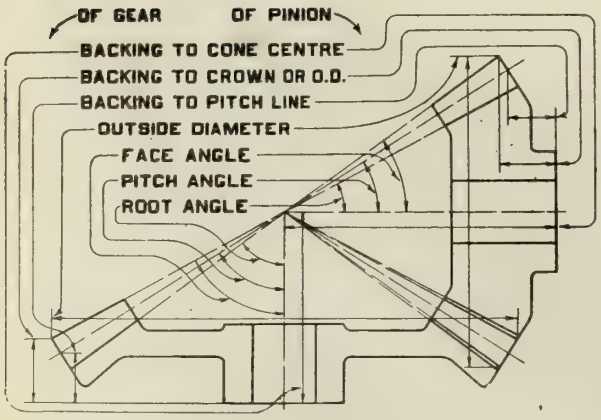






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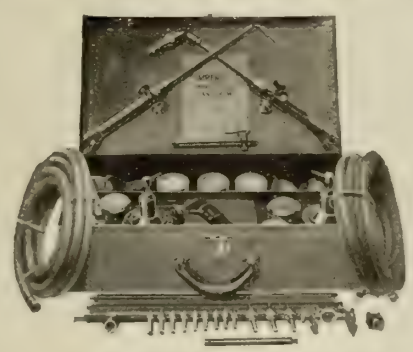


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Sizes: 15, 25, 50, 100, 200 and 300 lb.

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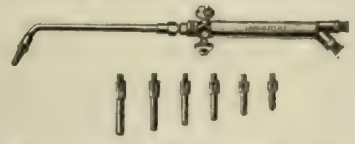
That means you never run out of gas in the middle of an important job. It does away with the bother and expense of handling and hauling cylinders. The Imperial Generator is easily mounted on a truck to make it quickly transportable about the shop. In a short time, it pays for itself, for it generates acetylene at an actual saving of 2 to 4 cents a foot. **And it is not expensive.** Made in four sizes.



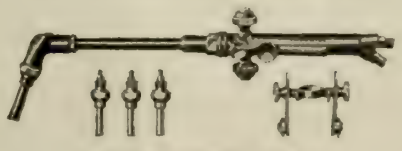
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Type EE—Cutting Torch

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Write for the new No. 22 "3" Starrett Catalog, free on request.

Production of a new Starrett Tool is never begun until the most exhaustive and practical tests have proved its definite superiority for the purpose it is designed to serve.

Men who know fine tools know that a new Starrett Tool is not merely another tool—it's always a better tool.

THE L. S. STARRETT CO.

The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled

ATHOL, MASS.

42-35

STARRETT TOOLS — STARRETT HACK SAWS — CUT QUICKER — LAST LONGER

Starrett Tools

Do Your Share To Prevent Fires



Every man should do his full share to prevent fires and to reduce Canada's fire loss, amounting to millions of dollars annually.

Almetl Fire Doors and Shutters will give your plant the greatest protection against the spreading of fire.



The **Almetl** is built of corrugated steel interlined with asbestos and will withstand the most intense fire without twisting or buckling.

Reed's Fire-Tite oily waste cans should be in every factory, mill, power plant and garage, wherever waste is used. Built of steel, with light stork legs and self-closing lid, they are positive against spontaneous combustion fires from oily waste.

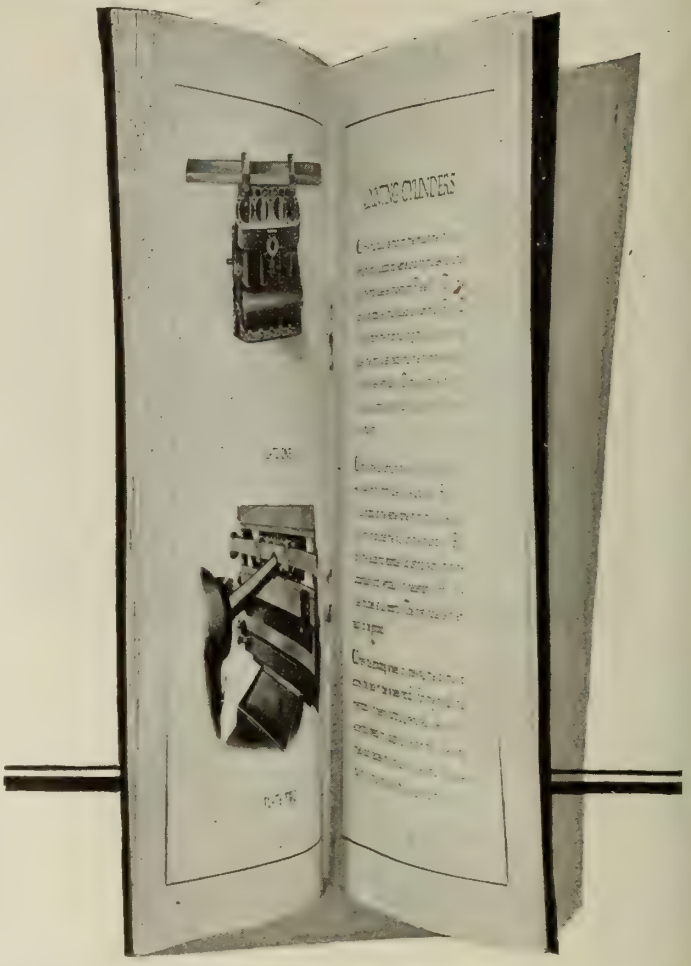
Made in three sizes.

Almetl Fire-Doors and Fire-tite oily waste cans bear the Underwriters' Label.

Write for particulars.

Geo. W. Reed & Co.
LIMITED
MONTREAL

LANDIS



Get this free book

Here's a new book, just off the press, on the operation of the Landis No. 5 Cylinder Grinder. It's indispensable to owners of a Landis and is just as valuable to those planning to install such a machine. It will help you to decide. Filling out and sending this coupon entails no obligation.

Fill in—Tear off—and Mail

Landis Tool Co.,
Waynesboro, Penna.

Gentlemen: Send me your new book. I have written my name and address in the margin of the magazine below.

Ford

"Construction Contracts are running ahead of any similar period since 1912"



Truck Chassis

$575 f. o. b. Ford, Ontario

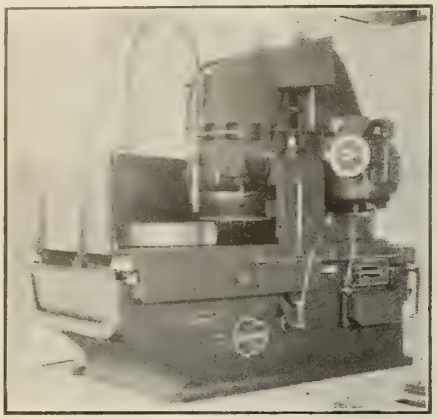
Ford Motor Company of Canada, Limited

Ford, Ontario

THE JOHNSON FRICTION CLUTCH

AS USED ON THE

NEW No. 27-R, BLANCHARD VERTICAL SURFACE GRINDER



Courtesy The Blanchard Machine Co., Cambridge, Mass.

Another advance of progress in abrasive engineering is the use of Johnson friction clutches on this *NEW* machine.

Two No. 6 double clutches provide for rapid raising or lowering of the wheel.

One No. 10 single clutch is located in the gear box for rotating table.

The **AUTOMOTIVE INDUSTRY** demands reliable friction control—the Johnson Friction Clutch is the answer.

Write for Stock List and Yellow Catalog



Double Clutch-Exterior

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860

PARKER VISES

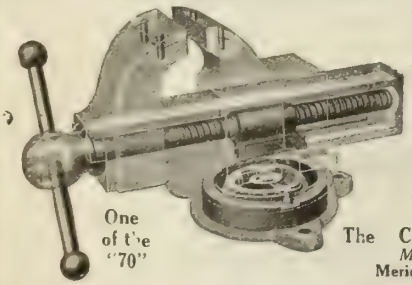
Built Like a Fine Truck



They "Grip Like a Grizzly"

Extra strength everywhere. Tool steel renewable jaws covering entire top; as they are pinned on from the top, not screwed onto the face, they can't pound loose.

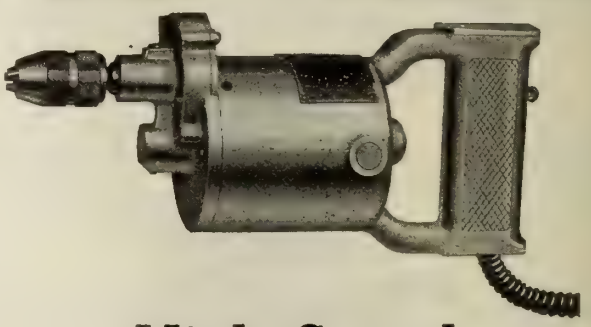
Steel bar cast inside slide the full length. Double-strength screw and nut. Positive-grip swivel base. Also many other points of interest to the man responsible for heavy automotive production.



One of the "70"

Write for Folder No. 12. (Dealers and service stations, write.)

The Charles Parker Co.,
Master Vise Makers
Meriden, Conn., U.S.A.



High Speed Lovejoy Electric Drills

You will find a Lovejoy Electric Drill a valuable addition to your machine shop equipment. Its lightness makes it easy to handle, yet is built to give efficient service in many classes of small work.

Weight, 4 lbs.; bronze bearings; spiral cut bronze gears; Westinghouse universal motor; 110 to 220 volts; speed, 1,600 r.p.m.; Nebaco chuck; handy switch; air cooled. Capacity, ¼ inch in steel.

Price $30 Net.

LOVEJOY TOOL WORKS
CHICAGO, ILL.

GUTTA PERCHA & RUBBER, LIMITED
TRADE P.M.S MARK
TORONTO, CANADA

For Efficient Transmission

Use

"P.M.S" BELTING

Effective belts mean savings in power transmission and, consequently in costs. If you would get maximum delivery of every dollar's worth of power developed—use "P.M.S" Belting. Our belting experts will gladly help you solve belting problems, if you desire it.

Manufactured Exclusively by

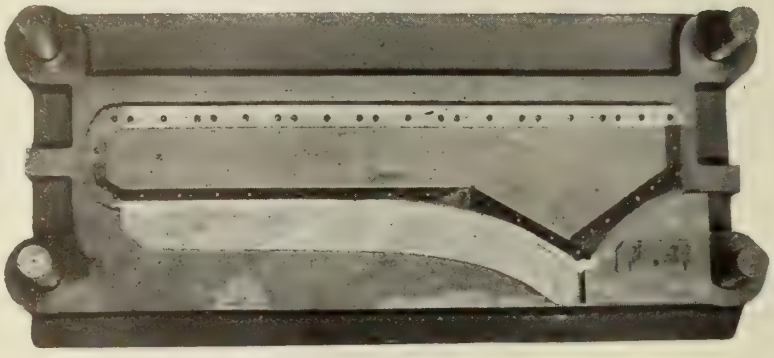
GUTTA PERCHA & RUBBER, LIMITED

Head Offices & Factories, Toronto

Branches in all Leading Cities of Canada

FORD-SMITH

Dies for Automobile Parts

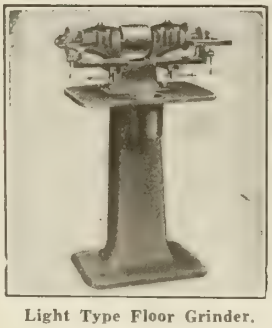


The die shown here is a male automobile die and is used for blanking automobile fenders. It is one of the many dies made by us for the automobile manufacturers of Canada.

We Make Any Kind of Dies You Need

Dies for automobile parts represent only a few of the designs we make. We have the equipment and staff for designing and manufacturing any kind of die you require, and our designers are at all times at your service to instruct and advise.

GRINDERS
to Meet All Requirements



Light Type Floor Grinder.

From the Ford-Smith line of Grinders you may select the machine best suited to your class of grinding—General purpose grinders, disc grinders; all types, floor and bench, belt and motor driven. Polishers of all kinds.



30" Double End Grinder.

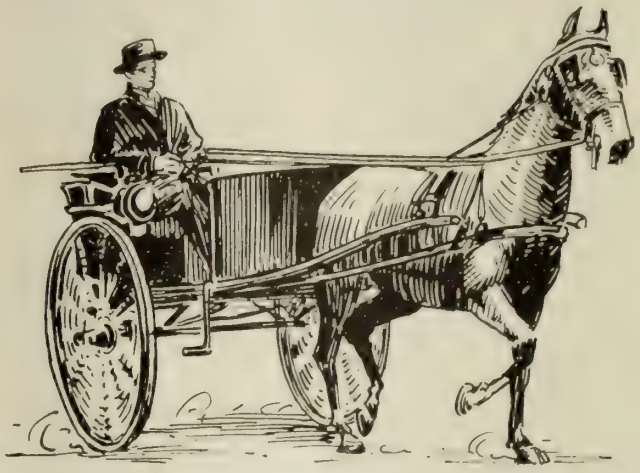
MALLORY TIMER FOR FORD CARS—It is the greatest ignition device ever invented for FORD owners. It is different from the ordinary timer, as the vibrating points are screwed down. We manufacture the MALLORY. Write for details.

THE FORD-SMITH MACHINE CO., Limited

Hamilton, Ontario, Canada

Built in a Logical Way

RECOGNIZING that "there is always somewhere a weakest spot," the story goes that the deacon, in the time of George II built him a "shay" that had no weakest spot. After one hundred years' service it had not broken down, but just simply wore out. There was a maximum service in every part, "Step and prop iron, bolt and screw, spring, tire, axle and linchpin too, steel of the finest, bright and blue —she was a wonder and nothing less."

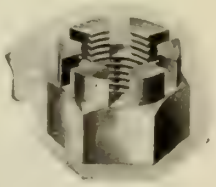


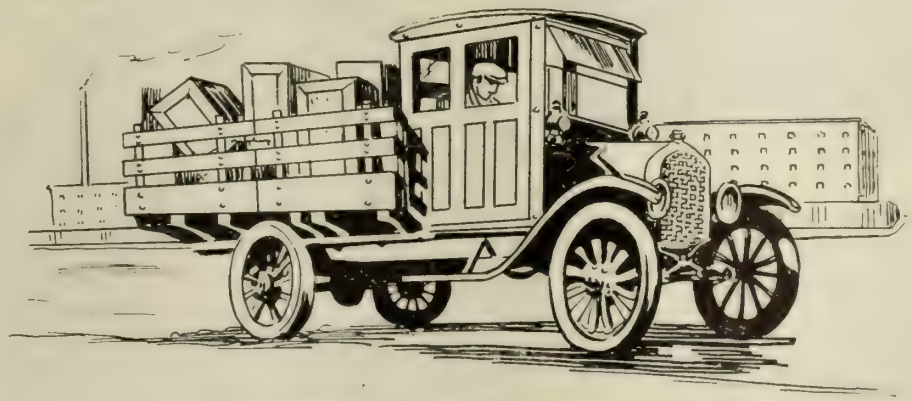
Galt Machine Screws

are made with the same care, skill and accuracy

Industry is trying to eliminate the weakest spot. In the building of chaises 100 years ago, so it is in the building of the modern motor car and truck. The best results demand products that are accurate, reliable, dependable. We adopt the highest standards, the utmost care in working out these essentials of satisfactory service.







SEND US YOUR BLUEPRINTS FOR ESTIMATES

We specialize on immediate shipments of all standard products.

THE GALT MACHINE SCREW COMPANY, LIMITED

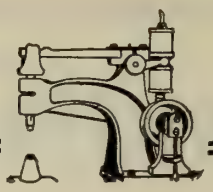
GALT, ONTARIO, CANADA

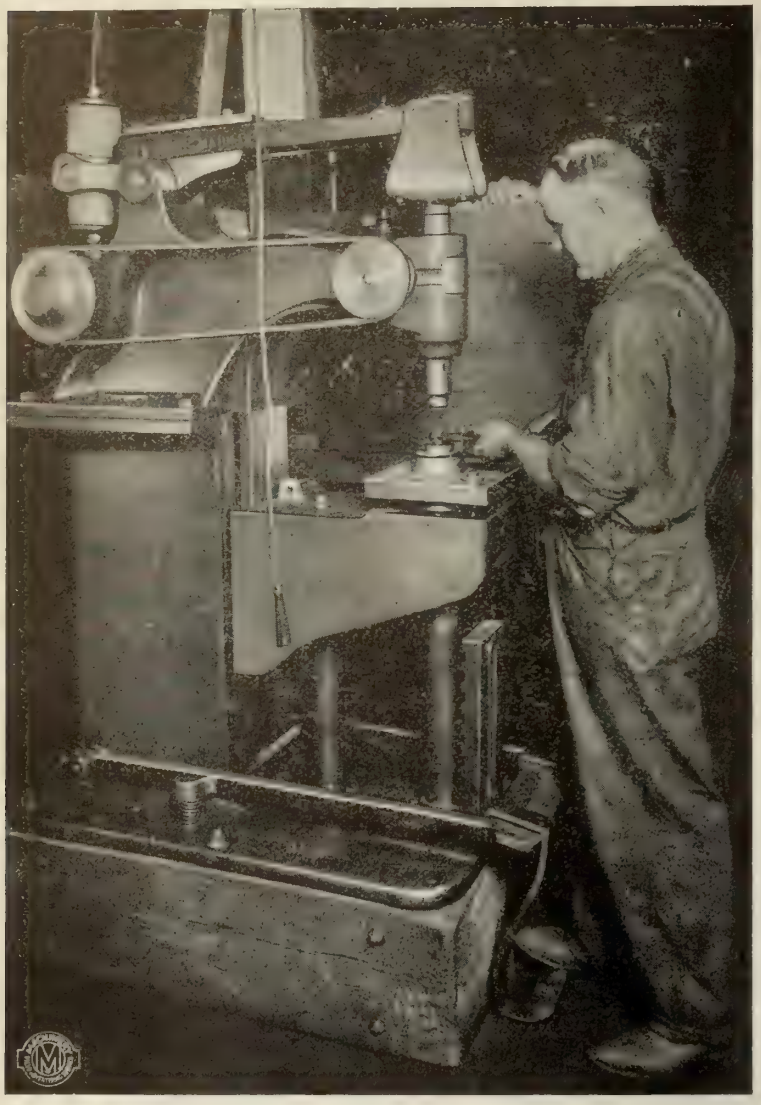
Eastern Representatives: F. Bacon & Co., 131 St. Paul St., Montreal, Quebec
Western Representative: D. Philip, Winnipeg, Man.



THE PRINCIPLE IS RIGHT

THE HAMMER WITH THE HUMAN STROKE





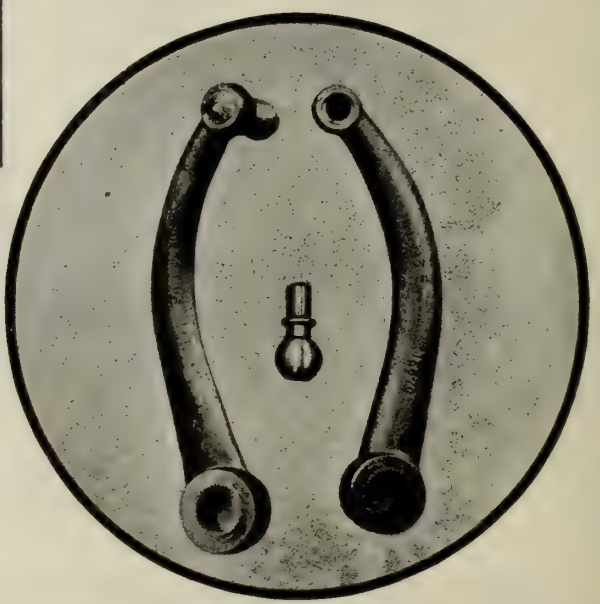
A No. 6-B HIGH SPEED RIVETING HAMMER

(PATENTED)

Gives remarkable Production on the Famous "Jacox" Steering Gear, where Dependable Riveting is Absolutely Essential.

The latest product of the High Speed Hammer Co., Inc., the No. 6-B Hammer, weighing a ton and a half, has proved one of the most efficient production units in the works of the Saginaw (Mich.,) Products Co. It is in this plant, (a division of the General Motors Corporation), that the famous "Jacox" steering gear is made.

This No. 6-B High Speed Riveting Hammer is being used for riveting a nickel steel ball to a forged steel pitman arm. The ball has a 5/8 in. shank, and is pressed into the arm by an arbor press. About 1/8 in. stock is left to rivet, and the machine turns the head over to 3/4 in. diameter.



On a 5-hour test run the remarkable production of 2,200 was obtained.

The No. 6-B Hammer is specially designed for heavy cold riveting. Its capacity is full round heads on 5/8 in. to 3/4 in. stock; oval or flush heads 7/8 in. to 1 1/2 stock.

Send us samples of your work and let us demonstrate **our process** of **cold** riveting on **your** own product.

THE HIGH SPEED HAMMER COMPANY, Inc.

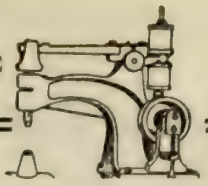
Rochester **New York, U.S.A.**

CHICAGO BRANCH: C. W. Schuchardt, Mgr., 568 W. Washington Boulevard. AGENCIES: F. O. Stallman Supply Co., 167-173 First St., San Francisco. Agents for Pacific Coast: Burton, Griffiths & Co., Ltd., London, E. C., for the British Isles. Atkiebolaget Rylander & Asplund, Stockholm, Sweden, for Sweden and Finland. China, Japan and South American Trading Company, Ltd., Yokohama, Kobe and Osaka, Japan, for Japan and Dependencies.



THE PRINCIPLE

THE HAMMER WITH THE HUMAN STROKE

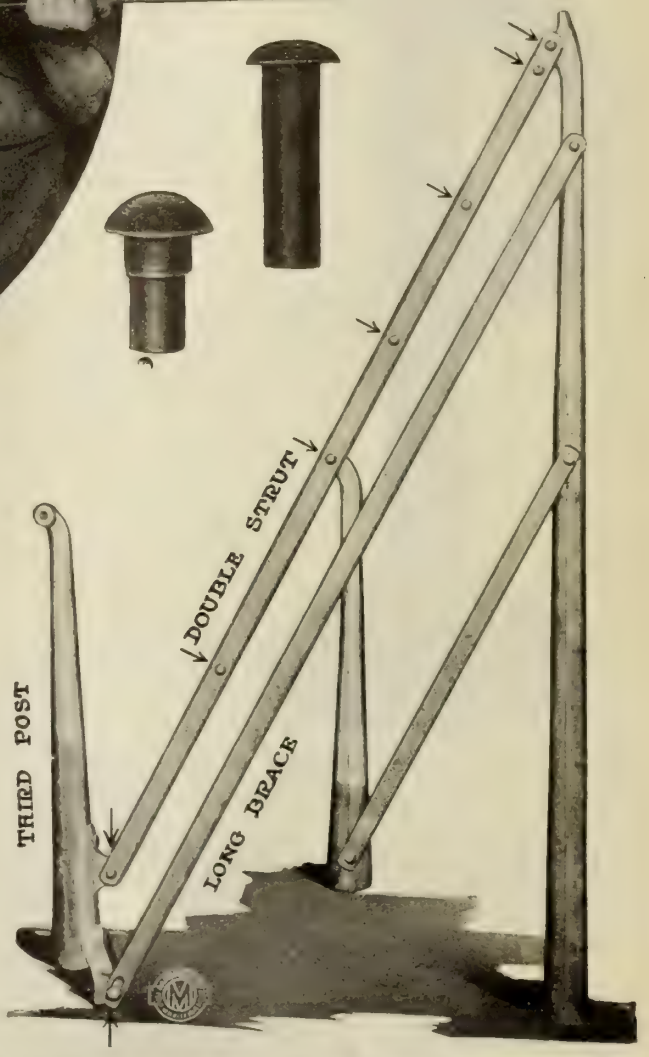


HIGH SPEED RIVETING HAMMERS

(PATENTED)



Photograph by courtesy of the Brewer Titchener Corporation (Crandal-Stone Division,) Binghamton, N. Y.



Note How Rivets of Different Heights Are Headed Without Changing the Dies

A very interesting point about this operation is the fact that rivets of different lengths are headed without changing the dies, and by stopping the machine only for the fraction of a second. This end is achieved by two anvils operated by a foot pedal. High-speed Riveting Hammers lend themselves very readily to such labor-saving devices, which is one of the many reasons for their entry into such varied industries. This work is riveting double struts for auto tops. Seven long and one short rivet are headed in each set. There are two assemblies per set, production being 250 sets—4,000 rivets—per nine-hour day.

Send parts or prints for riveting sample and production estimate.

THE HIGH SPEED HAMMER COMPANY, Inc.

Rochester **New York, U.S.A.**

CHICAGO BRANCH: C. W. Schuchardt, Mgr., 568 W. Washington Boulevard. AGENCIES: F. O. Stallman Supply Co., 167-173 First St., San Francisco. Agents for Pacific Coast: Burton, Griffiths & Co., Ltd., London. E. C., for the British Isles. Atkiebolaget Rylander & Asplund, Stockholm, Sweden, for Sweden and Finland. China, Japan and South American Trading Company, Ltd., Yokohama, Kobe and Osaka, Japan, for Japan and Dependencies.

BEST TOOL FOR ADJUSTING TAPPETS AND ALL AUTOMOBILE WORK

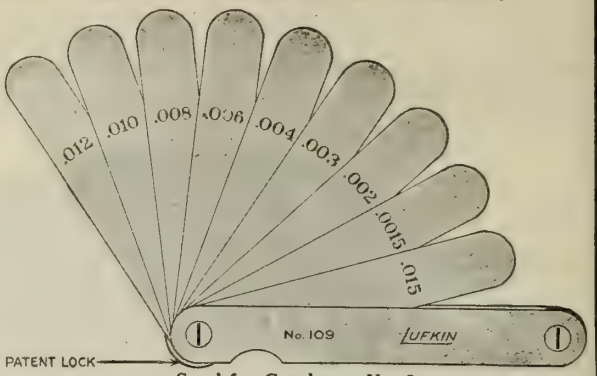
LUFKIN Thickness Gauges With Patent Lock

Thumb Nut Locks Any One or More Blades in Any Position

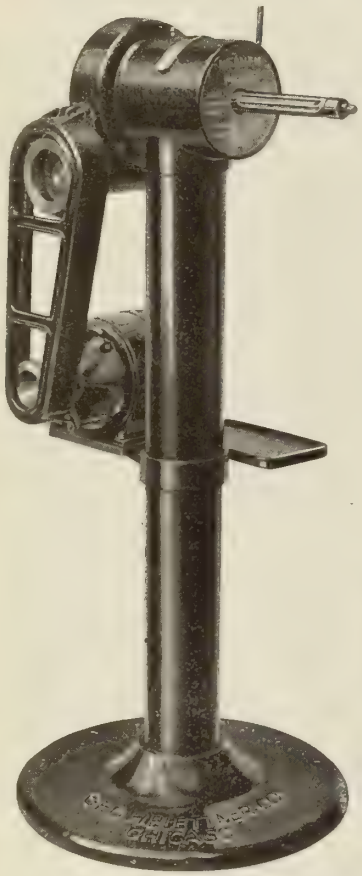
Handy on all work; almost indispensable on work done at an angle. Multiplies the uses of the tool. Permits its use in full length, 5½". Eliminates chances of error. Adds nothing to the price. Made in 6, 7 and 9 leaf popular priced garage type, also 9 leaf in standard pattern. These gauges carry just the leaves required for automobile work. All are of highest grade, with leaves accurately ground to thickness.

Call for them at your dealers.

THE LUFKIN RULE CO. OF CANADA, LTD.
WINDSOR, ONT.



Send for Catalogue No. 8
MECHANICS' FINE TOOLS



REAMER DRIVE

Power propels the Reamer continuously.

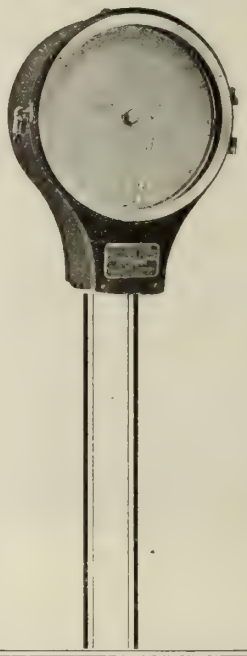
Saves time and effort.

Improves quality of the work.

Indispensable where reaming is required for final fitting

This Reamer Drive should be part of equipment of every motor service station in Canada. Write now for circular describing same and be convinced of its adaptability to your shop. The price is right.

Geo. H. Blettner Co.
1841 W. Jackson Blvd.
Chicago. U.S.A.



One of These Gauges Is Saving a Firm $1,200 a Month!

The same combination of circumstances may never occur in relation to your own gas supply, but this situation, which is vouched for by the firm's own figures, actually exists. It may serve to suggest some place in your own plant where a reliable

TRADE MARK
BRISTOL'S
REG. U.S. PAT. OFFICE
Pressure Gauge

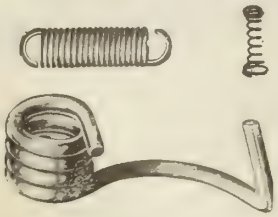
can save you money. Gas, air, steam and many liquids are being accurately measured and continuously recorded by one and another of the Bristol pressure gauges.

Full details will be found in Bulletin I-1005.

THE BRISTOL CO., Waterbury, Conn.
Canadian Distributor
A. H. WINTER JOYNER
TORONTO — MONTREAL

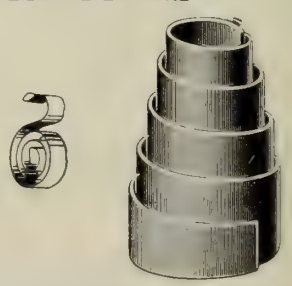
"Bristolize for '22"

PRECISION SPRINGS
SPECIAL TORSION AND SMALL WIRE SPRINGS



THE WALLACE BARNES CO. LIMITED
WIRE
BARNES CANADIAN SPRINGS
STEEL
HAMILTON, ONTARIO
CANADA

FLAT AND FLAT COIL SPRINGS OF ALL DESCRIPTIONS



STYLE HEALD Nº55

REGRINDING HEADLIGHTS

STYLE HEALD Nº65

For Centralized Repair Shops

If you are connected with automobile repair work in any manner such as a small machine shop, welding concern or even a regular garage, you are passing up an excellent opportunity if you do not look into the regrinding of automobile cylinders. Especially is this true if you are in the center of a large number of registered cars, not necessarily in the city but a strategic point in a medium sized town.

It is a new proposition to both repairmen and motor owners but its results are fast becoming known to both and the latter are, in a large percentage of cases, insisting on reground cylinders when overhauling to enable them to get a motor as good as new.

The commission usually allowed to garages is sufficient to make it a worth while proposition for them, especially when they are not in a position to put in the necessary equipment, and by obtaining work from all of these in your working center you will get unusually handsome returns on the investment. Once established you will create a market that now does not exist for there are many owners who do not know of the value of a reground block and still more who do know but neglect having it done owing to the inconvenience of sending the block away.

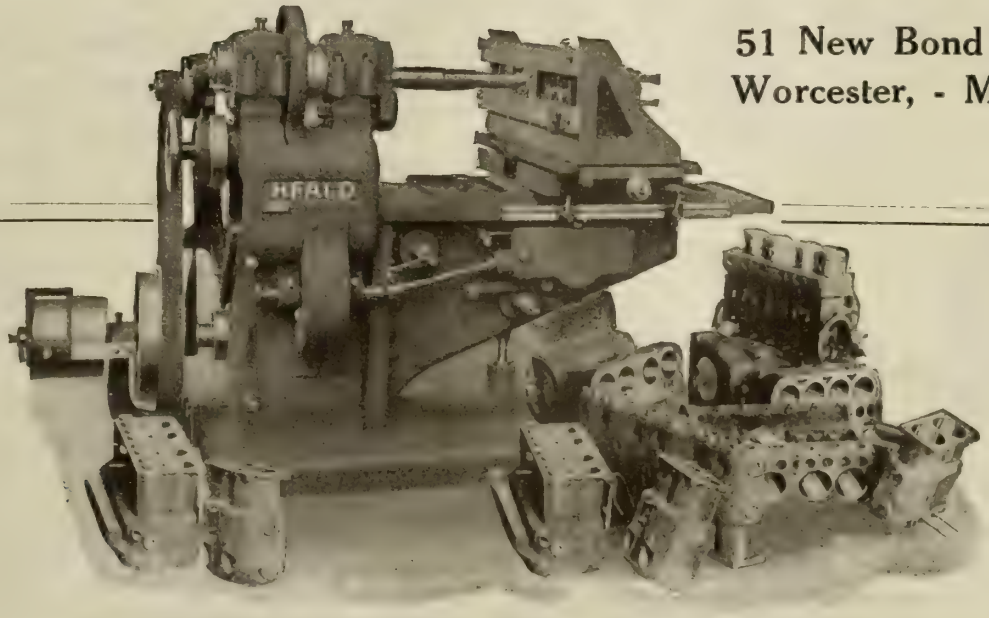
The Heald Style No. 55 was built especially for this class of work, simple, reasonably priced and with a range that will take care of any block that you may have whether it is from a pleasure car, truck, tractor, motorcycle or marine engine. Heald machines are used exclusively by every motor manufacturer that grinds his bores and motor owners who fully appreciate a reground job will insist on having it done on a Heald machine.

We would be glad to talk over the possibilities personally with you, giving you our frank opinion and furnish you with sufficient information to enable you to decide for yourself whether you can make a success of it or not.

Get in touch with us direct or through our branches or agents.

The Heald Machine Co.

51 New Bond St.,
Worcester, - Mass.



AUTOMOBILE CASTINGS

When You Need Them
You Need Them QUICK—*and that's our specialty*

And the problem of dependable castings can be solved by specifying

"MAPLE LEAF" CASTINGS

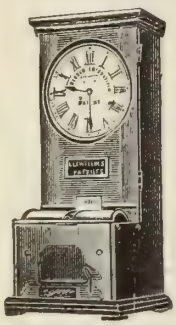
which are made, annealed and tested according to the requirements of the American Malleable Castings Association.

It will pay you to become acquainted with "MAPLE LEAF" Castings.

Canadian Malleable Iron Company, Ltd.

OWEN SOUND ONTARIO

Time Checking Machines, Time Recorders, Watchman's Watches, Recorders for all purposes



P 18 Class, Patent Card Recorder

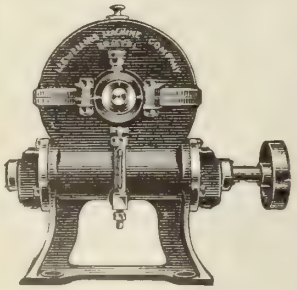
WATCHMAN'S Watches check the rounds of watchmen ensuring less risk from fire etc. with a consequent reduction in insurance premiums



Watchman's Watch

GEARS Machine Cut Machine Moulded

All Sizes and Descriptions



Totally enclosed Worm Reduction Gear.

Specialists in High Speed-Reducing and Accelerating Gears.



D.H. Stag Tooth Wheel & Pinion

Llewellin Machine Co., Bristol, Eng.

TELEGRAPHIC AND CABLE ADDRESS: Llewellins, Bristol, Eng.

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

Emery
Glass
Flint
Garnet
Corundum
Carborundum

Paper and Cloth

In Sheets, Rolls, Discs, Bands, Strips and Tapes, &c.

JOHN OAKEY & SONS

LIMITED

WELLINGTON MILLS
LONDON, S.E. 1, ENGLAND

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Frank Manley, 290 McDermott Ave. W., Winnipeg
Sturgeons, Ltd., 64-66 Richmond St. E., Toronto
Sankey & Manson, 839 Beatty St., Vancouver

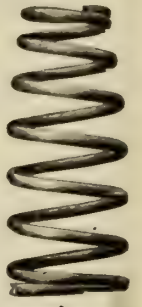


Raymond Springs

Made in any required shape or size to meet the demands of the



Automotive Industry

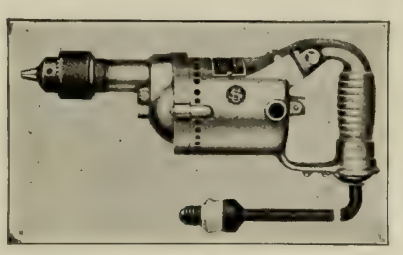


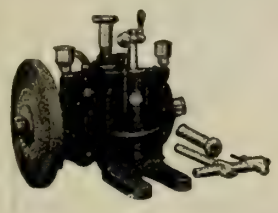
Furnishing coil wire springs which agree with your specifications as to quality and quantity and delivery date—this is Raymond Service. Prices will meet your approval. Send us your enquiries.

RAYMOND MANUFACTURING CO.
LIMITED
CORRY PENNA.

U. S. ELECTRIC
Drills and Grinders
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For drilling in metal these drills are the superior of every other kind of portable drill. Their operating cost is only half that of air drills. And they can be attached to any lamp socket.





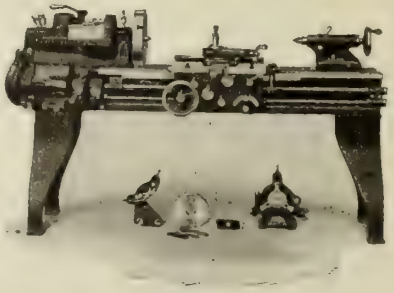
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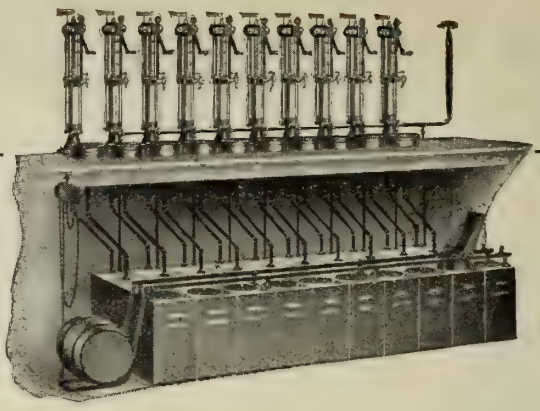
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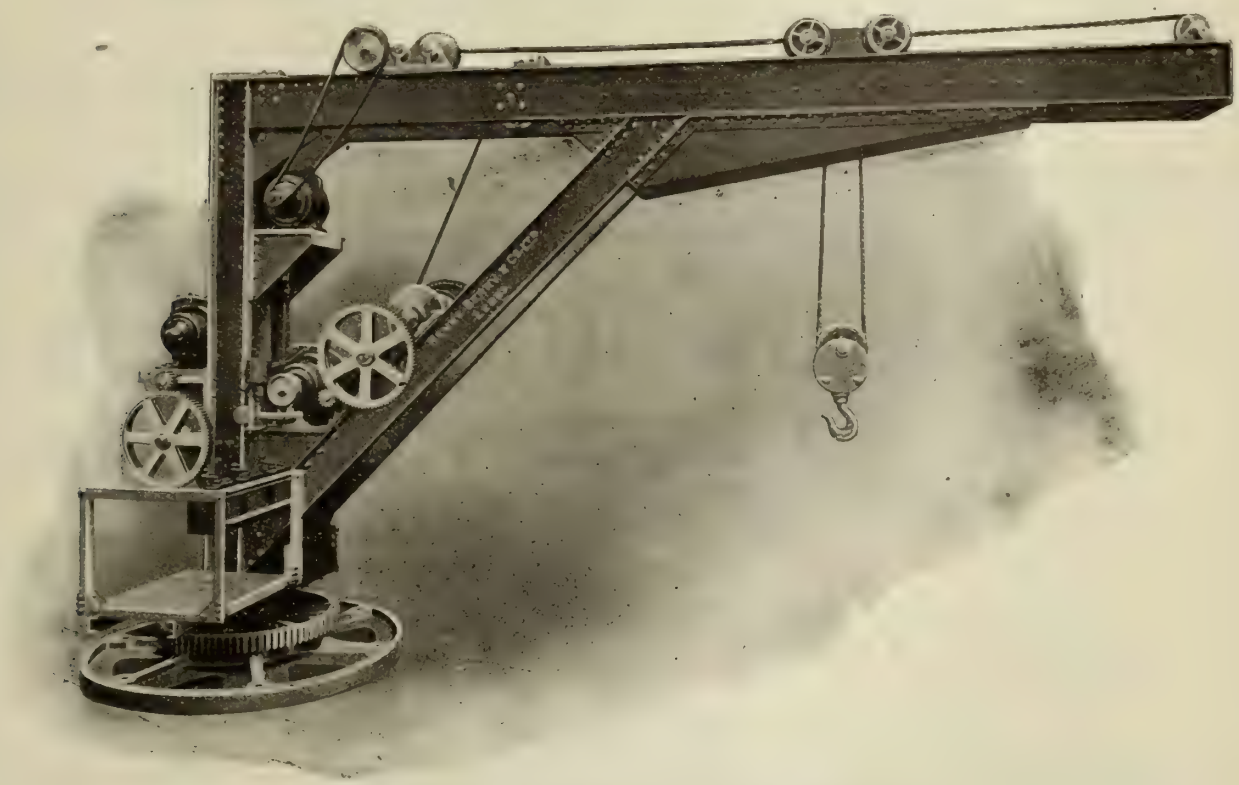
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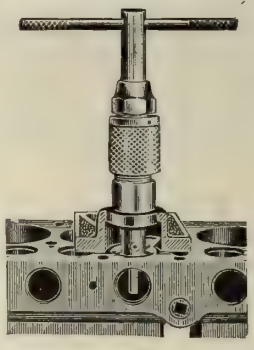
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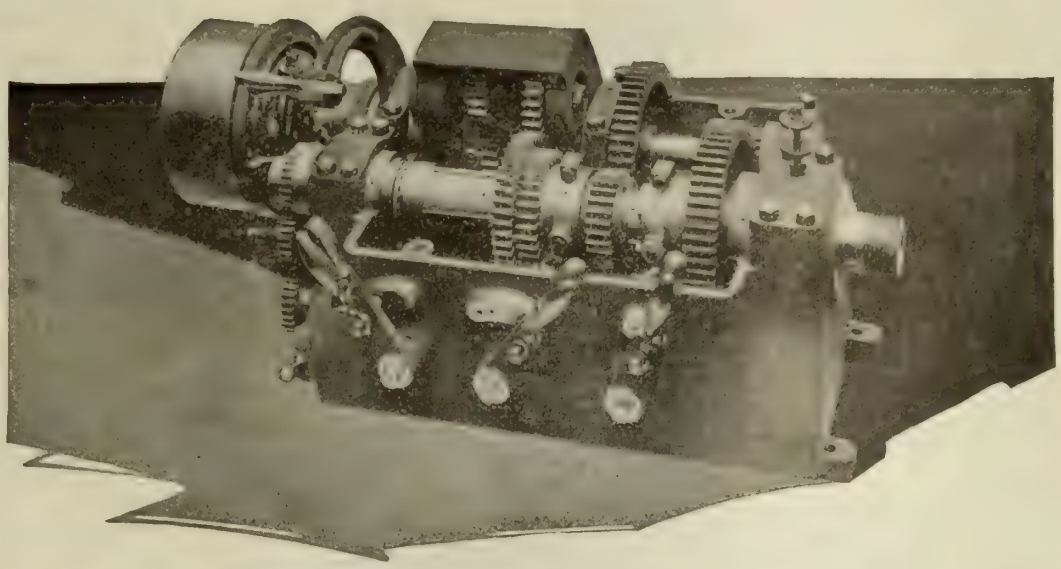
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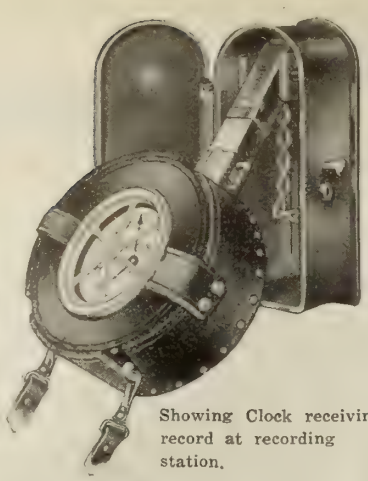
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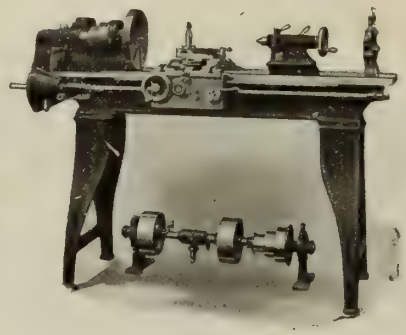
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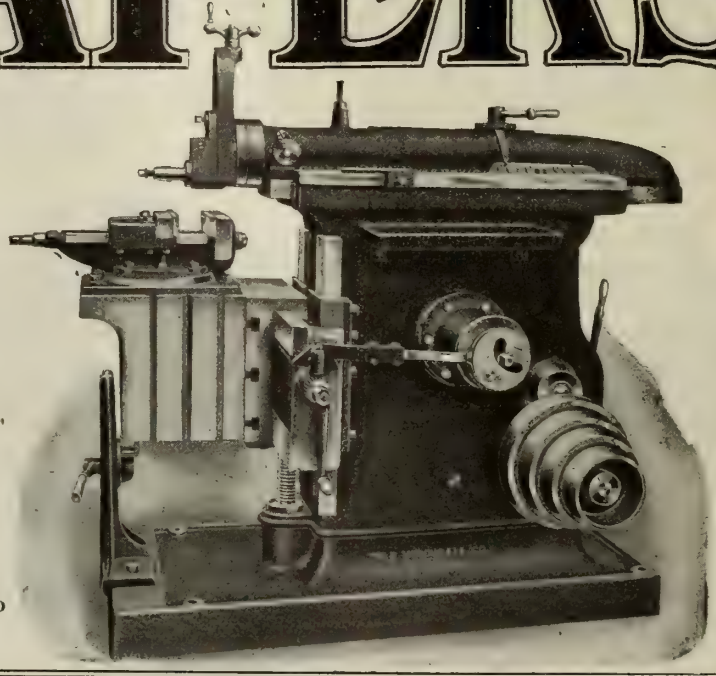
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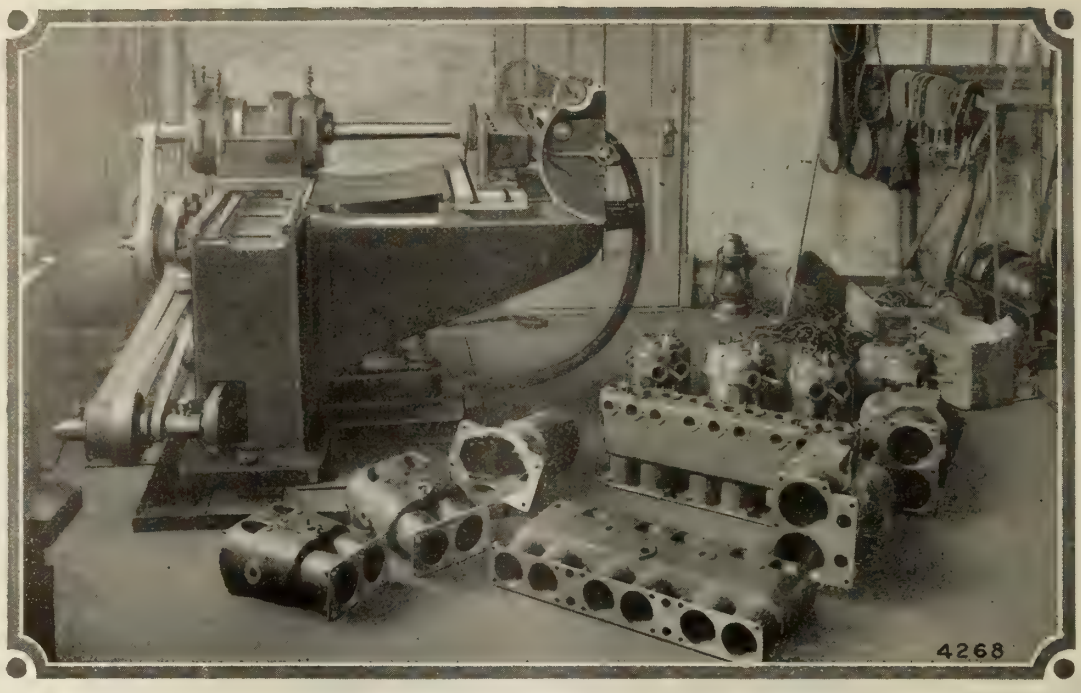
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CANADIAN MACHINERY
AND
MANUFACTURING NEWS

Vol. XXVII. No. 25 JUNE 22, 1922

From a Novelty to a World Wide Necessity

Down the railroad track came a galloping horseman; close on the heels of the horse followed a panting steel monster. A man guiding this contraption, from which belched forth volumes of black smoke, yelled for the horseman to get off the track, and, upon his command being obeyed, he opened a throttle, speeding up his locomotive to the then marvellous rate of 12 miles an hour. In this spectacular fashion, George Stephenson introduced to the world the rail method of transportation.

The development of railways since that date reads like a romance, and this romance has been repeated in recent years in another innovation which has shown a progress equally remarkable to that of the steam locomotive. Picture to yourself for a moment the first gasoline driven vehicle. Crude, clumsy, expensive to operate, and far from pleasing in appearance, it was looked upon as a useless new fad, yet before long its possibilities began to make themselves felt. At first the complicated mechanism was against it, and had it not been for the faith of its inventor, who knows what the future of the automobile might have been!

With a persistent belief, however, in the commercial value of this new idea those interested persevered, until at the present day, obstacles have been largely overcome, new pleasing lines developed, and efficient power plants installed on modern autos. Simplicity has been the keynote of success in the automotive industry, and this feature has been chiefly responsible for the present popularity of cars, both pleasure and commercial.

At the present time the world would feel lost without the automobile as a method of transportation. This system of travel has broadened every field of endeavor, has developed new markets, aided agricultural development and helped the farmer to reach his special markets. Other lines of business have been likewise benefited and the value of the automobile and truck to the world in general cannot be figured in dollars and cents.

A modification of the automobile engine has also proved itself invaluable for harvesting uses, and we now see on the modern farm, gasoline driven plows, harrows and other similar implements. All over the country we find motor trucks carrying commodities to and fro, quickly, without damage, and economically. They have proved themselves a decided asset to business and a speedy means of transportation.

In 1809 it cost 75 cents to move a bushel of salt from the mouth of the Niagara River to the head of the falls, a distance of 28 miles, and in 1824 it took 20 days, and cost $100 to move a ton of merchandise 224 miles. In comparison with the low running costs of 3 cents per mile for a motor truck fully loaded, one can readily see the phenomenal improvement which has occurred since that date.

Manufacturing methods of automobile construction have kept pace with improved design, this bringing the selling price of the product within the reach both of merchant and individual. In the following pages we show how several makes of cars are produced, but these stories are but sketches of a gigantic industry, an industry so large that it is impossible for the average individual to gain any adequate idea of its magnitude unless he visits several of the factories engaged in this work and sees for himself the number of men engaged and the vast capital which has been invested.

Canada may well be proud of its automotive industry for it has developed by leaps and bounds in the last decade and will still further develop as time goes on. He would be a rash man indeed, who would prophesy the type of car used ten years from now, for with designers straining every nerve for economy and simplicity, who knows what the future holds?

Gasoline may even be superseded by some cheaper and more efficient fuel, be it refined oil, a chemical combination, or other liquid. Time alone will tell what the improvement will be, but one thing is sure, the future car will be even further simplified than it is at present, and will be more economical in fuel consumption. All things point in that direction, and with the best brains of the automotive industry centred on these objectives, failure is well nigh impossible.

Producing *55,000* Cars and Trucks a Year



General view of the Ford plant at Ford, Ontario.

A HUGE enterprise turning out a carefully manufactured product. A well arranged plant with a splendid balanced organization. These thoughts, and many others of similar nature, came to our mind when we visited the plant of the Ford Motor Company of Canada, at Ford, Ontario.

Quietly, yet very efficiently, this organization is producing approximately 55,000 cars per year. This figure includes cars and trucks only, as tractors are not made in Canada at the present time. Just picture for a moment what this rate of production means, then read the following figures, which will be eye-openers to many we feel sure.

The plant itself is valued at $8,683,091—this including all departments, which although housed in different buildings, are all part of the Ford plant.

The total floor space occupied at plant is 605,000 sq. ft., and at the branches, 428,000 sq. ft. Over 3,100 employees are engaged in the factory and offices. The average daily payroll amounts to about $20,000, this including only the main factory and office. In addition to these items several other factories are employed on Ford work—thus adding of course to the figure given. Then there are 14,159 employed in the different branches, service stations, and dealers throughout the country.

During the fiscal year ending July 31st, 1921, the Ford Co. purchased from other Canadian firms $19,000,000 worth of products. This included bodies, tops etc. Approximately 40 firms received the benefit of this business, and in about 50 per cent. of these cases, the plants turning out parts for the Ford car, are wholly engaged on this work.

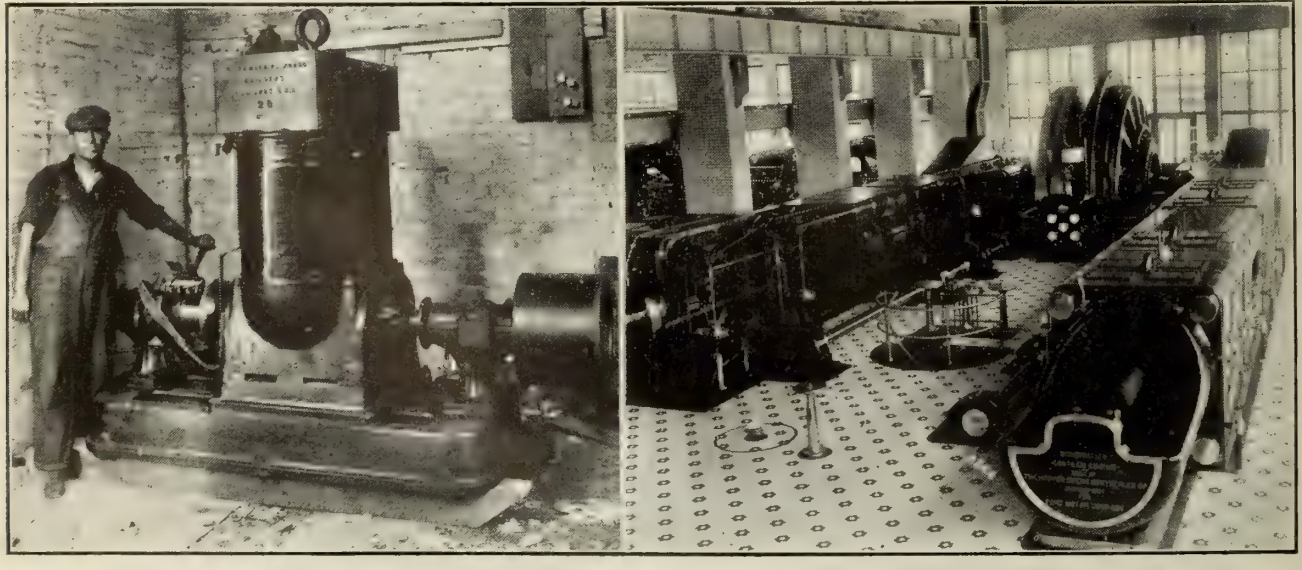
In fact, from statistics, we find that about 30 per cent. of the population of the Border cities, is directly dependent on the Ford Co. for their livelihood, and approximately 40 per cent. indirectly employed on work for the main plant. These figures show conclusively the importance of the automotive industry in this section of the country.

Going further into the matter we find that the railways get their share of the work created, for it has been figured out that practically 1,000 railroad employees are busy shipping and handling Ford Cars and parts every day of the year.

The progress made in the plant and its output, is remarkable. In 1910, the total valuation was only $73,921, against the present figure of over eight million, and the production in 1905 was only 117 cars, against over 55,000 at the present time. Only $47 is spent for imported material on each car made in Canada, all other parts being Canadian. In 1921, 46,500 cars and trucks were sold.

Would You Believe it?

When you see the next Ford car, think of the following figures which are facts culled from many others, and based on the amount of material used every year when making various parts of the car.



Showing the old power plant and a corner of the new. Note the combination gas-steam engine in right hand photograph. There are two of these engines, in addition to other power units.

On magnetic construction, some 718,000 lbs. of special steel are used, and 1,720 miles of wire. In making gasoline tanks 496,000 sq. ft. of galvanized metal is used, also 3,000,000 sq. ft. of sheet steel for car body construction. Over 1,500,000 ft. of steel rods is used to make radius rods, and other similar parts.

The tool equipment in the machine shop uses over 800 gallons of lubricating oils, and more than 7,500 gallons of cutting compound. To make 50,000 cars, over 25,000 tons of steel are required, and more than 3,000,000 sq. ft. of top material. Then there is the question of 200,000 wheels and tires, 150,000 lamps, headlights, etc., and more than 250,000 sq. ft. of plate glass. Over 7,000,000 ft. of copper tubing is used every year, but it is unnecessary to go further, for the figures given are ample proof of the magnitude of the plant and its demands.

The automobile industry, like many other industries, had first to pass through the skeptical period, and when the late Gordon M. McGregor first started his tiny plant, making Ford cars, many shook their heads and prophesied a horrible failure. The company was organized in 1904 with a capitalization of $125,000, and has increased rapidly between 1911 and the present time. It now has factory branches in nine Canadian cities, and has grown into the automobile factory with the greatest output in the British Empire.

A first the proposition was chiefly one of assembly of imported parts from Detroit, but after organizing in 1904, the new firm shipped its first car in Feb. 1905. The entire sales for this year amounted to only $110,000 and the only machinery for automobile finishing to start with was a solitary drill press, but now in the machine shop alone, there are over 1,700 machines in operation, these being valued at $2,186,000.

In the old days, when power was required to run the drill press, or elevator, a belt was attached to one of the rear wheels of a model "C" car, and away went the factory. Compare this with the present power house illustrated in this article. There is no need of following the growth step by step, but rather consider the present modern plant with its total of 600,000 sq. ft. floor space.



Fig. 1.—Showing how pistons are turned, grooved and faced.

Trip Through Factory

When we started on this trip we realized that unless we were prepared to devote an issue to a detailed story we had better stick to a brief description of the plant methods, for there was so much to see and talk about. Starting with the miscellaneous stock room, where many varied parts are stored in neat bins, and carefully carded and checked, we passed into the electrical department where the operations on magnetos, generators, and starters are performed.

Everything is carefully planned, even the benches, which are equipped with a slow moving belt carrying the work along by gradual stages. Jigs and fixtures are the rule, not the exception, and even when winding the copper tape into shape, a special arbor and winding machine is employed. When stripping the wires to obtain the bare ends, a knife, operated by foot treadle is used by the operators. They merely slip the end of the wire between a plier-like knife, press the foot, which brings down the knives, then a slight pull, and the end is stripped. Even when tightening the screws in the field coil of generator, a jig is used, which guarantees that the screw will be absolutely tight. This is very necessary, and pays the firm to arrange the operation in this way.

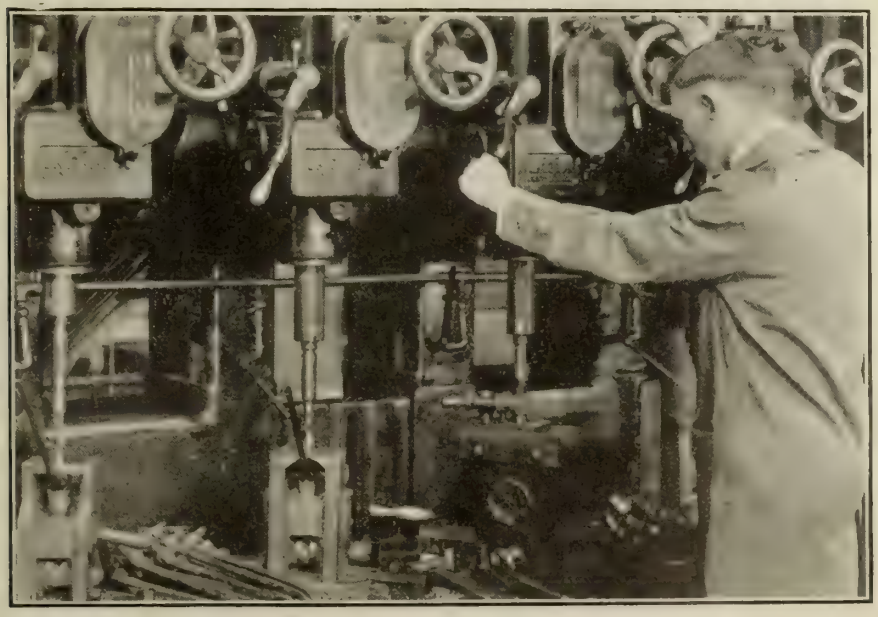


Fig. 2.—Drilling front fender iron and spring perch.

The coils are dipped and baked in the electrical department, but as this is a specialized operation we will not dwell at length on the process.

We next passed into the machine shop, which includes various departments, such as the press, automatic, cold bolt header, bolt threader, die castings, and electro plating departments. In the press section, we find all sizes of presses large and small, and the variety of work completed, ranges from small stampings to the heavy crank cases. One press weighs 52,000 pounds and has a pressure of 900 tons. The crank cases are drawn to shape on this huge press, and the parts after being drawn, are annealed in nearby furnaces between each draw.

The complete machine shop is 705 x 210 ft. and every machine used is made as automatic as possible. For example, on the bolt headers, the feed is automatic. In the bolt threaders, either hoppers or automatic gripping fingers are used, and this applies to both the rolled thread and die-cutting machines. When making the running

board, a special machine is used, and the flat strip of steel passes between rollers and dies, the necessary trade mark and embossed foot treads being completed at the one pass.

Everything in Sequence

The chief feature of Ford methods, is systematic production. As far as possible everything passes on, and keeps going, not turning back for minor operations. This meant careful arranging of equipment, and the present state of perfection was not reached overnight, but has taken years of patient study.

Take for example the operations on the cylinder. This includes milling and drilling. Every operation is a follow up of the other, and when the block reaches the end of the line, it is completed so far as machining is concerned. To start with, a huge milling machine finishes 15 blocks at one time, milling the top face and side lugs simultaneously. This is made possible by a special jig arrangement accommodating several blocks in position to machine the top, while other cutters are set at proper spacings in order to machine the side lugs.

In another special milling jig, attached to a continuous miller, 44 valves are held and machined. The stems of the valves are placed in holes equally spaced around the circular and as the valves move under the milling cutter, a roller holds down the valve while the bottom of stem is faced off to proper length.

On a drum type continuous milling machine, 8 axles are machined continuously on twelve faces. The fixture itself is extremely simple, merely holding the axle while the 8 faces at fork end of axle are finished, also the four faces at the spring pads.

An ordinary 20 in. drill press, fitted with a special milling attachment, is used to machine six bosses on the transmission cover, and this is arranged as follows. Six cutters are attached on special spindles the proper distances apart, and these get their power from one main spindle which is connected with the gearing of the machine itself. The cover simply slips in place, is fastened by a swinging clamp and all bosses are milled simultaneously.

The four holes at the crank end, of crank shaft, are drilled and reamed on a vertical circular jig which holds four shafts at one time. A multiple spindle drill press is used, and eight spindles are in operation, six being equipped with drills and two with reamers.

The method of polishing the cylinder bores after machining is worth mentioning. A special machine is equipped with spindles having a series of rollers at their ends. These are used as burnishers, and bring the bore to a good, high polish.

Another machine of interest is the one shown at Fig. 4. Here we see the turning and grooving of pistons, also the facing of top. On the table of machine are shown some castings partially and finally completed. The operation is somewhat similar to any vertical boring work and the only difference in this case is that every hinge is self-contained and specially tooled to suit this particular part.

Fig. 2 shows the drilling of front fender iron and spring perch. The two left hand spindles complete the one part, the other spindles completing the spring perch. This is a straight drilling proposition, but note the method of holding fender iron in position by means of the quick-acting clamp, or plunger, based on the cam principle.

Motor Assembly

On the second floor is the motor assembly, and again we find the value of careful planning. Everything is done in sequence, and each man has a specified task to perform. After the valve springs are put in place, the crank shaft is installed, and the main bearings tightened down. This being completed, the engine is run in a special burning-in stand for three-quarter of a minute, and is run dry. The bearings are now removed, inspected, and if scraping is necessary, the operator makes everything O. K.

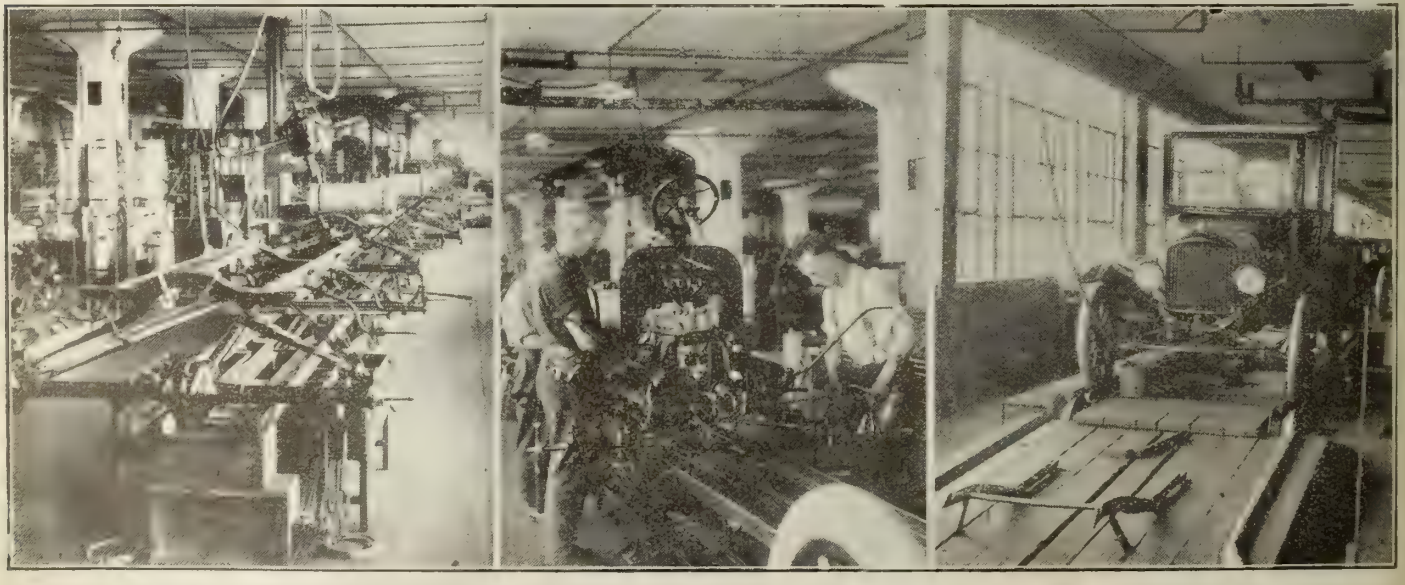
The connecting rods, pistons with rings, etc., are next installed, and these are run in for a suitable length of time. From then on many things happen. The magnetos are tested, assembled, and then a timing test on the engine takes place. The operator keeps grinding off a portion from the ends of the valve stems until everything is timing properly.

The transmission is now placed on the engine, after which we come to the assembly of the magneto, starter gear and flywheel. These parts are also assembled to motor, brake band lining, crank case, universal ball cap and starter being added. At this point they come to the end of the slow-moving assembly chain, where they are picked up by the hook shown at Fig. 3, where they are swung over to the running-in stand, the transmission cover being put on at this point.

The Test

The complete motors are next placed on dynamometer test stands, and driven by a 20 h. p. electric motor. They get a 15-minute running test in oil, the speed being about 14 m. p. h. Later on the engine is run under its own power and put under the regular S. A. E. tests. Should anything occur which shows the engine is not working properly, it is promptly torn down, the defect remedied, and tested once more. This is done until the inspector puts his O K. on the finished motor.

On the third floor we have the front axle assembly and the method of testing is worthy of mention. A special jig fits over the completed axle. The radius rods operating the knuckles, are moved around as if the axle were in actual use, until every point registers properly. The operator then knows that if the axle were assembled in a car, it would guide the wheels in proper manner.



Reading from left to right, Figs. 5, 6 and 7, showing step in the assembly of chassis, tightening up of motor fittings, and the completed car just before the test run.

We now come to the assembly of rear axle, and without entering into the operations step by step, sufficient to say that all axles are tested before being assembled on to the motor. This test is shown at Fig. 4. As the axle reaches completion it is attached to motor shown, and run in until passed by the inspector. Should trouble arise, the whole thing is torn down the same as the motor, and the defect remedied. The test is very exacting, as the motor and rear axle are, after all, driving members of the car.

The different units being completed, we come to the final assembly. Again we will not attempt to touch on every operation, but will show by three photographic reproductions some of the stages through which the car passes. At Fig. 5 we see the chassis assembled to the front and rear axle, springs, running board, braces, etc.

From this point on the gasoline tank is added, the steering wheel and panel, motor and so on, each part being added as best suited to the completed car. Accessibility is one of the main considerations, and as the chassis passes down the slow-moving chain, it is wonderful to see the framework looking more and more like a completed car.

During these stages of assembly, hand power is supplemented with air and electric power as much as possible. When tightening bolts, the air speed wrenches are used, and except in such cases as Figure 6, hand-tightening is done away with.

To show how carefully every step is planned, here is what happens when the car has reached the stage where wheels and tires are required. On the floor above, the tires are placed on the wheels, inflated, then put into a chute leading to the final assembly floor. These reach the assembly line at the proper point, and all the workman has to do, is pick a wheel up, place it on the axle, and repeat the performance until the car is fully equipped with tired wheels.

At Fig 6 the men are making sure that the motor is properly fitted up, the placing on of wheels being the next operation. The bodies of the cars are placed in position by means of a monorail system, part of which can be noted at Fig. 7. This view shows the car just before the test is run. When it reaches here, there is gasoline placed in the tank, and the car is ready for a test run. Note in this picture, the two grooved wheels, and the flat iron cradle affair on the forward platform. This is used for starting purposes, when the engine is new and perhaps very stiff to turn over.

The car is moved until the rear tires rest on the grooved wheels and the front axle is locked in the cradle. A motor, not shown in photograph, starts the grooved wheels in motion, this of course operating the rear axle, thereby driving the engine through drive shaft transmission. As soon as it is warmed up, the car is taken out for a test drive by competent inspectors and until the man puts his O. K. tag on the car, it is not considered a completed article. The patience and perseverance displayed in this department is remarkable, but the slogan is "Make the car right at all costs."

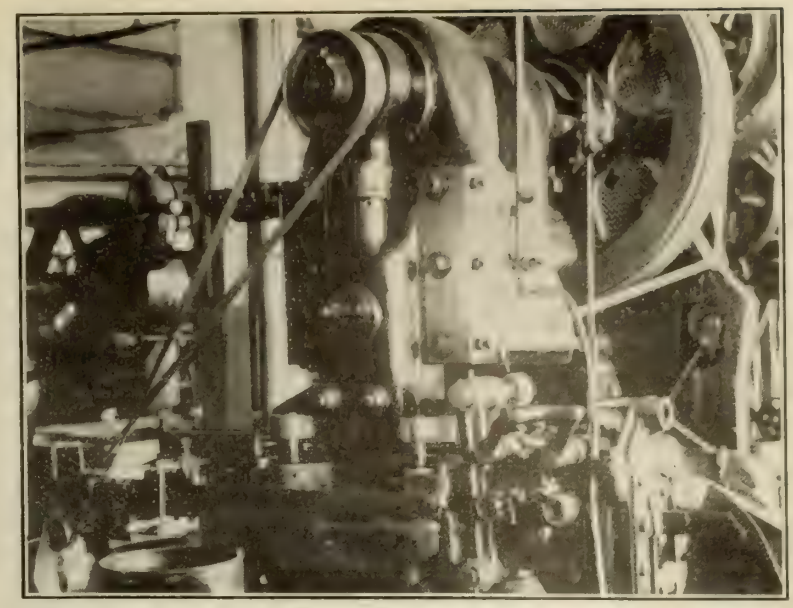


Fig. 8.—Stamping radiator fins automatically from a roll of brass sheeting.

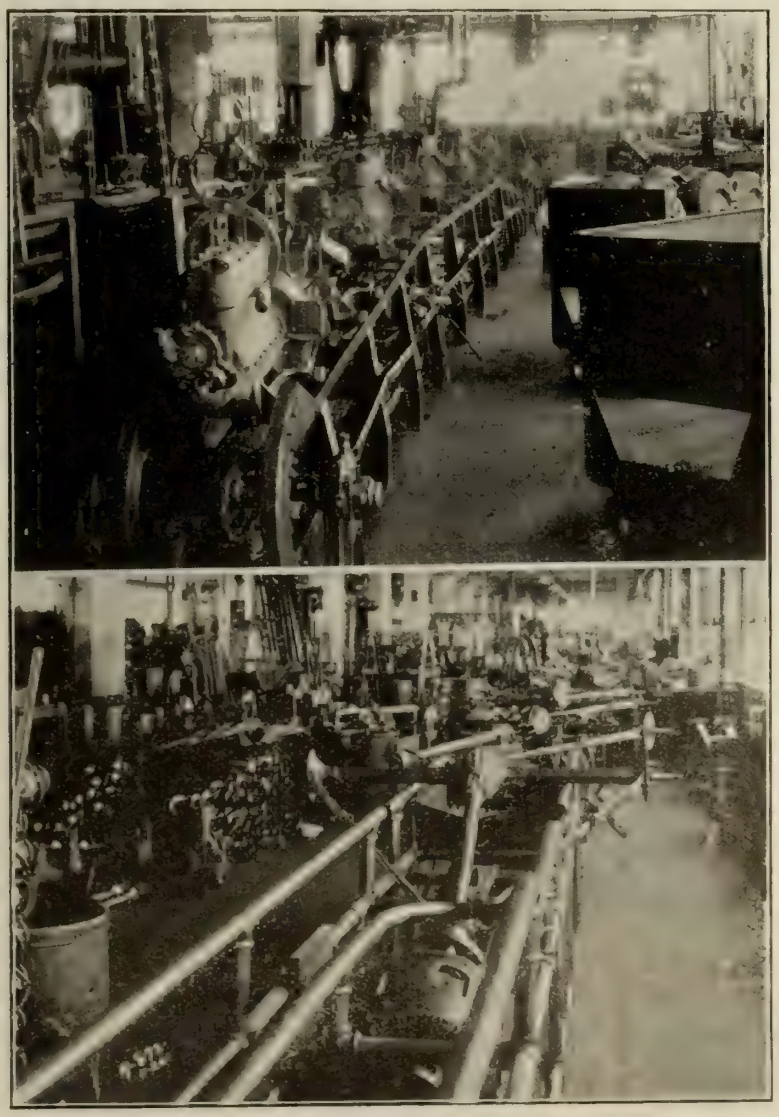


Fig. 3.—Upper view showing engine ready to be picked off assembly chair and swung over to running-in stand. Fig. 4.—Lower view showing step in assembly of rear axle.

Having followed the car through its assembly, we shall briefly dwell upon varied operations entering into the making of the parts. Take for example the radiator department. Here we see the radiator built up gradually, and Fig. 8 shows an interesting operation in this section. The radiator fins are stamped automatically on the press shown, and a roll of brass sheeting of the proper width is placed on a reel at one end of the press. An automatic feed and trip does the rest. In comes the stock, it is rolled over at the edge, the proper number of holes punched in the part, and as it leaves the press, it is sheared off into proper lengths, and drops down a chute into a container.

The method of assembly is interesting. Jigs are used, and into these fixtures are placed the fins we have just referred to. At another part of a circular table, (for the operation is arranged in this manner) a workman has a large number of tubes, which he simply pulls around in a jig until almost before you realize it, the tubes are all in place. They are next pressed out from this jig by means of air, into the fin jig and of course as the fins are encased in the fixture, the operation becomes merely one of routine. The present method however was only arrived at through painstaking experimenting. Other operations are sweating, soldering, etc.

The sheet metal department is a plant in itself, and owing to the extreme length of this article, we will simply pass the matter up by mentioning that only first-class equipment and dies are used. Here again we see that every operation is carefully planned in sequence, this making for good production.

Heat Treatment

A department which must not be overlooked is the heat treating section. Here all parts to be treated are placed in the furnace and according to the material and use to which the part is put, the chief furnace control man gives it the proper treatment. The method of control is splendid. In a room, above the furnaces, are several men, who although they seldom see the material going into the furnaces know exactly the moment it enters and issue orders when it must leave. The men attending the furnaces are not heat treaters in the actual sense of the term, but are ideal order attenders. They work through a series of lights, and these bulbs tell them what to do. Red, white, and green are the colors used, and here is how the system is operated:

A small card is issued by the foreman of heat-treating room to the control room stating that such and such a part is ready for heat treatment. The control operator then makes out a card stating the furnace into which the parts are to go, the time they must enter, and the maximum temperature to which the oven must be heated.

Suppose the parts have entered the furnace and the heat registers much too high on the control pyrometer, then the operator flashes a red lamp on the furnace attendant. Should the heat be only a little higher than necessary a red and a white lamp are lit. A green light tells the attendant that the heat is much too low, while a green and white signal means just a little too low.

When all three lights show at one time it indicates to the furnace man that he must load up. In this way, guess work is eliminated and the control board operator keeps a very close check on all parts passing through his hands.

For example, here is how one of the furnace check cards was made out while we were there. Gears were being heat treated and the batch consisted of 250. The date was clearly shown, and the time of entering the furnace, viz. 11.30 a. m. The time out, 2.15 p. m. was also registered, and the furnace number was twelve. It was stated on the card that the furnace used was air and gas, and that the maximum temperature was 1,560 F.

A check on the furnaces is made every 15 minutes, and in some cases, a soaking heat is given, after the furnace has been brought up to the proper temperature. For example, some of the gears for the back axle are heated to 1,560 F., then allowed to soak for several hours.

To know just where to stop in an article of this nature is difficult, for there are so many points of interest to discuss. There is the printing plant where all sorts of circulars, letter heads, and so on are produced, and there is the photographic department where moving pictures and still photographs are made and developed. At present they have eased off on the motion picture section, but ordinary photographs are being taken at all times.

Then they have the power house, which is illustrated in this article. Here they produce 26,000 k. w. hours per working day of 8¾ hours, with two engines, other engines are held in reserve for emergency use. The large engine has a rating of 5,000 h. p. and is of the special gas-steam type. There are four smaller engines totaling 3,000



Figs. 9 and 10 showing method of placing material in box cars, also system of receiving and distributing goods to other plants, etc.

h. p. There is layout, equipment and space for another 5,000 h. p. engine, which will be installed at some future time. A full gas producer plant is in operation, supplying gas for the engines, and other purposes.

Methods of Packing

To leave the subject without mention of their excellent packing methods would be unwise. Here again, every step has been carefully thought out, and every workman knows his duties exactly. He contributes his share to the packing of the car, and usually these men work in teams. The cases are made sufficiently strong to stand the railway journey, and as considerable export business is done, this precaution is very necessary.

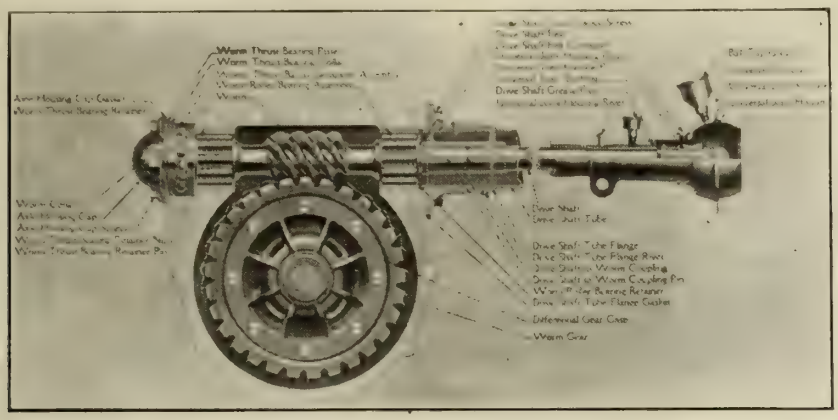


Fig. 11.—Sectional view through truck axle.

A careful check is made on parts entering each case, and the head of the team knows without question that everything is in place before the case is closed. The shipping building is a wonderful sight with its high roof and heavy duty crane. Tracks run up the complete length of the building, and the loading platforms are spaced to suit as shown at Fig. 9. Box cars are used for shipping, and the photograph shown was taken while box cars were in place.

Their method of receiving and sending out the smaller parts could well be copied by other firms. The idea is shown at Fig 10. On parts being received, they are sent up the roller incline to the distributing floor of factory and the man in charge makes a note of the time of arrival, number received, and so on. Should parts be leaving the main plant, for some of the other buildings, check is made of this, so that nothing leaves or enters the factory without a note being made of it.

The office staff must also be reckoned with, for they are well organized and work in close harmony with one another. While their work may not show in the shop, the year's total sales is ample proof of their activity.

A passing mention only is made of the first-aid department and welfare work. These are of the best and considerable money is spent yearly in order to keep the sections as modern and helpful as possible.

Making Trucks

In making trucks, several changes in plans have to be followed out. The rear end is entirely different, being a worm drive. Fig. 11 shows a section through this drive, and as all parts are clearly shown, we leave the reader to study same at his leisure. On the completed chassis, any body and special equipment can be placed, and includes the standard express and stake body, rapid delivery with canopy top, all-purpose combination body, end dumping, steel dump bodies, etc.

Fig. 12 shows a standard stake body, which consists of a regular platform and slatted side. When other styles of bodies are used they are made by outside body factories, such as the Commercial Motor Bodies and Carriages, Ltd., Guelph. The Brantford Carriage Co., Brantford; The Canadian Top and Body Corp., Tilbury, and Hay and Harding, Calgary, Alta.

To discuss all styles of body would occupy more space than we have at our disposal. There is the all-purpose farm body, the combination grain, freight and stock body, dump bodies for contractors' use, and so on. Specially designed chassis is also part of the truck, this being made by the Swedish Crucible Steel Co., of Canada, Windsor, Ont. According to what the truck will be used for, the frame and body equipment varies, but in all cases, a recommendation is made as to the shortest and longest body best suited to the frame. Fire trucks, equipped by the Bickle Fire Engine Co., Woodstock, Ont., are also made, these being of varied combinations, as to equipment of chemical engine, hose, etc. Then there is the semi-trailer, the passenger bus body, and other arrangements.

The same principle of manufacture holds good. Nothing is put into the truck which will not stand rough usage, and a gear ratio of 5 to 1, gives it a speed up to 25 m. p. h. without undue increase of engine's speed. In the main some of the operations are similar, so we will pass on to a few more figures regarding the Ford plant which readers can think over at their leisure.

The annual pay roll of the company is over $5,800,000 and to this must be added the millions disbursed as wages by the branches, and other manufacturers located in Canada who depend almost entirely on the Ford Co. for business. To keep the plant clean costs approximately $15,000 per month and the average wage is $6 per day. Over a period of ten years, the increase in wages per employee has gone up 214 per cent. During the fiscal year, 1921, the company purchased over $19,000,000 worth of material and supplies and have paid over $12,000,000 in duty during the past twelve years. In the last eight years the wage bill has totalled more than $32,000,000 and at present $1,500,000 a year is being paid in taxes. In spite of the massive proportions of this industry, everything moves like clock work, with the result that any visitor cannot help but be impressed with the fact that only a far-seeing mind could have conceived such a wonderful factory.

A great deal of praise has been given to the late Gordon McGregor and it has been well deserved, because he worked and brought the factory up from its infancy but has now passed on, and from our observation, the present organization will not only carry things along successfully, but as the years go on, a larger and more wonderful plant will result.

W. R. Campbell is first vice-president and treasurer of the Canadian plant; P. W. Grandjean, secretary and assistant treasurer; G. E. Dickert, plant superintendent; H. S. Pritchard, sales manager; W. J. Baxter, advertising manager; L. C. Wilkinson, service manager; W. R. Burgin, traffic manager, and W. E. Disher, purchasing manager.

MAKING LAMPS AND OTHER METAL PARTS FOR AUTOMOBILE TRADE

AT THE Canadian Lamp & Stamping Co., Ford, Ont., head, tail and dash lights are manufactured. This plant has a floor space of 30,000 sq. ft., is valued at $200,000, and produces about 15,000 head lamps, 8,000 tail lamps, and several thousand dash and rear stop signal lamps every year. Hub caps, and other metal parts for automobiles are made in the same plant, these running up into the thousands.

On the first floor the punching, blanking, and drawing operations are performed, and in making the reflectors for the headlights several drawing operations have to be gone through. Other general press work needs no further discussion in a general article of this nature.

Plugs, connections and bulbs, come from the States, and are assembled to the lamps on the ordinary tables, and packed ready for shipment. Before reaching this finished stage they pass through the regular buffing and polishing department, electro-plating section and enameling room.

A well-equipped tool room forms part of the plant and it is here that all dies and tools for production are made. Lamps for Ford, Overland, Gray Dort, Studebaker, General Motors, and Ruggles truck are made, and others are always being added from time to time.

Reduce Your Truck Costs and Improve Service

Explaining How to Keep Close Tab on Driver and Other Operating Expenses—Standardized System of Cost Keeping by Means of Simple Cards

"WHAT does it cost you exactly to run your truck?" If this question were put to the average manufacturer, owner of a single truck, it is very doubtful whether he would be able to give an intelligent rereduce his stock costs and better his ply.

Every truck owner naturally wishes to service as much as possible. What then is the answer? The first step is to find out the true cost of every item of motor truck expense. Without every item, the cost keeping system is useless, for you must have all possible leaks covered.

An accurate record of the daily performance of each truck should be kept, this including loading time, running time, available but not used time, etc. All such statement should be clearly and simply recorded, so that the system can be carried out without undue effort on the part of the truck driver.

Once let the operator understand you are watching the performance of the truck, and the savings effected will astonish you. Through the courtesy of G. M. Grant, of the Packard-Ontario Motor Co., Toronto, we are able to show a daily record sheet, also a record sheet for the month of March, both of which are from annual tests, and not merely filled in for the occasion. The Packard Co. have made an exhaustive study of truck costs, and use the National Standard Truck cost system, on all their work. They do so, because, as Mr. Grant says, "It has been developed to such a point that it is easily kept and is accurate in every respect."

Motor Truck Transportation

All conditions being equal the cost per day of a truck will vary with the miles travelled per day. It will increase as the daily mileage increases. The cost per mile will vary with the miles travelled per day. It will increase as the daily mileage increases. The cost per unit (for example, ton) will vary with different capacities, and the distance hauled. It will increase with an increased truck capacity. It will increase with an increase in hauling distance.

The cost per unit-mile (for example, "ton-mile") will vary with different capacities and the miles of truck travel per day. It will decrease as the capacity increases. It will decrease with an increase in daily mileage.

But what is the unit-mile and how is it figured? Suppose a truck travels from A to B a distance of five miles, and carries one ton. This truck has then performed five-ton-miles of work. If it carried three tons it would have accomplished 15-ton miles. Suppose it now returns empty to the starting point. It has run miles, but carried no tons, so there can be no ton-miles. This fact has caused most of the misunderstanding of this subject.

See page 6.

Owner and Truck Operating Costs

Truck owners may be divided generally into two classes: Those who haul for themselves and those who haul for others. The Chicago Tribune is authority for facts showing that approximately ten per cent. of the cost of doing business is represented in transportation. System states that the net profits of business do not average above eight per cent. The owner who keeps costs is in a position to reduce his transportation expenses and thereby increase his net profits.

Form 1 NATIONAL STANDARD TRUCK COST SYSTEM. TRUCK OWNERS CONFERENCE, INC., CHICAGO.

DAILY RECORD, MONTH OF _____; HOURS IN WORKING DAY _____ FROM _____ TO _____ TRUCK NO. _____

| | OPERATING DATA | | | | | | | | | | | | | | | COST DATA (Posted to Form 3c) | | | | | | | | | | | | | | |

The man who undertakes motor truck hauling for other concerns must know his operating costs in order to fix a fair price for his services. Such records will insure adequate profits and he will be in possession of facts to justify any necessary increase in rates. Because operating cost facts tend to eliminate the hazard of an unexpected loss, the vendor of equipment on a partial-payment plan should encourage his customers to keep them. They will be added insurance that the notes will be promptly redeemed.

While the actual cost of operating a motor truck varies a great deal, the reasons for these variations can be easily determined. There are certain standard principles which should be used in estimating operation costs. Motor truck operating costs, either estimated or actual, contain two factors. The fixed costs must be paid regardless of how much or how little the truck is used, while the variable costs change with daily performance.

Fixed Costs

Money at work in a business is entitled to a fair wage called interest, which is usually figured at a certain per cent. of the money at work. Many truck owners consider the price of their truck and its equipment as money at work and so charge the normal "interest wage" against the truck as an operating expense. There is a growing tendency however, to omit interest as an item in operating costs. This is especially true to firms hauling for themselves, because they believe that dividends on any investment must come in the regular profits of the business. This rule, on the other hand, would not apply with equal force to firms running their own trucks to serve others.

The following conditions affect the daily or monthly amount of interest: Amount of investment, rate of interest, assigned book life of truck in years and miles and days in operation per year.

Taxes and License

These items vary according to the laws of states and cities, and are usually

Form 4 NATIONAL STANDARD TRUCK COST SYSTEM TRUCK OWNERS CONFERENCE INC. CHICAGO Series 1920

DAILY SERVICE RECORD (TO BE TURNED IN DAILY) TRUCK No _____

NO. OF TRIPS	TRIP TIME LEAVE	TRIP TIME RETURN	DELIVERY OR PICKUP STOPS	LOAD UNITS OUT	LOAD UNITS IN	HELPER USED	TRAILER USED
1	8 30	9 40	4	2764			
2	10 20	12 15	12	2107			
3	1 25	2 50	7	3300			
4	3 15	6 25	9	4000			
5							
6							
7							
8							
9							
10							
	DAILY TOTALS						

MONTH Mar DAY 9th 1920

ACCEPTED FOR WORK AT 8 A.M.

RELEASED FROM WORK AT 6 25 P.M.

MILEAGE READING FINISH

MILEAGE READING START

MILEAGE TODAY 46

GASOLINE OR K. W. H. 6 Gls.

CYLINDER OIL PINTS 0

LUNCH TIME START

LUNCH TIME FINISH

DRIVER

USE REVERSE FOR REMARKS ON DELAYS, WEATHER, ROAD, ACCIDENTS, MISCL. EXPENSE, ETC.

Fig. 1.—Daily Service Record Card made out by the driver each day and turned into the office.

levied with reference to truck capacity, total weight and horse power. Many forms of insurance have been developed to cover hazards incidental to motor truck operation. The yearly charge for insurance will depend upon the following conditions: Location, trade classification, protection deemed necessary by the owner, necessity for protecting merchandise carried in the truck, and requirements of partial payment plan.

Drivers and Helpers

The salary factor is frequently the largest single item of expense. It is usually considered a fixed sum, but variations may be expected on account of the following conditions: The business location and owner's policy, method of payment—salary, hourly basis, overtime, bonus and local labor conditions.

The duties assigned to laborers and helpers also affect the wage scale: For example: Do they serve only as drivers and helpers? Does one person serve in both capacities? Must the driver serve as a mechanic? or, Must the driver be a salesman and handle money?

Another point to be considered is: Do you use a public garage or house your truck in a part of some building? Does the rent include washing and filling with oil and gasoline? what is your accounting practice? Do you include charges for water, light, heat, interest and depreciation? Is there any overhead or administrative expense?

Occasionally the owner of a motor truck will allow it to stand unprotected or else use an old building, which is considered worthless. Under such conditions, owners usually refuse to make a garage charge and when making comparative estimates this fact should be taken into consideration.

Depreciation

As a reserve or sinking fund to replace a motor truck, this item is considered as a fixed charge when calculated on a yearly basis, and as a variable charge when calculated on a mileage basis. The amount to be written off in either case will depend upon the share of the total investment which is to be replaced by the fund thus established. The usual practice is to subtract the value of the tires from the total cost of the vehicle and thus arrive at the sum to be amortized.

The total amount to be depreciated, divided by the number of years, will give the charge per year.

Variable Costs

When depreciation is calculated as a variable charge, the life of the vehicle is estimated in miles, usually 100,000 and the amount to be depreciated is divided by this figure. The result is a depreciation charge per mile which, multiplied by the mileage of any period, will determine the reserve to be set aside for that period.

In estimating the cost of gasoline used in the operation of a motor truck, it is well to bear in mind that the actual cost will depend upon a number of things, among them being carburetor adjustment, ability and care of the driver, load, road, grade, traffic, delivery and climatic conditions, price of gasoline and amount of gasoline used for cleaning, but charged to the truck.

The cost of lubricating a motor truck is one of the smallest items of expense,

Form 3 NATIONAL STANDARD TRUCK COST SYSTEM TRUCK OWNERS CONFERENCE INC. CHICAGO

MONTHLY ANALYSIS OF OPERATION CAPACITY 9000 LBS. MAKE Packard FISCAL YEAR _____ TO _____ TRUCK NO _____

		July	Aug	Sept	Oct	Nov	Dec	Jan	Feb	Mar	April			
A	NUMBER OF DAYS OPERATED	24	25	22	25	24	26	23	24	27	24			
B	NUMBER OF ROUND TRIPS	89	109	77	106	82	86	92	103	113	98			
C	DELIVERY OR PICK UP STOPS	434	567	411	609	467	776	547	633	638	572			
D	TOTAL UNITS Cwts. OUT	1643	1652	1684	1872	1872	1523	1841	2315	2467	2264			
E	TOTAL UNITS Cwts. IN	201	249	140	194	54	685	248	128	64	159			
F	MILES TRAVELED	743	914	728	825	921	822	800	868	899	783			
G	GALLONS OF GASOLINE OR K. W. H. CURRENT	126	132	115	140	159	154	182	168	184	98			
H	PINTS OF CYLINDER OIL	10	28	7	12	25	11	20	20.5	8.5	6			
I	HOURS AVAILABLE BUT NOT USED	2230	9.00	5405	16.40	800	0	715	405	805	840			
J	HOURS LOADING	42.00	53.30	33.40	51.00	60.10	50.43	47.40	47.35	2912	4250			
K	HOURS RUNNING INCLUDING STOPS	138.40	173.5	134.15	167.4	173.35	167.27	147.15	12435	163	147			
L	HOURS LAID UP FOR REPAIRS	0	0	0	0	0	0	1800	0	0	0			
M	HOURS WAITING, ETC.	0	5	0	0	0	0	0	0	0	0			
N	TROUBLE DATA	0	0	0	0	0	0	0	0	0	0			
	AVERAGES FROM ABOVE													
B1	NO. MILES PER DAY	30.9	41	33.1	41.2	38.4	31.5	34.8	36.2	33.3	32.6			
C1	NUMBER OF PICK UP STOPS PER DAY	18	21.8	18.6	26.7	34	29	23	23	23	23			
D1	TOTAL UNITS Cwts. PER DAY	68.4	73.1	60.2	74.6	80.2	60	82.0	97.1	91	105			
E1	AVERAGE UNITS Cwts. PER TRIP	19.5	17.5	22.9	22.5	23.5	17.1	20.0	23.1	23	26.2			
E2	UNITS Cwt. MILES PER DAY	298.8	307	276.9	313	405	279	384	412	345	309			
F1	MILES TRAVELED PER DAY	31	35.1	33.1	34.2	39.6	32.8	37.3	36	33.2	31.3			
F2	AVERAGE ROUND TRIP DISTANCE	8.8	8.4	9.4	8.1	11.6	9.3	4.3	8.5	8.0	7.8			
G1	MILES PER GAL. OF GASOLINE OR PER K. W. H.	5.9	7	6.3	6.1	6	5.4	6.8	8.0	8.2	7.8			
H1	MILES PER GALLON OF CYLINDER OIL	59.6	26.1	83.3	56.6	32.6	62.0	82.9	33.0	82.9	101.7			
I1	AVERAGE HOURS LOADING PER DAY	1.42	2.02	1.21	2.02	2.30	3.04	2.05	1.58	8.10	1.47			
J1	AVERAGE MINUTES LOADING PER TRIP	30	30	31	29	44	52	31	28	31	26			
K1	AVERAGE NO. HOURS NO. MILES NO. STOPS PER DAY	5.46	6.41	6.06	6.42	7.13	6.26	6.24	6.20	6.33	6.09			
K2	AVERAGE HOURS IN SERVICE PER DAY	7.31	8.46	7.37	8.46	9.43	8.30	8.29	8.24	8.13	7.26			
K	AVERAGE SPEED IN MILES PER HOUR	5.4	5.4	5.4	5.2	5.2	5.2	6	6	5.5	5.2			
L	ESTIMATED RUNNING TIME PER MILE	5	5	5	5	5	5	5	5	5	5			
P	ESTIMATED TIME PER LOADING STOP	10	10	10	8	6	4	6	8	8	9			
Q	COST PER DAY OPERATED	11.87	11.40	11.87	11.31	12.46	10.91	12.83	11.91	10.24	10.92			
R	COST PER MILE	.368	.326	.358	.339	.314	.339	.328	.316	.314	.348			
S	COST PER UNIT Cwt.	.168	.159	.142	.129	.125	.184	.149	.118	.104	.104			
T	COST PER TON MILEAGE	.0386	.0326	.0319	.0291	.0278	.0284	.0310	.0271	.0261	.0264			

Fig. 3.—This form shows the monthly analysis of operation.

COST RECORD CAPACITY 4000 MAKE Packard MODEL E.B. ENGINE NO. LICENSE NO. TRUCK NO.

FORM 3A INVESTMENTS		FORM 3B CHARGES BY MONTH OR YEAR	Year Estimated	Month Estimated	Month	Maintenance & Repair Actual
		Interest 4960.00 @ 7 %	193.62			
Chassis	4595.00	Taxes				
Tires & Tubes		License	36.00			
Body	225.00	Administrative Overhead				
Top	115.00	Garage (Rent Light Heat Power)				
Painting		Insurance	128.96			
Fenders						
Special Equipment	25.00					
Total	4960.00					
Subtract Tire Value	240.00					
Subtract Storage Battery Value						
Total Cost Less Tires & Batteries	4720.00	Total		28.21		

Months on which Depreciation is According to Limits of Fiscal Year Use Insurance for First Month Etc. *Average Yearly Interest $\frac{A+1}{2} \times \frac{C \times B}{2}$ In which (A) equals length of sinking fund period in years (B) equals the investment and (C) equals the rate of interest

PRESENT BOOK VALUE

FORM 3C MONTHLY ANALYSIS OF COST

Month	Total Mileage	Ch. Lubr. Oil Cost	Drivers & Helpers Wages	Repair Due To Accident Actual	Sinking Fund (If Used) Budget	ESTIMATED OR BUDGET: Washing Lubr. and Repair	Battery Renewals and Recharging	Tire Cost	Variable Monthly Expense	Fixed Monthly Expense	Total Monthly Expense	ACTUAL: Washing Lubr. and Repair	Battery Renewals and Recharging	Tire Cost	Variable Monthly Expense	Fixed Monthly Expense	Total Monthly Expense
July	4788	1 20	117 00			83 01	18 62		22 33	242 36	2[illegible] 21	270 67					
Aug	4620	4 20	117 00			42 89	22 65		27 42	260 62	28 21	288 83					
Sept.	4023	1 40	117 00			34 86	18 28		21 87	233 00	28 21	261 21					
Oct.	4900	1 80	117 00			40 18	21 37		22 03	255 00	28 21	263 21					
Nov.	5784	4 20	117 00			44 69	23 77		28 53	272 43	28 21	303 64					
Dec.	5544	1 65	117 00			40 09	19 32		25 54	259 07	28 21	287 30					
Jan.	4500	4 00	117 00			40 46	21 50		25 60	253 76	28 21	281 93					
Feb.	3942	1 64	117 00			40 70	21 70		26 04	246 58	28 21	274 80					
Mar.	3978	1 20	117 00			42 88	22 45		26 97	246 65	28 21	277 86					
April	3377	90	117 00			35 66	19 07		22 68	231 48	28 21	259 70					
Total																	
Average																	

Total Cost to be Depreciated $ 4720 00 for Est. Life of 100,000 Miles = 4.7¢ Per Mile

Estimated Yearly Maintenance & Repair $ 850 00 for 10,000 Miles = 2.5¢ Per Mile

Tire Estimate Per Mile { Actual Life by Past Experience 10,000 Miles / Guaranteed Life 8000 Miles } 24 Per Mile

Battery Renewal Estimate Per K.W.H. Consumed

Fig. 4.—This cost record shows every item of importance and sums up the information given.

but nevertheless one of the most important in truck maintenance. Among the factors controlling this cost are price of lubricants, regularity of application and renewal and condition of vehicle and the design of the lubricating system.

Repair and Overhauls

This item, while usually not the largest, generally receives the most attention. It casts an immediate reflection upon the quality of the vehicle. Among the factors controlling it may be mentioned quality of materials, design and workmanship, load, road, and operating conditions, ability and care of driver, frequency of inspection and garage attention, line of business.

Among the factors affecting the tire cost are road condition, tire design and wheel alignment, and loading practice and driver's efficiency. Any estimated tire cost will depend upon the price of the tires, and the nature of the manufacturer's guarantee.

Having covered these essential points we will next discuss briefly the purpose of the system shown on the four forms. Large cards similar to Fig. 2 are bound together and there are sufficient leaves to keep the complete cost and operation data on one truck for one year. It is so arranged that each page represents one month's running. There is also a monthly analysis sheet as shown at Fig. 3, and a cost record sheet illustrated at Fig. 4.

At Fig. 1, we see the driver keeps track of his trips; on the reverse side of his form, he places any additional remarks, delays, weather, road conditions, accidents, etc. or anything that is necessary in the way of explanation. At the end of each day he turns in his slip to the office clerk handling the cost record and he or she, as the case may be, fills in the data on the card shown at Fig. 2. It is unnecessary to comment on the different columns, as they are self-explanatory.

From the figures shown on Fig. 2, form at Fig. 3 is compiled. Note how complete the information and how simple it is to find any desired item. The cost record, Fig. 4, shows the final analysis and as everything is clearly illustrated we leave readers to study all the forms at their leisure.

With each cost keeping set of forms comes detailed description, so that there is no confusion in this respect. As Mr. Grant, so aptly puts it, "When owners study and apply this method of truck operation and cost, they will reduce expenses and increase efficiency."

Makes Seventy-Five Thousand Sets of Auto Wheels Yearly

WITH A production of 75,000 sets of wheels per year, the Kelsey Wheel Co., Walkerville, are keeping a large percentage of the automobile factories in Canada supplied with this most important part of a car. The value of the plant is $860,000, and the factory covers over four acres. Property owned is more than 11 acres, so they have ample room for expansion if necessary.

The present number of employees is 292, and the plant is working right up to normal. The average weekly pay roll is about $7,700, and right from the raw material stage, wheels are produced at high speed. Where to start a description is rather difficult, for the parts are made in different departments, later meeting at the proper point for assembly.

The raw material is cut to proper width and length, then rolled in forming rolls until reaching proper shape. The joint is next welded, and after welding, the rim is finally brought to true shape on a machine built on the tire setter principle which is set at an angle for convenience. Tire carriers go through practically the same process.

The woodworking end of wheel making is very interesting. The spokes are first rough formed on a horizontal turning lathe, then they are mitred or beveled on a vertical machine having two knives set at the proper bevel. Leaving this machine they go to an automatic sander, after which they reach the first assembly bench. Here the spokes are assembled to the wooden rim, being squeezed into proper shape on a machine working on the principle of the tire setter. The outside of rim is next turned, then the metal rim assembled to the wooden rim.

During this procedure the hubs have been passing through the various machine operations, this consisting of regular turning, boring, reaming and drilling operations. Single and double-spindle turret lathes form the largest part of the tool equipment in the hub department.

There is quite an amount of sheet metal and fairly heavy stamping done at this plant, for in addition to wheels and tire carriers, they make a patented clip used on detachable tire rims. In the press department they have considerable money tied up in equipment and dies.

Painting Wheels

The method of painting the wheels is simple and very quick. The workman places the wheel horizontally over a spindle in an automatic paint-dipping machine, drops the wheel into the paint tank, then raises it above the paint. He puts on the power for a moment allowing wheel to revolve rapidly, thus throwing off any excess paint into tank. The operation is completed so rapidly that a wheel can be painted quicker than it takes to read this description.

The value of suitable carriers is pressed home to anyone visiting this plant. The carriers used are extremely simple consisting of band iron fastened together into the form of guides. One of these conveyors can be seen in the illustration showing interior of another wheel company at Chatham.

The shipping of this enormous quantity of wheels yearly is a problem in itself, but it is well handled, as the shipping facilities provided are splendid. Although a large percentage of the steel used in these products comes from the other side, the work of fabrication is 100 per cent. Canadian. Mr. Campbell is manager, while Mr. Fox handles the sales end.

Making Five Types of Cars At One Plant

Many Improvements in Manufacturing Methods Have Taken Place—Considerable Export Business Handled—Packing of Crates Watched Very Carefully



IT IS surprising how many changes and improvements can take place during a few years. On July 3, 1919, we published an article on the making of the Chrevolet motor car at Oshawa, but to visit the same plant to-day, and write the story is an entirely different proposition. Instead of speaking about one make of car you must mention five, viz., the Chevrolet "490", Chevrolet "F B," McLaughlin Buick, Oldsmobile and Oakland.

These cars are all manufactured under the name of the General Motors of Canada, with extensive plants at Oshawa and Walkerville. In order to avoid confusion, we shall consider the Oshawa plant first.

The proposition being so large, several buildings are required to handle each make of car. These consist of paint and trim shops, chassis assembly, final assembly, final test and export shipping building. Other structures are, body plant, radiator department, central enamel plant and closed body building. The total acreage covered is approximately 15 acres.

The number of employees engaged is 1927, and the average monthly pay roll is around $234,000. The daily capacity of the combined plants is 175 cars, of which about 50 per cent. are shipped to the following countries: Great Britain, Scandinavia, Spain, Greece, Northen Africa, East and West Africa, South Africa, India, China, Strait Settlements, South American Republic, Australia and New Zealand. In addition to cars, one-ton trucks are made at the Chevrolet plant. These figures will give an idea of the size and capacity of the combined factories. Next we will consider the actual manufacture. In some ways, the process is much the same on all cars, so we will treat the subject in a general way.

The Frame

First comes the assembling of the frame. The different members are drilled then assembled on special stands, pneumatic rivetting hammers being employed. Air hoists are used to lower the assembled frame on to a slow moving chain, and once they start on this line, the springs, axles and motor, etc., are assembled. In 1919 ordinary four wheel trucks were largely used for this work, but general use of the chain has been a wonderful improvement.

While the frame has been at the rivetting stand, and passing through the first stages of assembly, men directly across the floor have been putting finishing touches to the motors. This arrangement is carried out as far as possible on all makes of cars. When we speak of the motors being assembled, it is of course, understood that we refer to assembling the transmission to the motor, electrical units, carburetor, etc., because each of these themselves are in assembled condition, and it is really a final assembly to the engine that takes place. Once being bolted together, the now complete motor passes on to the department where the frame is being made into a complete chassis.

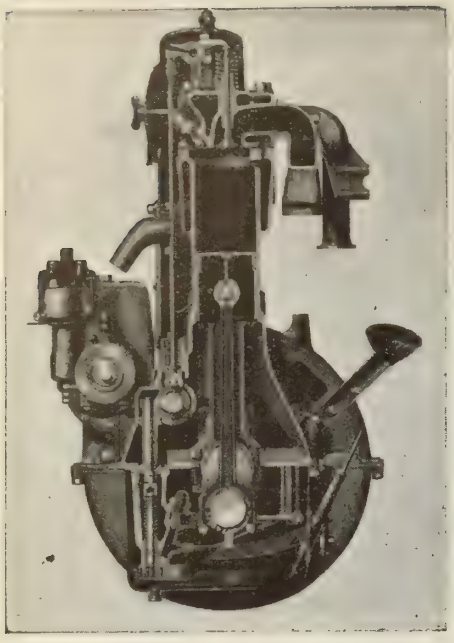


Showing bodies passing into enamelling ovens, shaping wooden body parts, early stages of body building, and building the wooden body frames.

Every Movement Studied

It will be noticed how carefully these initial steps are planned, and the same condition holds good throughout the entire group of factories. Every movement counts, nothing passes backward, and each workman has his own particular duty, being a specialist in that operation. Lost motion is reduced to almost the vanishing point, and naturally production soars accordingly.

The muffler, gasoline tank starting gear, underpan, drip pan, radiator, coil distribution tank, tire carrier, etc., are now assembled, after which the chassis is inspected, and all necessary parts filled with grease and oil.



Sectional end view of Mc-Laughlin-Buick Motors

From here it goes into a special paint chamber, spraying by air gun being the process. This gives it an even penetrating coat of paint, speeding up the operation at the same time. It only takes about ten minutes to paint a complete chassis, and after leaving this room it goes into a drying oven with a temperature of 180 degrees. In about 55 minutes out comes the chassis at the other end, dry and ready for further assembly.

Mounting Department

This section of the plant is referred to as the mounting floor, and here the car goes through various steps of assembly. The wheels with tires in place are put on the axles, the bodies are lowered through a hole in the floor above, having been previously assembled in the regular body department. Later we will describe this operation, but for the present will stay with the car on its road to completion.

The fenders, running boards, and aprons are added next, and by this time, it is looking more like an automobile. The final assemblers take hold of it and go all round and all through the car, putting everything in first class shape. Various adjustments are made, then the top is placed on the body. A final inspection is made before the car goes to the test department. During our visit in 1919, this final line of assembly had to push the cars along by hand from operator or operator. A chain now supersedes the manual labor, and quicker and better work results.

The cars next go to the test room, where every one undergoes a rigid road test before being passed O. K. Should a defect of any nature show up, it is removed at once, and another road test taken. This is kept up until the inspector feels the car is shipshape in every way, and good enough for his own use.

Starting with the bodies, here is the method employed in their manufacture. Down in the woodworking department all that is heard is the buzz of hundreds of wood working tools, each thoroughly up to date, and equipped with jigs or forms to guarantee that all parts made will be similar. These forms are very necessary, for many of the wood parts of a car are very peculiar in shape.

In this department are two machines well worthy of special mention. Wood is fed in from both ends, having been cut to certain length previously, and as they pass in, they are tongued and grooved and these joints coated with a thin layer of glue. Reaching the center, they are glued together at such a speed that you wonder almost how it happened, and in this way certain parts of the body are built up. The shaping of the door frames is also very interesting, the complete frame being placed in a form jig, and in less time than it takes to tell, is formed to shape.

The bending of the bows is also well arranged. These are made of maple ash, and are first steamed. They are then placed over a form, pressure exerted, and formed to shape. Several bows are shaped in the one form, then they are tacked together and placed in the kiln to dry.

Leaving the wood working, we will consider a very vital operation performed on another floor. The back metal portion of the body is welded by oxy-acetylene torch to the two side portions, this forming the rear seat part of body of car. A special, yet simple holding jig is used, and the operator merely runs his torch and filler rod down the seams welding all three parts together.

We will next consider the method of assembling body. Everything is placed in a form, and at the start you would imagine they were building a small boat instead of a car body. In a remarkably short time however, a change is noted. Pieces match together almost like magic and soon we have a complete wooden framework. The next stage is the metalling of the frame work, that is, nailing on the sheet steel coating, and after this is done, the latches, doors, and all other small attachments are added. The body is despatched to the paint shop and then, when it is ready for mounting, it is sent to the upholstery department. In both the body building and upholstery work, the men work in teams.

An up-to-date enamelling plant handles the work of enamelling fenders, hoods, pans and such parts. They are first washed in a washing machine similar to that used in large restaurants, a cleaning compound is employed to remove all oil, stains, etc. This is a very important operation, for if the parts are not thoroughly cleaned, the enamel will not adhere to the metal. Great care is taken however, and after the parts leave the washer, the moisture is blown out of all seams by air nozzles. Should any rust stains show up these are removed with fine emery paper.

Next comes what is known as tack ragging, that is, the workman uses a pad with a little tack varnish on it, this removing any dust stains or grit. This having been done the parts are hung on hooks, over slow travelling bars, attached to a conveyor chain. Each style of part has a certain shaped hook, and these have been arranged to allow enough space between the hanging parts to prevent rubbing and allow clear flow of the enamel. The conveyor chain operating the movements of parts, moves



View showing plants of General Motors of Canada at Oshawa.

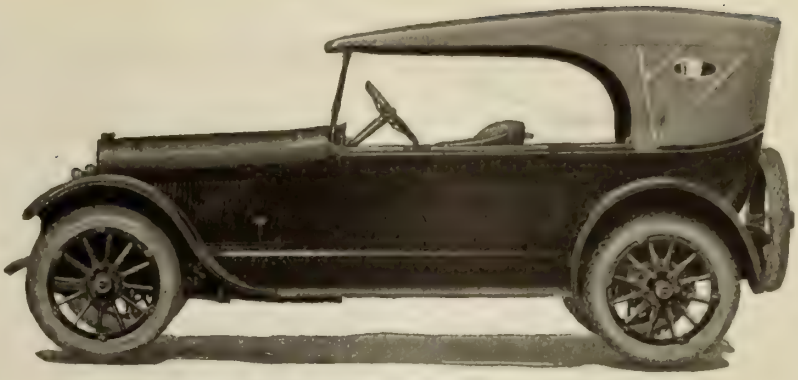
at the rate of 18 inches per minute, and there is 510 ft. of chain.

The pieces now dip down slowly into the first enamelling tank, rise slowly, allowing ample time for dripping. They pass up through a drying oven down into the second tank, up into another drying oven and repeat this performance at the third tank, coming out at the end of the line with a three coat finish of black enamel. From the time the parts pass through the washing machine until they reach the end of their enamel journey, only 2½ hrs. have elapsed.

The heat of the ovens is electrically controlled, and in order to safeguard against fire special precautions have been taken, including a Foamite installation. Even should a fire occur, it should be out in 20 seconds according to the methods of smothering flames employed. However, should the one method fail to function, they have another system of automatically emptying the enamelling tanks into outside storage tanks that would be sure to prevent serious damage.

To show the care taken to enamel their product correctly, here are a few features regarding the installation. The air in the ovens is changed every four minutes, and dipping tanks are cleaned out periodically, and all the air used is washed before entering the drying tunnels. Every morning, a workman goes over each bar on the conveyor chain, removing all dust and enamel which may be there. He uses a certain type of tallow on the rag, this preventing the dipping hooks from sticking to the bars. Every bearing on the conveyor chain is automatically oiled, and throughout the entire enamelling plant cleanliness is demanded, otherwise the workman must leave.

It is surprising to see how neat everything is, in a building where practically nothing but oils, paints and enamels are used. An idea of a month's requirements in this building are worth studying. Here are a few items. 310 gallons of cleaner, 283 gallons coal oil, 254 gallons reducer, 520 gallons rubber coat, and 1101 gallons of fender finish.



General View of New McLaughlin Special.

The enamelling ovens used for certain models of bodies in another part of the plant are very efficient. In this case the pieces pass through three horizontal ovens, and a slow moving chain carries them along. By the time the three coats have dried, a smooth hard finish has been secured. As the process is similar to the other enamelling, we will leave the matter at this point to consider briefly how other bodies are finished. Where an enamel finish is not desired, these have to be done by hand. Colors vary considerably, especially in work for export. The usual washing and rubbing down decks are employed, and as the process is covered in another article in this issue we will pass on to the car top.

Making the Top

Here again we find that a frame work is used to work from, and although a top looks a complex unit when completed, it becomes a simple operation when handled on a production basis. The operator could almost assemble it in his sleep. First come the bows and sockets, then the pads, stringers, back curtains, deck, front and back, then the finishing of the raw edge.

The Export Building

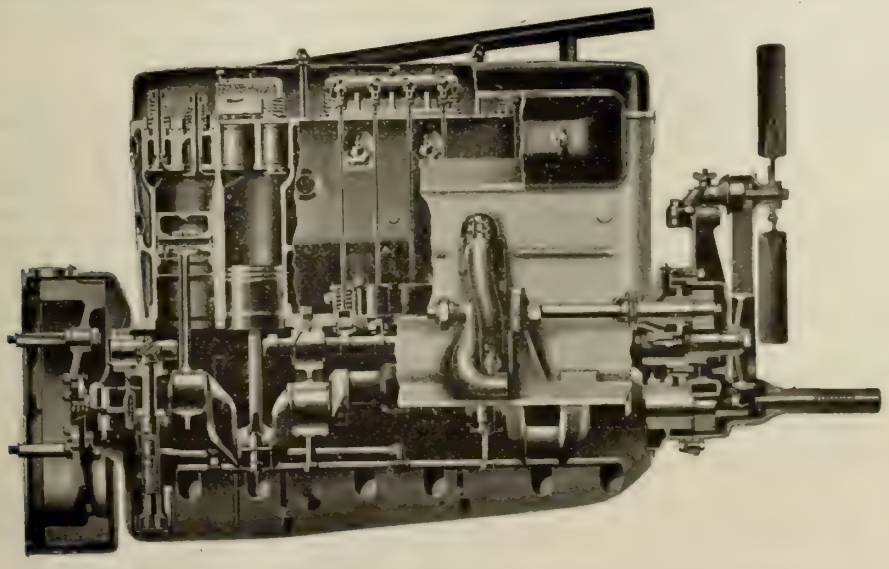
In domestic shipment the matter is fairly simple. If the destination is less than 100 miles, usually the car is driven over the roads, and if more than 100 miles, placed in a box car, and sent forward. Where export business is concerned, it is a very different matter, for in this case the car must be partially disassembled again, and boxed in a very careful manner. The General Motors Co. have made a study of their export trade, and have developed the packing end of it to a fine science.

In the crate making department, are piles and piles of wood cut to proper length. On long flat tables, the men nail the sides or ends of crates as the case may be, and these are forwarded to the main export shipping floor, which really consists of various platforms, in between which are railroad tracks. Huge cranes handle the boxes, but first let us start at the packing. Depending upon the make of car, and its destination, certain packing rules must be observed. Each team of packers know their duties thoroughly, and the man in charge of each team is responsible for the contents of the crate, so naturally he is extremely careful to see that all parts go in.

After being torn down as much as required, the parts are packed and firmly braced in all directions. Every square inch is utilized, and when completed, with the exception of the box cover, the novice wonders how on earth they managed to get so many parts into so small a crate.

This general story may not be absolutely similar for all cars, but in the main the process is the same, so that it is sufficient for the purpose of showing the present activities at Oshawa. The photographs scattered through the article show clearly some of the various operations and as the underlines are self explanatory, we will pass on to the Walkerville plant where the engines and several other parts are made for the cars built at Oshawa. The plant in Oshawa also has a machine shop where miscellaneous pieces are machined. Following is a list of executives responsible for the production of the various models:

President, Mr. R. S. McLaughlin; vice-president, Mr. G. W. McLaughlin; purchasing agent, Mr. E. W. Drew; factory manager, Mr. W. A. Coad; chief engineer, Mr. W. H. Moyse; export executive, Mr. J. B. Thomson; sales manager, McLaughlin division, Mr. J. H. Beaton; sales manager, Chevrolet division, Mr. Ross McKinnon; sales manager, Oldsmobile and Oakland Division, Mr. R. D. Kerby; executive in charge of central committee, Mr. C. E. McTavish.



Showing sectional view of McLaughlin-Buick Six Cylinder Valve-in-Head Motor.

Over 30 Models of Motors Made at this Plant

AT THE Walkerville plant, which covers ten acres, 981 are employed. The factory is a veritable mass of machine tools of every description, large and small, and in the case of the smaller tools about 90 per cent. are Canadian-made. In the larger machines however, about 95 per cent. are American-made tools, although these were largely purchased through Canadian dealers, so that in some measure at least Canada received the benefit.

The production secured at this plant is surprising, when it is considered that some 30 models of motors are produced.

That is to say, the same engines are used in some respects, but with certain additions the number of styles reaching thirty. This means that the production line is often broken up just when things are moving nicely, and the time expended in changing the tool equipment is quite a serious item. In spite of this drawback, approximately 3,216 motors are made per month, these being for Chevrolets, Oldsmobiles, McLaughlin cars, and General Motor Co., business.

The success of the plant is largely due to the thought expended in the segregating of the various departments. Once a piston enters its particular section it does not leave until it is a finished article, and when we mention that the piston department is only very small in comparison with the complete plant, it shows at once how well the machines have been arranged. There is absolutely no waste floor space. Every square inch is made to count, and this same arrangement holds true all over the plant.

To discuss at length the many interesting fixtures and operations would take a volume, so we will comment only in a general way, passing quickly from section to section.

On a large Ingersoll horizontal table continuous miller, four McLaughlin crank cases are milled. These are arranged in suitable jigs, so that the top and bottom, together with the gear case ends, and flywheel housing ends, are finished at one time. The crank cases are made of aluminum, and since adopting this method a high production rate has been secured.

To prevent any further breaking up of the production line than is absolutely necessary, the service division is kept as a department by itself. Nothing but outside service parts are completed, and one particular jig used is worthy of special mention. The operation is the reaming out of crank shaft bearings. Previously these were put in a lathe and bored, but it was very slow work. A new idea was adopted, this being a jig which simply held the cap in place as shown at Fig. 1. An air operated drill, with pilot reamer completes the tooling and the sketch shows clearly how the cap is reamed. The production time has been cut in more than four, showing considerable saving in operation cost.

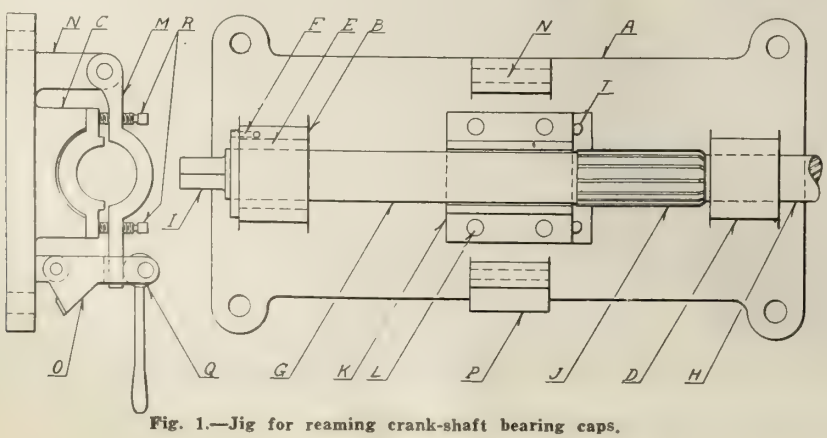


Fig. 1.—Jig for reaming crank-shaft bearing caps.

Making the Piston

In the piston department several special machines of their own design are used to speed up the work and bore the connecting rod pin hole, while automatic lathes complete the regular turning operations. Then there is the cam shaft and crank shaft turning and grinding departments, the connecting rod section, the gear cutting division, the cylinder line, the small part line, etc., all of which are extremely interesting, but which we will not dwell upon.

Balancing Section

A point on which they are extremely careful is the balancing of connecting rods, cam shafts, etc. Each part is balanced, first by itself, and in the case of the connecting rod, this part is also balanced after assembly to the piston. They are set up in jigs, straightened if necessary, weighed and balanced. The flywheels also go through a balancing process on a machine very similar to a vertical boring mill, holes being drilled at different points, until the dial on the balancing machine registers a smooth running flywheel. Another little incident which shows the care taken to make a first-class engine, is that the clutch shifter yoke receives a grind finish, and not merely a turning operation as generally occurs.

DATE _____ PART No _____
QUANTITY _____ **HEAT TREATMENT RECORD** MATERIAL _____
WEIGHT _____ PART NAME _____ ORDER No _____

CARB. & OIL OR WATER QUENCH								ANNEAL-OR DRAW							
LOT No	No OF PIECES	FURNACE No	TEMP ORD	CHARGING DATE	CHARGING TIME	TEMP ACT	DRAWING DATE	DRAWING TIME	LOT No	No OF PIECES	FURNACE No	TEMP ORD	CHARGING DATE	CHARGING TIME	TEMP ACT	DRAWING DATE	DRAWING TIME

AFTER QUENCH					AFTER DRAW				PHYSICAL PROPERTIES				
LOT No	SCLER READING	BRINELL READING DIA	BRINELL READING HARD No	BRINELL READING ULTIMATE EQUIV	SCLER READING	BRINELL READING DIA	BRINELL READING HARD No	BRINELL READING ULTIMATE EQUIV.	ELASTIC LIMIT	ULTIMATE STRENGTH	ELONG IN 2	RED'N OF AREA	

Fig. 2.—Sample record card for heat treating departments.

The assembling of engines is a very interesting process. First the valves and springs are placed in position, then step by step, in go the various parts. After the crank shaft is in place, the main bearings are run in, then disassembled and inspected. From this point on, the connecting rods, pistons, etc., are added, and another test is made. After the engine has proved satisfactory the bearings are again inspected, new gaskets placed in position, and a final test given after the clutch is assembled. Should the result be unsatisfactory, the engine is rejected, and must go through all the tests once more. Regular dynamometer stands are used in the final test, and the engine is subjected to the same conditions it would meet with if on the road.

When the clutch is being assembled to the motor, it is placed in a special jig which guarantees the location being correct. The starting motor is added and the engine must then run with starter motor in position. This guaran-

tees that when the inspector passed it, the starter was working O. K. and should anything occur between here and the assembly factory at Oshawa, it can be traced between these two points. It is very seldom however that anything occurs, and then carelessness is usually the cause.

To guard against wastage of steel, not to speak of poor machining, all tools are ground in one central tool-grinding room. Several tool grinders are used, and everything is sharpened to what has proved best practice.

Axle Department

The drop forgings for the front axles are made across the street at the Dominion Forge and Stamping Co., so the transportation between plants is very easily handled. The milling of forked ends of axles is done on a horizontal axle miller, and all faces are machined simultaneously.

From this point on the steering knuckles are added, with bushes, cones, king bolt, clip, tie rods, etc. In order to make sure that everything is in proper line, a special master jig is slipped down over the assembled axle, and from certain gauge points the workman straightens and adjusts the parts until everything lines up.

The rear axle division is carried on in a very careful manner, and after the various units have been machined and assembled, a test in a noise-proof chamber is made until all parts work smoothly under tests, which the car would experience on the road. To show the extent of work handled by these two axle plants, following are figures of an average month's production. Front axles 4,159; rear axles 1,655.

Heat Treatment

Naturally, the front and rear axles, including gears, etc., require heat treatment. A very well arranged building is used for this work, and Fig. 2 shows a sample record card used to keep tab on the parts passing through this department. Several sets of hot rolls are also included in the equipment, these being used to rough to size the rear axle shafts. Lead baths, and other usual heat treatment equipment are also installed.

Tool Room

To meet in with the requirements of the machine shop a large tool room forms part of the plant equipment. Here are found the usual types of tools including die sinking machines, etc., and the variety of dies and production tools handled in a month is surprising. Back of this department again is the engineering division who design tools and fixtures according to Mr. E. J. Mahar, the general superintendent, who is the power behind the throne so far as production is concerned.

Mr. Mahar does not take stock in efficiency experts. In fact, he says, they had a small army of them around at one time, but now that they have got rid of them things are going not too bad. Every man in the shop seems to know him personally and he has a greeting for everybody. We remarked upon this, especially in such a large plant, and his answer was that this condition was caused through his letting the men feel this was their shop as well as anybody else's, and that he was behind them, always providing of course they did the fair thing. A simple policy no doubt, but it works out to perfection, for we were much impressed with the friendly spirit displayed by all departments.

Reclaim Room

A very important section in this plant is the reclaim department. Should any small part be defective, down it goes to this room, even if the damaged part is only a small portion of an assembled unit. The man in charge is an experienced inspector, and removing the defective piece he replaces it with a new part, tests it, gives the complete part his O. K., and thus salvages what would otherwise be scrap. This room alone saves the factory many thousands of dollars every year. In the same department there is also a man who does nothing else but check up fixtures, castings, etc., this employee being an experienced layout man. He also checks up new patterns, or in case of dispute about poor castings, the old pattern in use at the foundry. By so doing, the firm have a careful check on the castings coming into the plant, and any foreman who believes the castings are not coming to his department correctly, can get this man to check the matter thoroughly.

In conclusion, we comment for a moment on the neat stock rooms which are centralized as much as possible. Everything is binned and tagged, so that the store keeper can tell from his card system the exact amount of material in his room. Nothing is left to chance in the factory, and as Mr. Mahar says, "We are always looking for ideas. Some of the best we have already received, came from the greenest of our men. At least they were green to start with, but once a man shows an inclination to not only advance himself but production as well, then we see that he does not lose out for his aggressiveness."

PARKER MOTOR CAR CO. LOCATE IN MONTREAL

One of the most recent additions to the number of automobile factories in Canada, is that of the Parker Motor Car Co., Ltd., of Montreal, P. Q. The Parker car has been undergoing development tests for the last four years, but only in the autumn of 1921 was active work toward the organization of the company commenced. The president of the company is Brig.-General Sir Alexander Bertram; first vice-president, W. H. Parker, of Montreal, former manager of Chipman (Canada), Ltd.; second vice-president, H. A. Bertram, sec'y-treas. of the Canadian Die Casting Co., Ltd., Montreal; sec'y-treas., Kenneth F. Dewar, industrial councillor, Montreal. The following compose the board of directors: Sir William Price, Frank W. Ross, T. J. Dillon, Thos. Craig, Hon. Rudolph Lemieux, Col. J. A. Scott, and C. F. Doutre.

The first cars produced had built into them all the road-going qualities that are featured in the regular cars although these machines were built for exhibition purposes. The cars were first shown at the Windsor Hotel early this year. A factory has been secured at Longue Point, an eastern suburb of Montreal. The building was originally erected by Messrs. Carron Bros. for the manufacture of farm engines and machinery. It is served with a railway siding from the Canadian National Railways. The plant is all on one floor, the roof being of saw-tooth construction. The Parker Motor Car Co. have 65,000 square feet of floor space. The length of the building is 850 feet.

At present the car is largely an assembled one. The company intends taking on the manufacture of some of the units in the near future. As sales increase, it is planned to undertake manufacturing on a large scale. The car is built mostly in Canada to-day. Up to the first of June only ten cars in excess of the exhibition cars had been built and sold. Another ten cars will be built in June. The manufacturing schedule for the following three months is: one a day in July, two a day in August and three a day in September. Very little machinery for assembling the cars has been installed. Mr. J. A. Wright, the automotive engineer, is paying a great deal of attention to individual assembling and testing, and has not turned his efforts towards quantity work as yet. James Vernon is the assembly foreman, and H. C. Doran is the shop foreman. The second vice-president, Mr. Bertram, in addition to his general executive duties, acts as purchasing agent and mechanical superintendent.

NUMBER OF MOTOR VEHICLES REGISTERED IN CANADA BY PROVINCES, 1914-1921

	1914	1915	1916	1917	1918	1919	1920	1921
Canada	69,598	89,944	123,464	197,799	275,746	341,316	407,064	469,310
Provinces								
Alberta	4,728	5,832	9,516	20,624	29,300	34,000	38,015	38,750
British Columbia	7,628	8,360	9,457	11,645	15,370	22,420	28,000	31,000
Manitoba	7,359	9,225	12,765	17,507	24,012	30,118	36,455	40,430
New Brunswick	1,328	1,900	2,965	2,251	6,434	8,306	11,196	13,564
Nova Scotia	1,324	1,841	3,012	5,350	8,100	10,210	12,450	14,250
Ontario	31,724	42,346	54,375	83,308	114,376	144,804	177,561	206,900
Prince Edward Island	31	34	50	303	639	967	1,419	1,751
Quebec	7,413	10,112	15,335	21,213	26,897	33,547	41,562	59,707
Saskatchewan	8,020	10,225	15,900	32,505	50,531	56,855	60,325	62,958
Yukon Territory	43	69	89	93	87	89	81	

Rapid Increase in Production and Registration

In Seven Years, Registration of Automobiles Has Increased Over 700 Per Cent.—Total Capital Invested Is Very High and Fuel, Wages and Other Miscellaneous Expenses Show Large Figure

HOW MANY automobiles were made in Canada during the past five years? How many firms were engaged in automobile manufacture during this time, and what was the total capital invested? These; and many other questions are of supreme importance, and it is only by careful and detailed investigation that figures can be secured. The Dominion Bureau of Statistics at Ottawa, have since 1917, covered the automobile and allied industries in a very thorough manner and from a huge mass of data, we have selected the following, because of their extreme interest to our readers.

The number of establishments classed as manufacturers of automobiles in Canada in 1917 was 11, in automobile accessories 24, and in repair work 497.

The total capital invested in these industries was $35,780,677, apportioned as follows: in automobiles $28,192,858, in accessories $3,155,893 and in repair shops $4,431,926.

The total salaries paid were respectively $1,376,692 in automobile plants, $266,147 and in plants making accessories and $334,780 in repair shops.

The value of materials used in manufacturing and repair work in each case was, automobiles, $35,585,820, accessories, $3,788,308, and repairs, $1,961,773. The total value of production and repair work for all classes was $66,053,207, of which automobiles amounted to $54,466,273, accessories to $6,495,868 and repairs to $5,091,066. Classified according to purpose, the number of different classes of cars recorded in the census returns was, touring cars 80,544, runabouts 5,502, closed cars 1,165, delivery wagons 1,231, club roadsters 561, trucks 117, and not classified 556, or a total of 89,676 cars.

In 1918, the number of establishments reported under the previous mentioned heads, automobiles 9, automobile accessories 24, and automobile repair shops 673. The capital investment in the whole industry was $36,977,979, classified as automobiles $27,796,303, automobile accessories $3,370,771, and automobile repair shops $5,810,905. Of this total, land buildings and fixtures amounted to $6,880,781, machinery and tools to $5,291,206, materials on hand, stocks in process, etc., to $16,403,940, and cash, accounts and bills receivable to $8,402,052.

Fuel and Miscellaneous Expenses

The outlay for fuel amounted to $347,810, and the miscellaneous items of expense or overhead charges amounted to $8,896,639. The cost of materials used in the industry including those in raw and partially manufactured state was $37,313, 296. The total value of production and repair work for all classes amounted to $72,286,040. The number of cars of each class was as follows: touring cars 61,258, closed cars 1,502, open runabouts 3,750, chassis 5,286 trucks and delivery waggons 2,515, others 66, or a total of 74,379 cars.

In 1919, the various provinces were considered by themselves and following is the way the figures shaped up:

Provinces	Automobiles	Auto Accessories	Auto Repairs
Alta.	0	2	96
Brit. Colum.	0	6	78
Manitoba	0	3	81
New Bruns.	0	0	84
Nova Scotia	0	0	49
Ontario	11	26	600
P. E. Isl.	0	0	2
Quebec	0	3	162
Sask.	0	2	134
Canada Totals	11	42	1,236

The amount of invested capital was also sub-divided for each section of the industry, but it is sufficient in our case to give the total which was $56,943,018, this covering automobile, auto accessory, and auto repair shops.

About 12,139 were employed in this work, with a wage total of $15,389,742. The fuel consumption, including coal, coke, gasoline, fuel oil, wood, gas and other similar fuels, reached quite a total, being $72,683 for Canadian goods, and $430,788 for imported material.

Other miscellaneous expenses such as rent, power insurance, advertising, etc., totalled $8,993,804 in automobile plants, $1,041,215 in accessory plants, and $1,633,216 in auto repair shops.

Cost of Material Used

The cost value of materials used includes freight and duty, and the quickest method is to give the information in table form.

FOR AUTOMOBILES

Steel bars and tubing	$ 1,264,305
Malleable iron and steel castings	2,329,830
Lumber	3,207,308
Bodies	9,851,443
Parts and accessories	11,927,533
Tires	12,388,576
Motor truck parts	4,779,141
Trimmings	2,612,770
All other materials	3,329,809
Total	$51,690,715

FOR AUTOMOBILE ACCESSORIES

Brass and copper tubes, rods and castings	405,549
Steel bar sheet and castings	806,632
Lumber	1,314,839
Malleable and grey iron castings	91,240
Bolts, nuts, rivets, tacks, etc.	589,487
Top materials	1,319,872
Glass and celluloid	313,192
All other materials	1,380,628
Total	$5,221,439

Parts and accessories for repairs totalled another $4,360,810. The selling value of products for the year in all factories already mentioned totalled $101,196,706.

The total number of cars was 87,835 with a valuation of $68,929,820.

Shows Steady Increase

The rapid expansion of the automo-

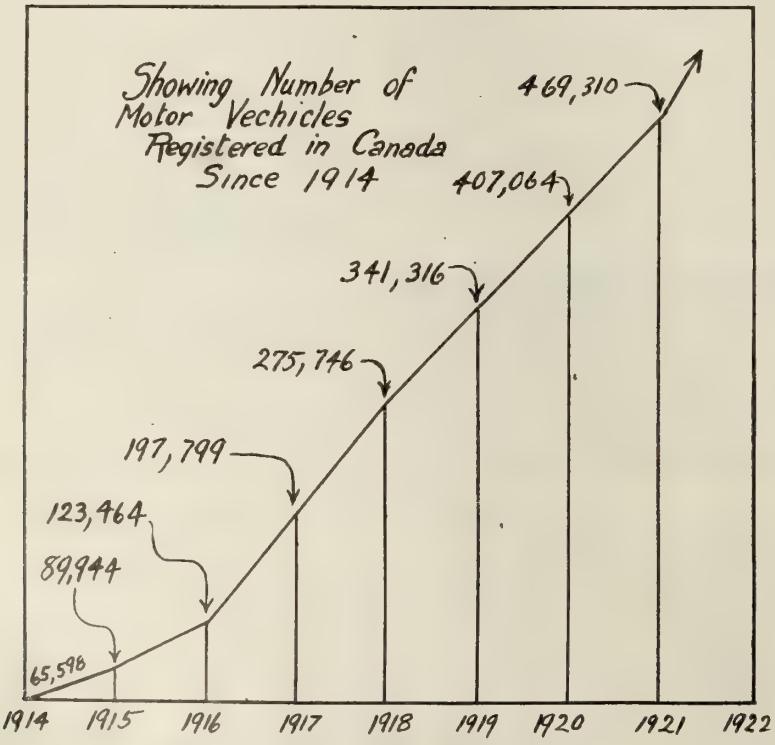


Chart showing motor vehicles registered since 1914.

bile industry continued during 1920. In each of the three branches, considerable development took place, and the total value of production in all classes equalled $137,420,351, or an increase of $36,223,645. This was made up as shown on the following table:

	1919 $	1920 $	Increase over 1919 $
Automobile Manufacturing	80,619,846	101,465,846	20,846,000
Automobile supplies and accessories . .	8,571,890	19,361,882	10,789,992
Automobile repairs	12,004,970	16,592,623	4,587,653
Totals	101,196,706	137,420,351	36,223,645

The number of plants manufacturing cars increased from 11 to 17, in 1920, two being in the province of Quebec, the other fifteen in Ontario. Automobile supply plants increased 20 over the 1919 total, 14 additional factories coming to Ontario. The investment in capital for 1920 was $53,906,506, an increase of $18,956,767 over 1919.

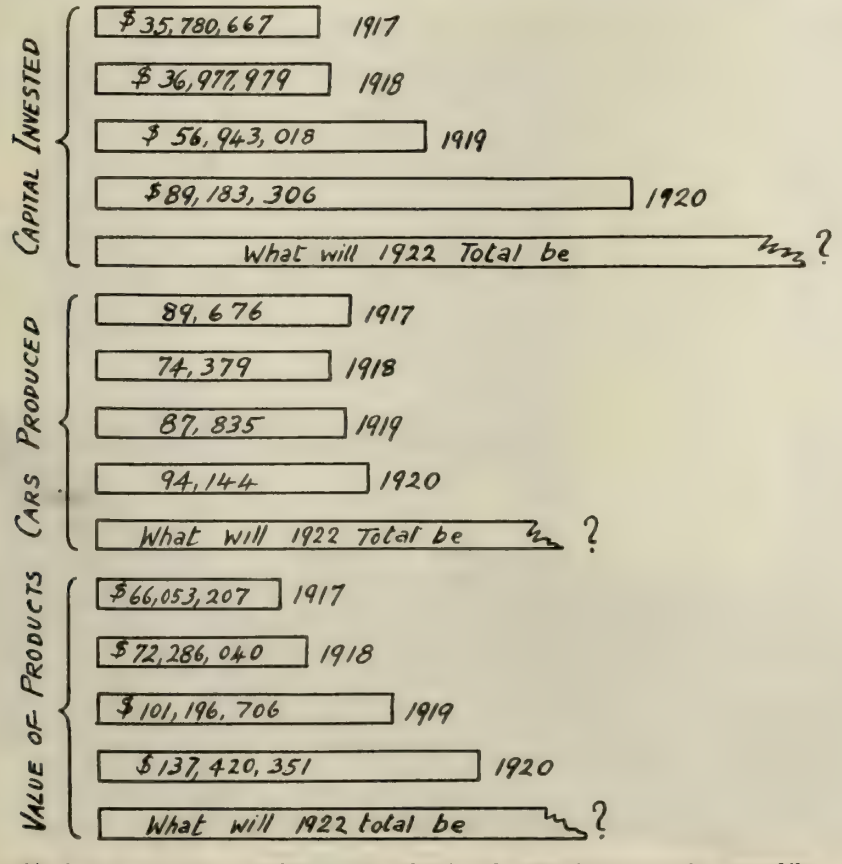
In salaries and wages the total was $13,331,084, an increase of $3,618,296. The total cost of materials used in the automobile industry during 1920 was $84,432,444, an increase of nearly $24,000,000 over 1919. The total value of production jumped to $137,420,351. Pneumatic casings, tubes, and solid rubber tires manufactured in Canada during 1920, were valued at $40,177,119.

The rapid increase in the use of automobiles has shown up plainly in the registration figures, for between 1914 and 1921, following is the increase: In 1914, 69,598 cars were registered. In 1921, 469,310 automobiles were accounted for, of course many of this total were imported cars. The number of automobiles produced, including pleasure cars, and commercial trucks was 94,144.

All figures given are based on the years ending Dec. 31, so that the final report for year ending Dec. 31, 1921, is not yet in complete form. However, sufficient has been shown to illustrate the development of this most important industry to Canada. To compare 1920 with proposed 1922 production, simply glance over the various articles in this issue. The Ford Company alone expects to turn out 55,000 cars, so that when you add the lot together, a very satisfactory total is secured. With improved machinery and better manufacturing methods the automotive industry has advanced rapidly, and the future is still bright for further development.

On May 24th in 16¾ hours between dawn and dusk at the English track called "Brooklands" an Aston Martin motor car, driven in turn by three drivers, covered 1,275 miles, an average of 76 miles an hour.

A total of 23,997 automobile licenses have been issued in the Province of Quebec from March 1 to May 15, as compared with 17,000 for the same period last year, according to a report of the Provincial Treasurer's Department. According to officials there has been less speeding recorded on highways and generally more prudence on the part of car owners and chauffeurs, resulting in a considerable decrease in the number of accidents compared with previous years.



This chart shows value of products, cars produced, and capital invested in the automobile industry in Canada.

SPECIALIZE ON AUTOMOBILE PARTS, SHEET METAL OR STEEL

TO describe the size and varied activities of Pedlars Ltd., at Oshawa, Ont., in a brief article of this nature is extremely difficult. As the present issue is chiefly devoted to the automobile industry, we will touch only on the automotive work being completed at this plant leaving a description of the many other lines manufactured for some future occasion.

A word or two regarding the plant itself. Of the latest design, every modern improvement has been incorporated. Each portion of the factory is well supplied with light and the equipment has been arranged according to a previous well thought out plan. All the heavier presses are placed down one side of the main floor, the other miscellaneous tools being arranged according to departments.

In the heavy stamping section of the plant, we find enormous toggle presses, capable of drawing out such heavy stampings as transmission cases, fenders, etc. The assortment of dies used, would open the eyes of the average mechanic. Apart from their size, they show clever design and painstaking experiment, before present production was obtained. Only the best drawing steel can be used in the construction of these fenders, etc., for otherwise the parts would crack when being drawn and become useless.

Over on the other side of the floor we find peening hammers which remove any slight dent or mark in the products being made, and in this portion of factory are also found the smaller presses and other metal working tools.

Up on a gallery floor, certain parts of the fender are made, also gasoline tanks, mufflers, etc. Considerable spot welding is done in the making of fenders, this work being completed on specially constructed forms.

In the making of gasoline tanks, both, round and rectangular, the main body is first formed and shaped, soldered, then the heads soldered in. Every operation is in sequence, with the result that there is practically no lost motion.

When making mufflers, the same careful method of planning operation is followed out. In fact Mr. Murphy, the superintendent of entire plant, rather prides himself on this feature of all departments. Each man has his own particular duties to perform and although not what could be termed an all round tinsmith, he becomes a specialist in one operation, which is really what is needed in a plant of this kind.

Leaving the manufacturing end, and coming to the shipping room we find ideal arrangements here as well. Careful check on all parts going out and coming in is made, not only for quantity, but quality. If a piece shows a defect, that is, should the defect occur between the

(Continued on page 68)

Durant "Star" Will be Made at Leaside Plant

Toronto Factory Now Operating at Capacity of Over 700 Cars Per Month—General Features of Present Models—New Car To Be Constructed On Slightly Modified Design

DURING the short period of activity at the Leaside, Ont., plant of the Durant Motors, since the inception of the Canadian company, rapid progress has been made in organizing the plant for quantity production. With the exception of the coverings for the upholstering and cab, and a few minor details, no attempt has been made here to manufacture any part of the car, and the work at present is almost exclusively confined to the assembling of the Durant Four and Durant Six in various models. About 350 hands are now employed and the output has reached 30 cars per day. Some general idea of the car may be had from the following description, of the model B-22:

The motor is of Austed design with specially constructed overhead type of valve, fully incased. Pistons have a stroke of 4½in. in a bore of 3¼in. The motor will develop 70 h. p. when operating at 3,000 r. p. m. All bearings are automatically lubricated. The flow of gasoline is controlled by the Stewart Vacuum system to the carburetor, from a 16-gal. tank at rear of car. The radiator is of the cellular type, the water being circulated by a large capacity impeller-type pump.

Worm wheel steering gear is used with an 18in. wheel of walnut and aluminum centre. Ignition is obtained by Auto-Lite Igniter, driven by helical gears from the cam shaft. Starting motor acts on flywheel through Bendix drive.

A feature of the frame construction is the tubular backbone rigidly secured between the two cross members of the chassis. The incorporation of this member, which also serves as an exhaust muffler, adds considerably to the stability of the car, preventing distortion of the chassis frame and virtually eliminating all possibility of racking and squeaking of the body.

Timken front and rear axles are applied, the former being a drop nickel steel drop forging of I-beam design. The rear axle is semi-floating with pressed steel housing and driving through spiral bevel gears. Sliding gear transmission is used, with 3 forward and reverse speeds. This is mounted as an independent unit. Brakes on the rear wheels are 14in. dia. with 2in. bands and are external contracting and internal expanding. Both front and rear springs are semi-elliptical and made of specially treated steel. Spring eyes are fitted with bronze bushings.

The steel portions of the body are made from 22 gauge stock. These parts are imported from the States and subjected to a pickling and cleaning process to prepare them for the various coatings of filler, paint and varnishes. The original coating on the sheet steel parts contains a certain percentage of rubber to provide an adhesive surface for the succeeding coats. During the entire finishing process careful attention is given to the temperature of the different drying ovens and likewise the rooms in which the bodies or cars are left to dry. In regulating the temperature of the different ovens allowance is even made for atmospheric conditions as these will materially affect the coated surface. The flow method is used for the final varnishing of the car body, after which it is placed in a large dark room for the last drying; this usually being for a period of two days. No unnecessary traffic is allowed in this room so that the mirror finish will not be affected by the presence of dust particles.

The upholstering is of genuine hand buffed leather over extra grade curled hair. This work is all carried out at the plant as every piece is fitted separately.

The New "Star"

For several months the engineers and designers have been engaged on the plans and specifications of the five-passenger car that will be placed on the market at an approximate cost of $620. Owing to the unavoidable delay in getting started on the new building it is anticipated that this new car will not be available for some time. The addition under consideration for the construction of the "Star" will be a three-storey steel and concrete building 600 ft. by about 200, fully equipped for mass production. In connection with this new development it was stated that a separate plant will be erected by the Autolite Company for manufacturing the electrical accessories used in the Durant cars.

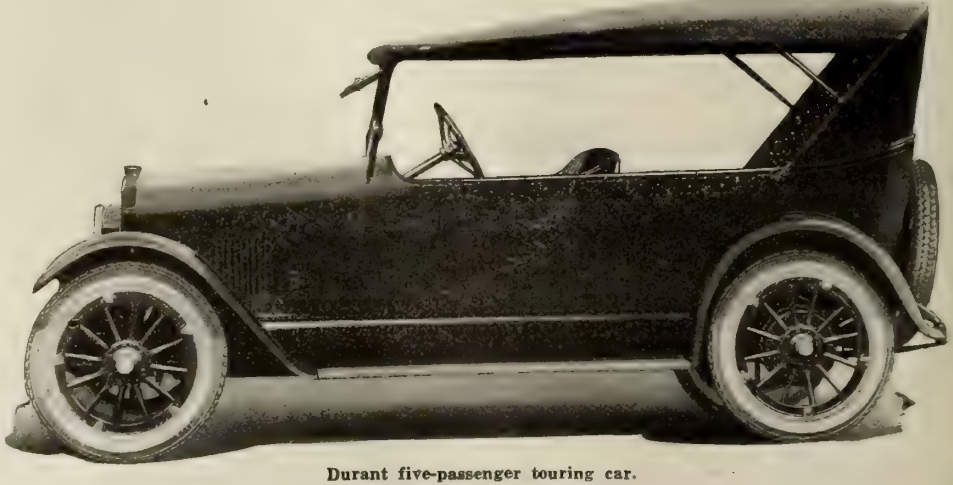
The general design of this car will be on the lines of those now made by Durant, incorporating all the improvements used on the other models. Continental engines will be used but with a slightly altered drive. The initial effort will be an assembly proposition with all parts specially made for this particular car. The piston displacement will be 152.1in. and the engine will develop 35 h. p. at 2,500 r. p. m. The inlet and exhaust manifolds are made with one common wall which serves as a hot spot to facilitate vaporization of fuel; carburetor is Tillotson type.

A combination pressure and splash system of oiling is used, the oil passing under pressure through the hollow cam shaft to the main bearings. The clutch is of the single plate type and similar in design to those used on other Durant cars. The rear axle will be Timken conventional semi-floating banjo type, fitted with spiral bevel gear giving a reduction of 4⅞ to 1. Ten-inch brake drums are fitted to rear wheels with internal brakes and external foot brakes.

A special feature of the Durant cars is the accessibility to all parts of the mechanism as in the majority of cases all parts requiring adjustment or possible repair are arranged so that operators can make changes without disturbing any adjacent parts of the machine.

IMPORTS INTO CANADA

During 1918, 16,118 passenger automobiles were imported into Canada. Following are the figures up to 1921; 1919—6,475, 1920—10,805, 1921—5,907 Trucks showed up as follows:—1918—964, 1919—1,744, 1920—2,274, and 1921—1,706.



Durant five-passenger touring car.

Business Founded Over *Three* Generations Ago

Plant had its beginning in blacksmith's shop—Production of cars now reaches 7,500 a year and factory has capacity for 15,000 should demand increase.



Manufacturing division No. 3 which is located at center of city

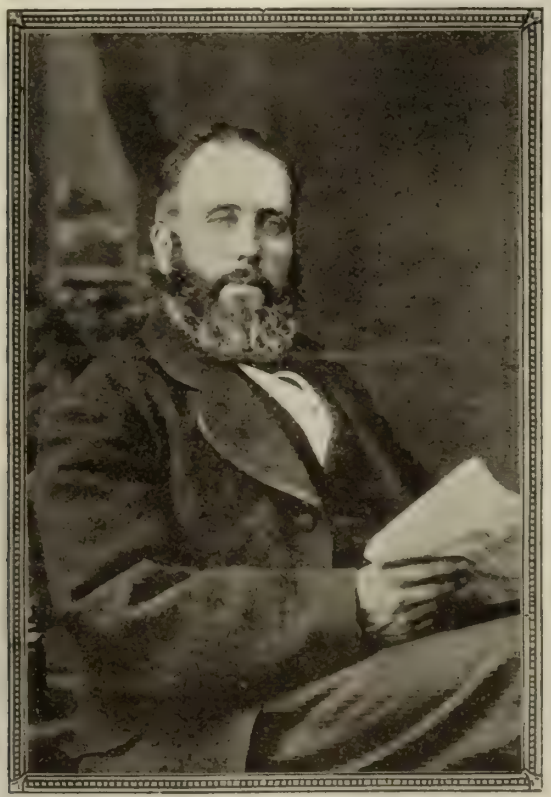
TO APPRECIATE fully the advancement which has taken place in the plant of the Gray Dort Motors, Ltd., Chatham, Ont. one must go back three generations, to the time before the railways spread their network of lines over the country, to the days when two million people lived in Canada. It was in these days, fourteen years before Confederation, that the Gray Dort organization had its beginning.

In 1853, William Gray came from Scotland and settled in what is now the city of Chatham. Here he opened a small blacksmith's shop to make vehicles. In less than seventy years the blacksmith's forge has developed into a gigantic automobile industry with a plant valued at $1,500,000 and a floor space of 400,000 sq. ft.

In 1883 William Gray was unfortunately injured in a railway accident, and after his death, his son Robert took over the responsibility although only 21 years of age. By hard work and close application, coupled with natural ability, the company developed, and in 1898 became a limited concern. Up to 1915, wagons, carriages and sleighs, had been the standard products, but in 1915 the decision to build automobiles was arrived at. Where people had been purchasing buggies, now they wanted automobiles, so it was decided to embody and add to their modern manufacturing methods, making possible a car at a reasonable price.

For two years Mr. Robert Gray had been studying the automobile industry in the States, and in 1915 he became allied with J. D. Dort of Flint, Mich., who, like the Grays, had been making and selling buggies. This briefly was the start of the present plant which has employed as high as 800 men, and produces some 7.500 automobiles per year. The plant however has a capacity 15,000, should the demand increase to that point.

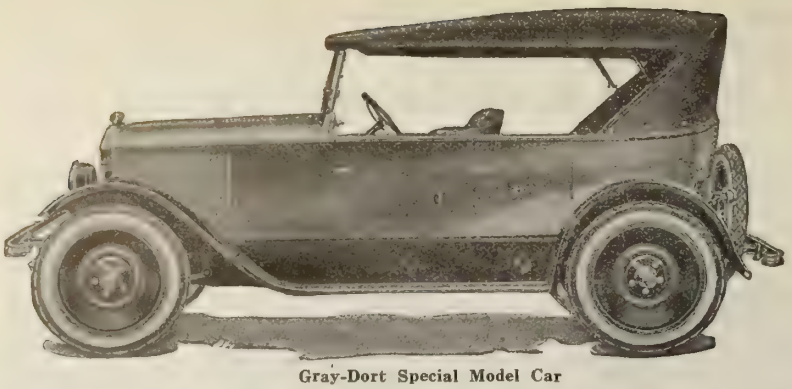
Both Robert and his son William M.



Wm. Gray the founder of the business. He started as a blacksmith, but soon blazed the trail in the automotive industry.



Robert Gray, president and general manager. The business end of the organization receives his closest attention.



Gray-Dort Special Model Car

Gray are men worth meeting. They have grown up with the business, know every angle of it, and are keenly interested not only in the plant itself, but in the welfare of their workers and the civic life of Chatham, generally. However, as it is the mechanical phase of this industry we are chiefly interested in, we will pass on to the making of the car.

First, we find that practically all parts are made in Canada, with very few exceptions, where the parts cannot be obtained. For example, the springs, axles, tire carriers, top bows, transmissions, radiators, tires, trimming, gasoline tanks batteries, and many other parts are all made in Canada.

The complete plant consists of three separate factories. In the main building the cars are assembled and tested, and the machine shop, paint department, and enamel plant are also located in this building. In another factory the bodies are built, while in the third plant all sheet metal parts such as engine hoods, fenders, side apron, etc., are completed.

In the latter mentioned factory we find a full complement of sheet metal machinery, including presses, shears, trimmers, benders, and expensive dies. The routine of the operations is carefully watched the result being that the quality of work produced is very high. In the machine shop in the other factory miscellaneous parts are drilled, milled, etc., and in every case a jig is used in order to secure interchangeability.

The wood working department is exceedingly interesting. Again we realize the value of jigs and forms, for all parts are kept standard by this means. The door frames which are made of maple, are cut to shape very quickly, because they are placed in forms, and the operator does not need to worry about the shape. He knows they must come right. This same condition holds good all through the department. Nothing is left to chance. Several bending machines are used in this section, and the usual process of steaming the parts to be bent is followed out. After bending, they are locked in their forms, and placed in the dry kiln until thoroughly seasoned to shape.

Body Building

The experience gained in carriage building stood this firm in good stead when they went into the making of automobiles. They have a master form for each body and into this is gradually assembled the wooden framework. Next comes the placing of sheet steel over the wood, to be followed later with the trimming, or upholstery.



W. M. Gray, vice-president and assistant general manager of plant. He specializes on production.

The metalling, in other words, the attaching of sheet steel to the body, also the doors, is accomplished on suitably shaped stands. When assembling the woodwork, adding the metal to bodies, also upholstering, the men work in teams. The body during assembly passes along in one direction so that it is a steady and progressive movement. The greatest care is taken in all these steps, and after each operation, the body is inspected by the man in charge of team in order to make sure everything is O K.

Painting the Car

This firm is exceptionally particular about the finish of their car. The smaller parts such as fenders, hoods, etc., are enameled and baked, but on the body itself hand painting is carried out. Special trucks are made to support the bodies while they are being painted, and fortunately they are well supplied with floor space for drying purposes. In order that the process of painting will be clearly understood, we give the method in detail.

First the wooden part of the body receives a wood priming coat, and is allowed to stand until dry. The metal part is next washed and cleaned, several different cleaning mediums being used. A metal prime is now applied and usually the body is allowed to stand four days until thoroughly dry. The next step is slushing after which the body is puttied. After standing a day the next operation is sanding down. Leading comes next in order, then oil rubbing. Color varnish coats are next applied, two or three being put on according to conditions, and of course drying time is allowed between each coat. They are again rubbed down on the rubbing deck, then a finish coat is applied. The Flocote brush is used in all cases with the exception of the wood priming coat, and when being painted, the bodies are mounted on special stands with suitable troughs surrounding them.

Standard colors are generally applied, but on special models a different finish is made, although the steps are practically similar. The chief point of interest is the care taken throughout every step. On the rubbing down deck, the men keep at it with pumice stone, water and the rubbing swab, and until every gritty spot is removed, nothing is considered O. K. The training obtained in the carriage making days is too deeply ingrained to allow them to rush a body through with undue haste. Production is very essential and they secure it, but not at the expense of the body finish.

(Continued on page 74)



Here we see what is known as manufacturing Division No. 1.

Modern Factory Produces Many Cars

WITH A plant valued at $350,000, the Studebaker Corporation of Canada, Walkerville, Ontario, produced 3,069 cars during 1921. The work is practically assembly, painting, and testing, but 200 are employed on this work. The factory is well arranged, and briefly here is the procedure.

The frames come from the United States in their raw state but are rivetted at the Canadian plant. The springs come from the Dowsley Spring & Axle Co., Chatham, so that this part brings Canada a revenue. After chassis is assembled it is painted in the usual manner by air gun, and when dry, the assembly line begins.

The sequence of operations when assembling any automobile are very similar, but special mention can be made regarding the arrangement of storing various parts entering the car. This has been carefully thought out, and every part is handy to the workman assembling his particular portion. When the time comes for the tires and wheels to go on the chassis, they come down a chute from the floor above and meet the assembly line at the desired point. The tires have all been inflated, and are ready to place on the chassis before passing down this chute.

The radiators are made in Walkerville by the McCoy Co., and the tops are also made by two Canadian concerns. The motor comes from their Detroit plant, also several other parts going into the finished car. Wherever possible they purchase parts in Canada, and the Canadian percentage would run about 30 per cent. or more of the finished car.

The other operations entailed are similar to what has already been explained in other articles in this issue, but the following figures will be of interest. The total floor space occupied is 120,000 sq. ft., and the average monthly pay roll is about $12,000. The organization is well balanced, and upon completion of a car, so far as assembly is concerned, an exacting road test is gone through before a car is finally passed. The factory is modern in every respect and very handy to the railroad, as can be noted from the illustration of their Walkerville plant. This is called plant seven, as they have several other factories on the other side of the line.

The Canadian company is under the control of the parent corporation, and the officials are as follows: Mr. A. R. Erskine, president, Mr. M. F. Wollering, vice-president, manufacturing, Mr. L. J. Ollier, vice-president, sales, Mr. N. R. Feltes, treasurer, and Mr. J. E. Spence, secretary.

The immediate direction of the Canadian company is under Mr. W. G. Palmer, sales manager; Mr. E. B. Mackie, production manager, and Mr. A. F. Fuerth, assistant treasurer.

EDMONTON ACTIVITIES

"IT IS RATHER DIFFICULT to secure complete information showing the extent to which firms in this locality are working on automobile work," says John Blue, secretary of the Edmonton, Alberta, Board of Trade. "Two or three of the firms are well equipped and organized to give pretty fair data," he continues, "but there are several others that scarcely know what they are doing in this business. They are running the repairing of automobiles and manufacture of auto parts in connection with other work, and find it impossible to separate the one from the other in order to give satisfactory statistics.

"I find that we have six firms in Edmonton employing altogether about eighty men. They are as follows: Imperial Brass and Iron Foundry, manufacturing pistons, cylinders, fittings for tops, wrist pins, bearings, etc. They employ about twenty men and have about $50,000 invested, turning over about $6,000 a month.

"Edmonton Auto Springs make and mend springs, producing about one hundred springs a week. As I understand it, they import the steel and make the springs here. Wm. Fane, with an investment of about $20,000, employs about fifteen hands. He manufactures truck bodies, tops, auto wheels and, in fact, does any wood-work in connection with a motor car. He reports a growing business, with more than he can do. He expects to do $40,000 worth of business this year.

"Masse Electric Co. manufacture batteries. They have a plant worth about $10,000, employ six hands and expect to manufacture six hundred batteries this year.

"The Edmonton Auto and Carriage Co. manufacture tops and bodies for cars. They employ about eight hands, and do about $2,000 worth of business per month. A particularly flourishing industry is managed by Nichols Bros. They are founders, but manufacture bearings, pistons, piston rings, bushings and housings and also do any repair work on a motor car. They have an investment of about $60,000 and employ about eighteen hands. Of course there are a large number of carriage and auto repair shops, but I have found it very unsatisfactory to get information from them.

"According to a return prepared by the Bureau of Statistics very recently, capital invested in plants for automobile repairs in the Province of Alberta is estimated at $2,710,464, in 315 establishments; the wages paid in these establishments is $603,000, and cost of materials $945,897. On making a calculation of these for Edmonton, I think it would be safe to take between 33 and 35 per cent. as representing Edmonton's share of these statistics."

BRANTFORD ACTIVITIES

THERE ARE THREE CONCERNS in Brantford, Ont., who manufacture parts for automobiles, according to W. H. Wood, manager of the Brantford Chamber of Commerce. They are as follows:—The Brantford Carriage Co., which manufactures bodies; the Brantford Machine & Tool Co., which makes jacks and H. V. Morris & Co., who manufacture a tire boot.

The Brantford Machine & Tool Co. employ about nine men. The extent of business handled each year is approximately $18,000. The value of their equipment is about $15,000.



General view of Studebaker plant at Walkerville, Ont.

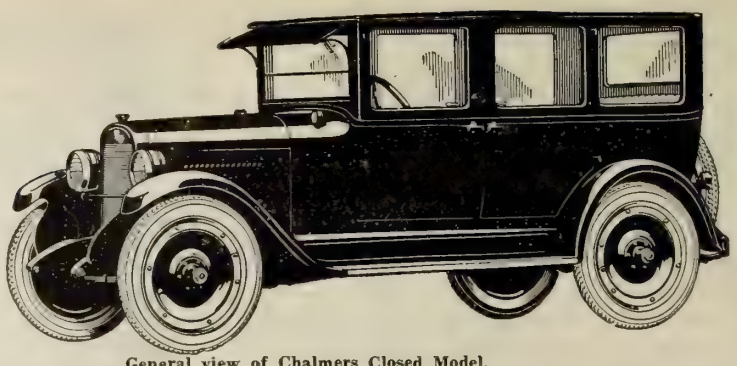
THIRTY CARS A DAY AT CHALMERS MOTOR

WITH A normal producing capacity of thirty cars per day, the Chalmers Motor Company of Canada, Windsor, Ontario, are busily engaged assembling their various types of automobiles. They have a modern plant in every respect which is well arranged and is 300 by 50 ft., two stories high. While the work is principally assembly, a good percentage of material used in making the car is purchased in Canada.

The material for Chassis frame is purchased outside, but assembled at the plant in the usual manner. It is then painted by the air-gun process, and after drying starts on the assembly line. The axles, motor wheels, gasoline tank, cowl, etc., are added in proper sequence, the body dropping down on the completed chassis, at the proper stage of the assembly.

After completion, every car is given a running test on grooved wheels set in the floor, these being driven by a motor in regular manner. The rear wheels of car are placed on the grooved test wheels, and rear axle undergoes an actual test while on the floor. Once the axle has proved to be running quiet, the road inspector takes the car out for a test drive. Every part is carefully inspected, and of course during the assembly stages, periodical inspections are given.

The bodies come into the factory in a finished condition, with the exception of the final varnish coat. This is applied in the usual manner at the Windsor plant. The motor used in the car comes from their Dayton, Ohio, plant and is thoroughly tested before shipment.



General view of Chalmers Closed Model.

SHERBROOKE ACTIVITIES

SHERBROOKE, Que. Speaking about the automobile industry in Sherbrooke, J. H. Brosseau, secretary-treasurer of the Board of Trade, remarks as follows:—

The Canadian Connecticut Cotton Mills, manufacturers of cotton tire fabric, when fully equipped will represent an investment of $5,000,000. In 1920 this concern did a business of $7,250,000, and had on the pay roll 950 employees. At the present time the number of employees is 600. They are doing a business for the year of about $5,000,000. The prospects for this industry are looking brighter for the future. This is the largest cotton tire fabric factory in Canada. The maximum number of employees will be 2,000 hands.

The Pressure Proof Rings Ltd., are manufacturers of piston rings for automobiles, launches and tractors. They also manufacture pressure proof aligning gauge, etc. This plant represents an investment of $30,000. The total amount of production for the year 1921 was about $40,000, and gave employment to 15. The prospects for 1922 are very encouraging.

The Panther Rubber Company Ltd. make rubber goods, moulded goods and sundries, such as automobile rubber mats, etc. This concern represents an investment of $300,000, but the automobile accessories amount to about $20,000 per year. The prospects are much brighter, and they are employing at the present time 75 hands and running full time.

There is also the Red Arrow Tire Ltd., of Quebec, which is a new concern, with the plant ready to start manufacturing rubber tires. This plant should do a business of about $300,000 per year and give employment to about 50 hands.

WINNIPEG ACTIVITIES

"WE FIND THAT THERE is very little manufacturing of automobile parts carried on in Winnipeg. Most of what is manufactured is handled as a side line. It is almost impossible, therefore, to give any idea of the amount invested in the manufacture of these particular products," says J. M. Davidson, of the Winnipeg, Man., Board of Trade.

The Winnipeg Motor Cars Co., mentioned on the following list, is just in the process of organization, and no cars have yet been turned out. The largest single industry assembling cars, is the Ford Co., but we are advised that none of the parts are manufactured here. Following are firms interested in the automobile industry in Winnipeg:

Bodies: Western Truck Bodies Co., Hulse Mfg. Co., Auto Body Works, Lawrie Wagon and Carriage Co.

Radiators: Hulse Mfg. Co., Rolfe Radiator Co., May Radiators, Ltd., Winnipeg Auto Radiators Co., Guarantee Sheet Metal & Roofing Co.

Tops and trimmings: Winnipeg Top and Trimming Co., O. E. Wood, J. Murray & Co.

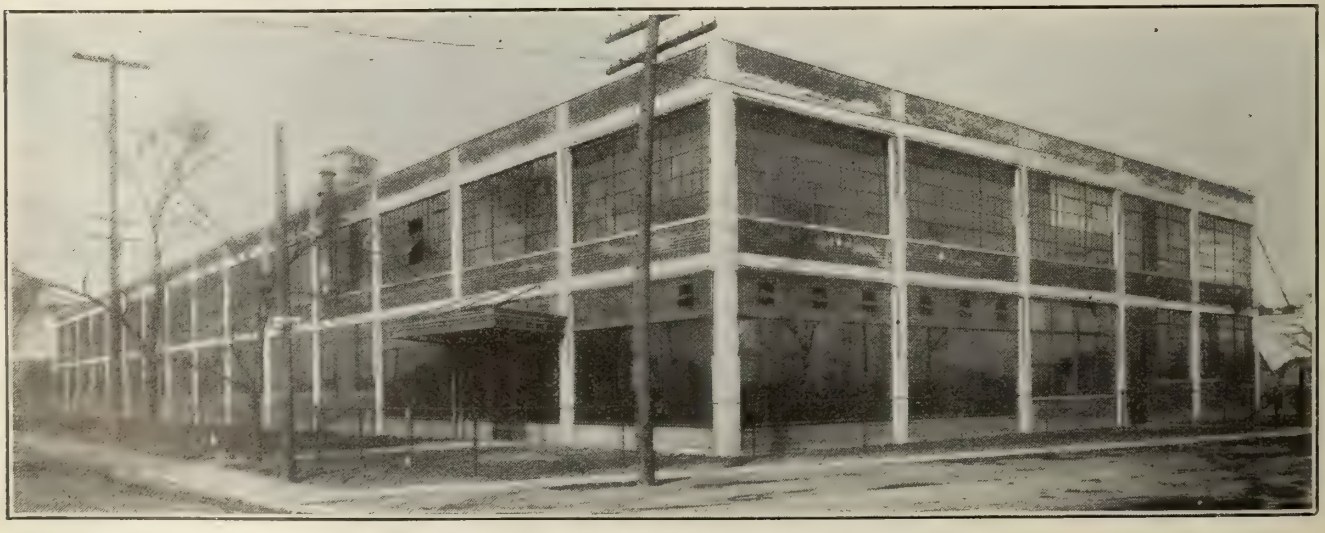
Steering Devices: "Made-in-Canada" Steering Device Co.

Tire Boots: Porcupine Sale Corporation.

Signals: Universal Auto Signal Co.

Automobiles: Winnipeg Motor Car Co.

Batteries: Canada Dry Cells, Burgess Batteries.



General view of the Chalmers Plant, Windsor, Ontario.

Rigid Inspection One of Rules at this Plant

Parts Purchased From Outside Sources Are Tested Before Leaving Place of Manufacture—Further Test Given At Hamilton Factory—Jigs and Fixtures Are Extensively Used

AT THE National Steel Car Corporation, Hamilton, Ont., they have a truck making plant of which they are justly proud. As far as possible, parts are made in Canada, but like many other firms engaged on automotive work, they use American units, their production rate being too low to allow them to specialize in the making of all parts going into the truck.

However, although they find it impossible to manufacture all parts, they see to it that all purchased material passes rigid inspection. For example, the motors have to pass an S. A. E. test before leaving the factory in the States. This includes a curve sheet showing the performance of the motor under load. When a shipment of engines are about to be sent, some competent man from the National Steel plant goes down to the engine factory and witnesses the tests. This means they are sure of the quality of the motor.

The same close check is taken of all other imported parts, and although someone may not be visiting the supply plants at all times, tests are made in the home factory to make sure the quality is there. In addition to this, the American factories have their own inspection systems, etc.

No attempt will be made to discuss the source of supplies, nor will we enter details regarding the makes of the carburetor, transmission, etc., for this can all be secured from the regular specifications. Enough to state the axle is worm driven, carefully designed, and that all steels entering into their construction are tested for strength, a maximum factor of safety being allowed.

When designing the truck, the engineering department figured each unit carefully, and until all parts were made of ample strength, work on the truck was not commenced. The wisdom of this move has proved itself by the confidence displayed by the engineers in the finished article.

Improvements are always being considered, and while we were there, the engineers were installing additional comfort for the driver. In fact, this is one of their strong beliefs, that the driver of a truck can tell of its value, and for this reson they use the slogan, "Ask the driver—he knows."

The springs used on the truck have an elastic limit exceeding 190,000 pounds per sq. inch, with ten per cent. elongation. The shackles are made of drop forgings instead of cast steel or malleable iron, the type used being considered much stronger. The gear ratios vary, three being provided for 1 and 1½ ton trucks, four for the 2, 3½ and 5 ton vehicles. The road speed with governed motor is, 1 ton, 32 miles per hour, 1½-19, 2-15, 3½-13 and 5-12.

The capacities of trucks range from one to five tons and the equipment, such as body, etc., depend upon what the vehicle is going to be used for.

Actual Manufacturing

Leaving the question of imported parts and coming to the work performed at the Hamilton plant, we find that the production methods are well thought out. Everything is arranged in sequence and after the rough castings are received and have been thoroughly inspected, they are sent to the machine shop in lots that will give a certain length of run. This means that the setting up time on jigs, tools and other various fixtures, will be only a small percentage of the actual machining cost.

A jig room is separated from the rest of the machine shop, and all fixtures with their tools are placed in suitable compartments, ready at a moment's notice. All castings are machined in jigs, nothing being left to chance, and particular attention has been given to the design, so that castings can be placed into fixture without preliminary grinding operations.

Should milling be the operation, multiple jigs are adopted in order that a number of parts can be completed at one time. After milling, the finished surfaces are used as gauge points when placing the castings in the drilling jigs.

Figs. 1 and 2 show one of the drill jigs used. This is for steering column and pedal shaft bracket, and in Fig. 1, we see a close up of the part itself and the jig. A taper key holds the casting in place and once it is put in the fixture, all holes shown are drilled before leaving. This is made possible by the unique construction. In Fig. 2, we see the four holes in flanges or fastening base being drilled simultaneously. The other operations are complete on a different single drill press.

The same procedure applies to the drop forgings which are now in their own plant, of which may be mentioned all the different shackles which support the bearing springs. It is very important that these be made drop forgings, as a casting with a blow-hole would be detrimental to the truck.

The pins for the shackles, etc, are machined from hexagon stock on a production basis, heat treated in the forge shop and ground to close limits. Heating of pins, spring clips, etc., is made in the presence of an inspector who makes sure that final structure comes up to specifications. The heat treated parts are scleroscoped to further ensure against poor parts being used.

All material before it is used on the motor truck production floor has to pass an inspection bench in order to make sure nothing but correct material goes into the trucks. Reamed holes for pins, bushings, etc., are gauged with plug gauges, and the pins with snap gauges, with a "go and no-go" limit.



Fig. 1.—Close up view of part to be drilled, also jig for same.



Fig. 2.—Drill jig in actual use.

NATIONAL STEEL CAR CORPORATION LIMITED

MOTOR TRUCK DEPARTMENT INSPECTION REPORT

DATE

PRODUCTION NO	DWG NO	QUANTITY	DESCRIPTION	MACHINED ON PLANT	ROUGH CASTINGS FROM	FINISHED MATERIAL FROM	O K.	REJECTED	REMARKS
P1257	3717	7R5L	Radiator Guard	Machine dept.	Upton Fdy	Blank & Sons Blankville. Ont	25	1	Blow hole caused rejection

INSPECTORS' SIGNATURE

Fig. 3.—Showing style of inspection report used in National Steel Company's plant.

The efficiency of the machine shop has been brought to a point where the amount of material rejected through faulty machining is very small and the motor production floor has practically no trouble in assembling the different parts. The frame parts are drilled to jigs as well as the castings, so that there is seldom any reaming necessary to assemble the castings to the frame. In regard to holes for rivets, they are drilled to size and reamed on the erection floor in order to secure a first class job all through.

Assembly Floor

On the assembly floor, everything is built up step by step, and as far as possible, such assemblies are made at the side of main floor, in order to shorten the time for completing the truck on main erection floor. Having assembled the motor to frame, with all electrical units, body, etc., the truck is taken out on an exhaustive road test. This is continued until the inspector is satisfied that all parts are functioning properly.

M. Blomberg, motor truck engineer, for the National Truck Co., is largely responsible for the data contained in this article as he conducted the writer through the plant.

Mr. Newman, is now sales manager at the Canada Metal Co., Toronto. He comes from Montreal, having considerable experience in this class of work.

Have Well Laid Out Plant in London And Are Working To Full Capacity

WHEN the Ruggles Motor Truck Co. built their factory at London, Ont., they combined modern plant construction with architectural beauty. The office is splendidly designed and creates a decided impression on anyone approaching the factory. Yet it is directly connected with the factory, so that efficiency is not sacrificed for the sake of good looks.

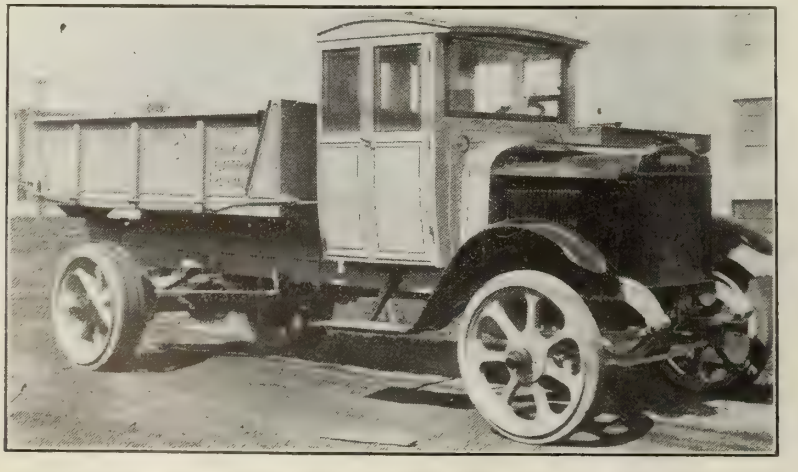
The plant is built in one unit, but is planned with a view to future extensions. The power house is in a separate building, and this is also designed to take care of future requirements.

The actual cash invested is $335,000, and in addition they are carrying inventory and plant machinery to the value of approximately $350,000, so that the total investment is really about $700,000.

The floor space is 40,000 sq. ft. and at present about 150 are employed.

These figures are given by J. Bridge, general manager, and he further states that they are working to full capacity. The average monthly pay-roll in London exceeds $18,000, and on the present basis of production their annual output will exceed 1,000 trucks, composed of four sizes, 1 ton, 2 ton, 2½ ton, and 3½ ton.

The annual turnover of approximately $2,000,000 represents a cash return of Canadian labor and materials of slightly over $800,000.



Showing a popular type of truck built at the London plant.

The plant is very well lighted, and down a portion of one side of the floor is the frame assembling department. The various members are drilled, then riveted by air hammers in the usual manner. On the other side are store rooms where parts are carefully kept in bins. Further on, we follow the regular routine of assembly, parts being added until the truck is completed. After being painted they enter drying ovens, staying there until the paint is properly baked on to the metal.

The Continental motor is used, this being made in Detroit, Mich. In some cases, the Herschell-Spillman motor is placed in truck, these coming from North Tonawanda, N. Y. Bosch high tension magnetos are part of the equipment, also the Brown-Lipe three and four speed transmission, clutch and control. The Clark internal gear drive is adopted as standard practice for the rear axles.

Depending upon the use to which truck has to be put, bodies are made accordingly. They do not make these at the London factory, but have made arrangements whereby any desired style of body can be attached. The photograph accompanying this article shows one style of truck which is very popular.

Following is list of officers at the London plant:—President, F. W. Ruggles; vice-president, A. T. Little, (of Robinson & Little); treasurer, John Pringle, (formerly manager of Bank of Toronto); general manager, John Bridge; sales manager, W. E. Finnegan; purchasing agent, P. A. Manross, and production superintendent, Chas. Austin.

Garage Must be Able to Handle Any Emergency

Motion Pictures Show Operations in Service Garage—Comparing Equipment and Efficiency of Different Establishments—Courtesy an Essential Factor—The Operating Pit

IN A RATHER likeable movie play that has been featuring during the last few weeks, two garages are made the scene of considerable action. It does not seem necessary, of course, that there should be a great deal of equipment in sight in either one.

The general scheme of things seems to call for little else than a gas tank and pump. The garages appeared to be located opposite each other on a prominent road and naturally a price war developed and when the margin of safety had been passed, one of the garages went out of business, temporarily at least, as a strategic move. The expected happened. The remaining garage man cooked his own goose as the result of excessive charges and poor service and when he had become thoroughly disliked by patrons, the other garage re-opened, advertised stability of prices consistent with costs, and courteous, efficient service. They simply drove the other people to the wall.

The point in the play that seems to get a laugh every time is that which emphasizes a tendency on the part of the garage men to charge exorbitant prices for indifferent, ridiculous service, and that, what may appear from the outside to be a garage, really has no equipment to make it worthy of the name. The principal tools are the two hands and the nimble wit of the owner or operator. Moreover, the greater the air of mystery about a fake institution, the higher the rates for service.

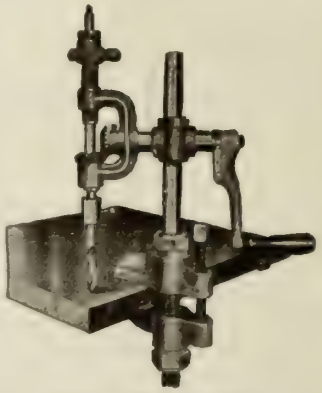
Equipment and Courtesy

In the movie referred to, the fact was emphasized that the garage or any other business that backs up its equipment with courtesy and efficiency is the only kind that will have stability of existence. The ability to handle any emergency in the least possible time and to send the patron away pleased is the strong point in the garage business. The mechanical equipment is, of course, important. There is some difference of opinion as to what it should consist of. One man will say he could not do without a lathe, another will declare that he is in a position to get done outside what little lathe work is required from time to time. In the matter of cylinder grinding, it is found in some towns that there are local machine shops equipped for this purpose and hence the garage man sometimes feels that this lets him out.

An Operating Pit

Local conditions seem to alter cases. In a city of some 18,000, there is a garage with an operating and storage floor 90 x 140 feet. The mechanical department for repair purposes probably occupies 50 x 90 feet. There is a pit, covered with heavy plank when not in use, from which workmen may operate with comfort on the underworks of a car, instead of crawling underneath. This pit is about two feet deep, the same width and in length will accommodate five cars of any size at once. Above this part of the floor, a light conveyor track, with chain block hoists, is installed. While the owner is a strong believer in the portable floor crane he finds the above plan suits the purpose better when crane service may be required for more than one car at the same time. This equipment includes a portable crane which has a special base for floor service or may be placed on a truck for emergency wrecking service. He also has the truck for that purpose and his equipment further includes cylinder and valve grinding machinery, a rapid tire changer and an electric battery recharging outfit. Needless to say there is air and gas service and the floor is laid out with good drainage facilities for car washing operations.

This garage has one floor only, carries the agency for the Studebaker, has storage room for something like eighty cars and is owned and operated by a skilled mechanic. It is not his first garage and



Hand drilling machine.

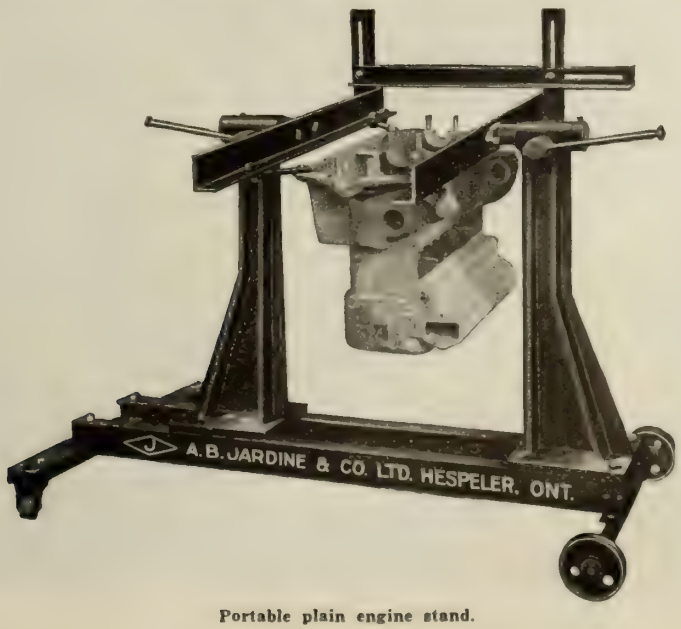
he pointed out that while he has eliminated some machinery, as not always necessary, he supposed he would be adding to it from time to time. The garage has a large display front.

When the storage end of the business is a desirable feature, and it is especially so in large cities, the two story garage has come into prominence. Here elevator service is essential when space limitations or other handicap will not permit of driveways or escalators at any easy grade. The hoist or whatever it may be, when it has to be operated by patrons, must be fool proof.

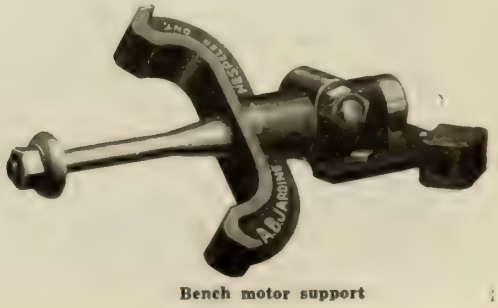
Manufacture of Equipment

The manufacture of garage equipment is an industry that has not developed altogether along exclusive lines. The production of some equipment works in well with regular lines upon which the

(Continued on next page)



Portable plain engine stand.



Bench motor support

Improved Machinery and Methods Helps Them Secure Production

AT WALKERVILLE, Ont., is located the Gotfredson Truck Corporation plant, where G. and J. trucks are produced. The factory is located in the heart of the automobile industry, and close to the steel plants, this enabling them to secure the various units and steels required without delay.

The present factory equipment has a capacity of 3,500 trucks a year, which is the number that will be built at the end of the present production year. Further increases in production are expected, according to statements from the management. The company is under conservative management, the president being Mr. Benjamin Gotfredson, who has developed the American Auto Trimming Co. to its present high standing. The policy is never to indulge in hurry-up methods to meet heavy orders. The absolute dictum of the management is that each truck must leave the factory well equipped to stand the battering and abuse most trucks are certain to endure. Extensive machine shops have been installed which permits of doing work correct to the thickness of a ten-thousandth of an inch. Improved modern production machinery makes for efficient and economical manufacturing. The accessibility of the Walkerville plants is another point in the company's favor. These are situated directly across from Detroit, and the G. & J. buildings are directly upon railroad sidings. Special loading docks expedite the loading of raw materials and the shipping of the finished product.

A complete line of trucks is made, including every model from one-ton speed truck, to heavy duty five-ton jobs. Almost every practical body design has been standardized, so that truck buyers can get this important part of their equipment at a distinct saving. Transportation engineers supply free the information as to what chassis and body are best suited for every trucking operation. An innovation so far as truck factories is concerned is the monthly service inspection policy which the company began about a year ago. Under this system, owners can bring their truck to any factory branch, or the factory itself once every month for inspection. Factory experts thoroughly test out the truck and advise what measures are necessary to maintain it at its highest efficiency. Speaking about this system the company says:—"This has proven a boon to owners who have seen slight troubles transformed by unscrupulous garage men into mountainous repair bills, and the popularity of the system is evinced in the manner in which owners never fail to take advantage of their monthly inspection. It also saves money for the owners because they only require a driver for their truck, leaving adjustments, etc. to the factory.

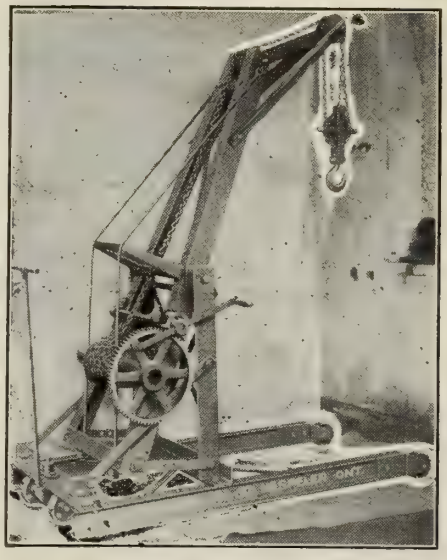
"The importance which we attach to service can be realized by the fact that our service station at Toronto alone cost over $100,000 for equipment that would insure trouble-free operation trucks in that territory. In addition we have service stations in Montreal and Hamilton. The factory at Walkerville has its service department and the different G. & J. dealers have their serivce stations.

"We feel that modern industry requires the motor truck. Thousands of factories find them indispensable. Trucks haul the raw material to factory, and return it finished to the warehouse, from where they haul it to its final destination. They have taken over every function of the horse and wagon, and in addition the functions of the railroad as well. For every haul under two hundred miles motor trucks have proven they can be more profitably employed than railroads. They also effect considerable savings by not requiring goods to be crated."

GARAGE MUST BE ABLE TO HANDLE ANY EMERGENCY

(Continued from page 49)

manufacturer has built his reputation. Just when to begin, however, and when to quit, is sometimes the problem. One house will produce lines that are adaptable to private garage purposes and



Floor and wrecking crane.

even venture into the accessories field with its great field for inventive genius. Another will confine himself to equipment for some specific branch of this rapidly-developing industry.

ONE FIRM INTERESTED

In Calgary there is only one firm interested in automobile work, and they make principally bodies. They sold goods last year to the value of $33.000 and the portion of the plant devoted to this work is valued at $9,000. Thirteen men are employed.

SPECIALIZE ON AUTO PARTS

(Continued from page 41)

last inspection and time of shipment, it is turned back and rectified before leaving the factory. A large percentage of their work is shipped by truck, because the General Motors of Canada, in the same city, use a great amount of their product.

Several well known automobile firms in Canada secure their sheet metal and sheet work from this factory, but although this automotive section is large, it is only a small portion of the entire plant, which we hope to describe in more detail at some future date. Suffice for the present to say, if the part is made of sheet metal or steel, Pedlars can make it, for their equipment is both modern and varied.

DEGREES TO CANADIANS

Among the Canadians who obtained degrees from the Massachusetts Institute of Technology at the recent commencement exercises were the following: Doctor of Philosophy, MacLeod Ewart Hurst, Vancouver, B. C.; Master of Science, Civil Engineering, Walter Maxwell Fine, Edmonton, Alta. Without course classification, Joshua Rowland, Kingham, Victoria, B. C. Bachelor of Science, Mechanical Eng. Irwin Burdette Cassidy, Toronto; Gordon Donaldson Croakery, Kinburn, Ont; Winston Allan Gardiner, Victoria, B. C.; Wilfrid Mulock Thomson, Toronto. Engineering administration, A. G. Oddlafsen, Winnipeg.

Mayor Dawson of Sault Ste. Marie, Ont., together with Ald. James Lyons, president of the Board of Trade, and H. S. Hamilton of Ottawa, recently paid a visit to Ottawa to interview the government in regard to the possibility of securing a rail order for the steel plant to relieve existing unemployment. Commenting on their visit the Mayor stated that, "We interviewed Hon. W. C. Kennedy, Minister of Railways and Canals, and Hon. James Murdock, Minister of Labor, and were told that the government policy in regard to any orders which might be given to relieve unemployment was to be given in the winter, when work was harder to obtain than in the summer. We were assured, however, that the Sault would be given equal treatment with the Sydney mill."

The Matachewan Power Co. are pushing construction work on their power plant now being built on the Montreal River. All the heavy machinery has been ordered and it is expected that this will be delivered to the site this summer. While primarily intended for supplying power to the Matachewan district it is expected that sufficient surplus will be available for distribution to outlying districts, including Gowganda and Shining Tree.

Geo. D. McDougall, chief engineer of The British Empire Steel Corporation, has been elected president of the Nova Scotia Mining Society.

Cutting Costs With Power Riveting Hammers

Work Produced at Great Speed and More Neatly Performed Than By Hand—Controlling the Force of the Blow—Riveting Irregular and Peculiar Shapes

By FRED. R. DANIELS

SEVERAL examples of cold-heating and rivet-setting operations performed on high-speed riveting hammers made by the High Speed Hammer Co., Inc., Rochester, N. Y., are illustrated in this article. One of the reasons that a high-speed riveting hammer is a valuable cost-reducing factor in metal-working plants is that the machine is easy to operate and regulate, so that boys and women are able to turn out as satisfactory a product as the more skilled machinist. The riveting hammer referred to consists of three main units—a pedestal, an attached hammer-head, and an adjustable anvil support. The hammer head carries a friction drive on one side and a pulley that revolves the spindle of the machine on the other, both being mounted on the crankshaft that actuates the hammer movement of the heading tool. The shock of the blows delivered is absorbed by the use of a hickory helve and large rubber bumpers.

The principle of hand riveting is incorporated in this machine in that the cold metal is caused to flow under repeated blows. The force required in delivering these blows for different classes of work is under the control of the operator through the friction clutch and foot-treadle by means of which the machine is operated.

The applications of the riveting hammer mentioned in the following are only examples of the wide field in which this type of hammer is in common use. For delicate work required in typewriter construction and in the manufacture of camera parts and electrical apparatus the high-speed hammer is regularly used. When parts are riveted with a hinge joint and freedom of movement is the prime requisite, the possibility of controlling the force of the blows permits rivets to be set without closing the hinge and causing the leaves to bind.

When rivets are pressed into place before riveting, two operators may be employed for the assembling and the riveting operations, one to press or hammer in the rivets and the other to do the riveting. Often the rivets are not a press fit, but may be assembled by hand in the parts to be riveted, and the work thus assembled passed to the riveter. In this case a boy can do the assembling work and keep the riveting machine in constant operation.

Riveting Rear Axle Drive Shaft Caps

The work being done in the set-up shown in Fig. 1 is the cold-riveting of forged steel hub caps to high-carbon steel rear axle drive shafts, 1¼ inches in diameter. The nature of the work performed in this operation is indicated at A in Fig. 3, from which it will be seen that the shaft extends 3/16 inch beyond the end of the cap, this metal being cold-riveted into the countersunk hole in the cap. This is an example of heavy cold-riveting, the work being done in the plant of the Reo Motor Car Co., Lansing, Mich. For work of this kind it will be readily understood that the peen must be properly shaped to fit the curvature of the cap so that as the tool revolves the rapid elastic blows will set the end of the shaft down even with the

By courtesy of Machinery, New York.

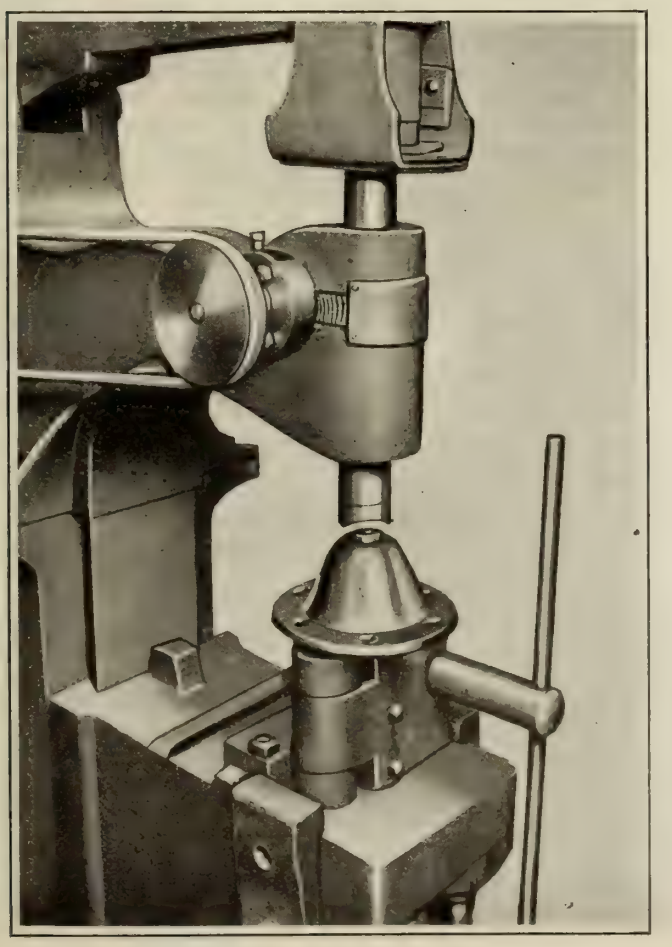


Fig. 1.—Cold riveting of forged steel hub caps to axle shafts.



Fig. 2.—Riveting eight heat-treated steel studs.

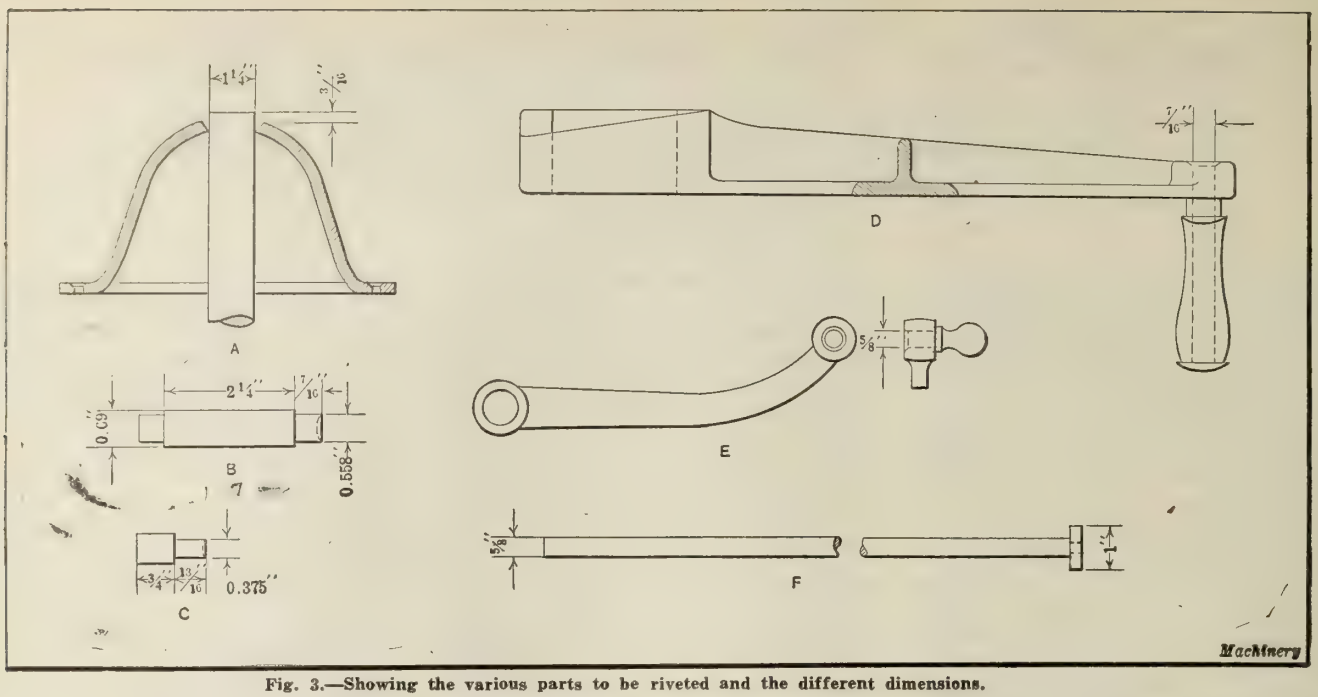


Fig. 3.—Showing the various parts to be riveted and the different dimensions.

curvature of the cap. The work is seated on a special fixture and chucked from within by simply turning the lever-handle a part revolution. The work was formerly done by hand, by which method neither uniformity of product nor speed were realized. Using the sledge hammer the production time was four minutes per shaft; with the machine and set-up illustrated, the time is one minute per shaft.

Operations on Differential Gear-cases

Another manufacturing operation in the automotive industry is illustrated in Fig. 2; this is the riveting of eight heat-treated steel studs in automobile differential gear-cases. This also is a heavy riveting job. The work, which is performed in the New Process Gear Corporation's plant, Syracuse, N. Y., consists first of loosely assembling the side plates, pinions, and studs. These studs are 0.558 inch in diameter on the end to be riveted, as shown at B, Fig. 3. With the gears and studs loosely assembled in the plates, the work is placed on a fixture and a locking pin inserted through the central hole to align the gears while the first stud is riveted. After the first stud is set, the locking pin is withdrawn and the differential gear-case turned around to rivet a second stud located diametrically opposite the first stud.

The operation continues from side to side in pairs until eight rivets have been headed over on the upper side of the case; then the work is reversed and the sequence repeated on the opposite side. During the riveting operation the gears are constantly manipulated by the riveter to detect any tendency for them to bind. The production for one man is from eight to ten completely assembled gear-cases per hour or an average of 144 headed studs.

Application to Wire Wheel Manufacture

Many of these hammers are in use in the manufacture of automobile wire wheels in which their most common application is for riveting the six steel pins in the hub flanges. In one shop this job is handled by two men, one driving the pins into the flanges, and the other setting the rivets. In this way a satisfactory production rate can be obtained.

In another shop, the work is performed by one workman, the operation consisting of cold-heating six steel pins such as shown at C, Fig. 3. It will be seen that the end to be riveted is ⅜ inch in diameter. A fixture plate may be used to hold the rivets in the hub flange in the correct position for riveting after they have been pressed into the holes. The pins are set flush with the face of the flange which, of course, requires a straight-end peen. The production with one man working alone, is 75 hubs per hour, not including the assembling of pins, or 450 pins headed in one hour.

Riveting Crank-handles and Levers

At D, Fig. 3, is shown an engine starting crank on which the riveting operation is the setting over of the pin that passes through the wood handle. These steel pins are 7/16 in in diameter, and some time is consumed in assembling them in the handles. The riveting operation is slowed up, because of the fact that more attention must be given to holding the overhanging end of the crank up at right angles to the face of the peen. The production is 75 cranks an hour.

The riveting of a nickel steel ballend into a forged steel pitman arm for an automobile steering gear requires the use of a large size hammer. The hammer used for this purpose in one plant is equipped with a special anvil in which the ball-end fits while the head is being set. A diagrammatic view of the assembly of a ball-end and pitman arm of the type referred to is shown at E. The diameter of the shank to be riveted, is ⅝ inch and it is pressed into the arm on an arbor press, leaving about ⅛ inch projection to form the rivet head. The head is rounded to ¾ inch

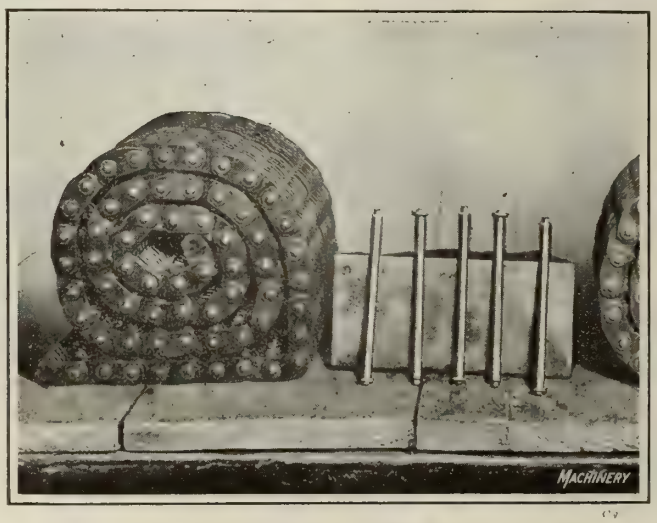


Fig. 5.—Coil of chain and pins on which links are assembled.

diameter, using an oval-head peen, at the rate of 440 per hour.

The setting of a cold-rolled steel head 1 inch in diameter on the end of a 5/16 inch drill rod is a good example of machine riveting. This unit, which is shown at F, forms a driver used in the construction of nailing machines for box manufacture. It will be noticed that the drill rods are comparatively long and slender, and they must be firmly clamped on end during the riveting operation. The type of vise used for this purpose encloses the rod and is split longitudinally, being readily tightened on the rod by a hand lever.

Riveting Brake Brands

The brake-band shown at the right in Fig. 4 is made of steel ¼ inch thick, and is 18 inches in diameter. It is covered with a brake lining which is assembled to it by copper rivets, this being a hand operation. The brackets that hold the lever-and-link device have a foot ¼ inch thick through which the brackets are riveted to the steel band. The illustration shows the position of these brackets after assembling. Steel rivets ¼ inch in diameter are used, sixteen of these being required to assemble both brackets. The production is 304 headed rivets or 19 brake-bands per hour.

Power Riveting in Chain Manufacture

Riveting the ends of pins on which the steel links of silent chains are assembled is regularly performed on the high-speed riveting hammer. The pins used in the particular size of chain illustrated in Fig. 5 are 9/32 inch in diameter, and the width of the chain is 4 inches. The riveted head is set over a washer and the operation must, of course, be so performed that freedom of movement is obtained between the links and spacers of the chain. The average production on this kind of riveting is 600 pins per hour.

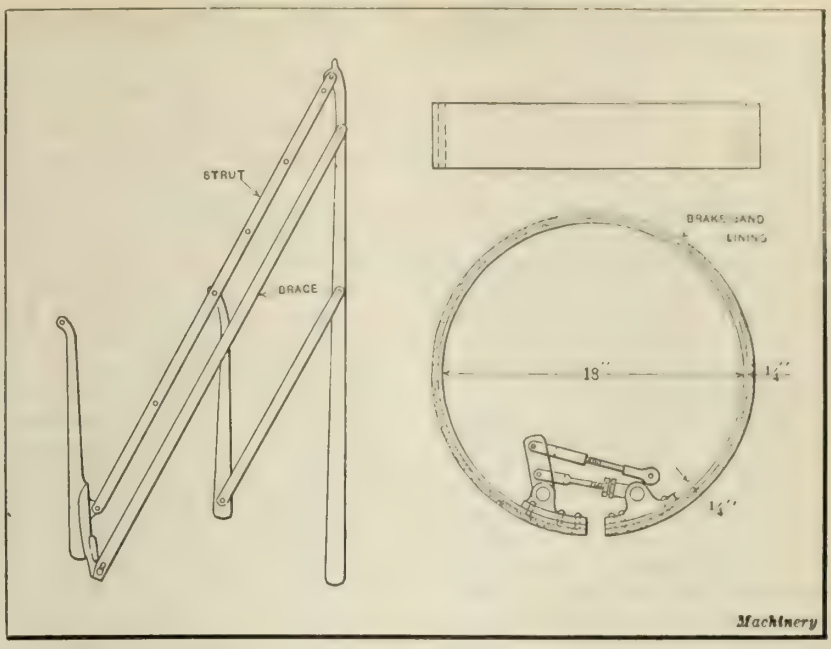


Fig. 4.—Side frame of an automobile top and friction brake-band.

The braces, posts, structs, etc, which go into the side frame of automobile tops are assembled by riveting, and practically all this work is done on power-driven machines. One example of this type is shown in Fig. 6 which illustrates the operation of riveting malleable iron forged clips to a frame post. This post goes into the frame of a Chevrolet automobile top, the work being performed in the American Forging & Socket Co.'s plant at Pontiac, Mich.

The post is made of sheet steel with beaded joint, and is prevented from collapsing during the riveting operation by inserting a mandrel by which one end of the work is held, while the post rests on the specially formed anvil. Two flat-head rivets, 7/32 inch in diameter by 7/16 inch long are used to assemble these clips, the rivets being inserted in place by a boy or woman who then hands them to the riveter to be set down. In operations of this kind when it is necessary to handle the work in this way, a production of 2,000 pieces in a nine-hour day is considered very satisfactory.

At the left in Fig. 4 is shown the assembly of the side frame for an automobile top. The operation to which attention is here directed is setting the seven long rivets in the strut and the short one in the lower end of the brace. Rivets of different lengths are headed without changing the dies. This is accomplished by the use of two anvils which are operated to bring them into alignment with the peen by a foot-treadle. Two of these side-frame assemblies constitute a set, and the production is 250 sets per nine-hour day, or a total of 4,000 rivets daily. This operation shows the possibilities of riveting work of an irregular or peculiar shape by the use of special mechanical devices and fixtures for holding the work.



Fig. 6.—Assembling auto top frames with power riveter.

Power Riveting on Agricultural Implements

The riveting hammer is a common machine in the agricultural machinery plant. It is used in the making of malleable iron chains, shoe runners, mowing machine pitmans, and various other parts. In the plant of Henry & Allen, Auburn, N. Y., malleable iron ends are riveted to a mowing machine pitman arm using eight ¼-inch rivets, four in each side. The heads are set at the rate of 400 per hour, 50 pitmans being completed every six minutes.

Small Gap Lathe Best Suited for Garage

Most Desirable Tool For Range of Work—Various Attachments Make the Machine Almost Universal in Scope—Extension Bid Provides Means of Handling Long Work

GARAGES and service stations are to the automobile owner as doctors and drug stores are to the public—an ever-present need in time of trouble. It is the desire of few to keep them on the regular visiting list but none refrain from calling them in when the necessity arises.

The primary object of the garage is to make speedy and efficient repairs to any and all makes of cars or trucks that may be in service. The ever increasing number of pleasure cars and the rapid expansion in the use of commercial trucks and tractors, necessitate adequate repair shop facilities in all cities, towns, and even in the rural districts. Not alone in the work of repairing automotive equipment, but in the handling of many small jobs of machine repair, can the garage man find an outlet for his service.

Selection of Machines

In the successful operation of a garage the selection of machine equipment is a very important factor. Many small service stations may get along without any machine tools, taking care of all general repairs by getting machine work done in local machine shops. The up-to-date man, however, will obtain the necessary tools for his own service. If it is a question of purchasing one tool, and only one, the choice would naturally be a lathe of suitable dimensions and on which could be used a variety of attachments for taking care of the wide range of operations that would be required in general repair work.

Extension Gap Lathe

For the proper repairing of automobile engines, trucks, tractors and parts, careful attention should be given to the selection of a lathe having the necessary swing, accuracy and equipment conveniences to take care of all of the many jobs—smallest to largest—both in diameter and length. Probably the best all-round purpose machine to meet these conditions would be the sliding extension bed type of gap lathe. The advantages and economy of this type of lathe for general light repair work will be readily seen and appreciated from the accompanying illustrations. The garage is seldom called upon to produce a volume of work but rather a variety so that the sliding extension gap is equivalent to two lathes in one, and likewise is a great saving in cost and floor space occupied.

The lathe on which the different operations here shown are being performed is one that swings 14½in. over the top bed and 24in. diameter through the gap. On the 7½ft. machine the gap opens 36in., and when open will take in lengths of 8 ft. between centres. The carriage travels up to the end of the bed, so that the gap need only be opened wide enough to clear the work. This is very convenient when machining a crank shaft with fly-wheel attached, etc. With the added equipment of taper attachment, milling attachment, and cylinder re-boring device, the lathe becomes a universal machine.

Milling Attachment

A view of the milling attachment is shown in Fig. 1, cutting a key-seat for a Woodruff key. It will be noted that the device is adjustable to almost any desired position, the swivel portion being graduated in degrees. By changing the tools held in the revolving spindle of the lathe, and altering the position of the device many interesting jobs can be accomplished, such as squaring the ends of shafts, sawing bars and heads of screws, splitting bushes, drilling and boring, etc. The advantages of a milling attachment on a garage or repair shop lathe is that it provides a method of doing work that would otherwise have to be sent out to another shop or perhaps filed or accomplished in some ingenious but nevertheless inconvenient and time-consuming manner—expensive to the customer. Hand work takes too much time and rarely is as satisfactory as good machine work. A thoughtful patron will understand and appreciate the difference. When equipped with the milling attachment, as here shown, the extension gap lathe possesses most of the essential features of the milling machinery and the latter is too expensive for the average small garage.

Re-boring Cylinders

A special attachment has been designed for this particular gap lathe whereby the reboring of any make of auto-engine cylinder can be successfully performed, as well as a wide range of general machining of a similar character. The attachment consists of a large angle bracket, the base of which is fastened to the carriage of the lathe. The boring bar is 2½in. dia. and fitted with a Morse taper shank and draw bolt for positive drive. The pilot end of the bar runs in a hardened steel bushing fitted in the body of the angle plate. When placing the work in position, alignment of the bore is facilitated by the use of taper bushings inserted in the cylinder. An angle shoe, that slides on the lower ways of the lathe, takes the weight of the overhanging cylinder body, through two adjusting steady bolts. The power feed of the carriage feeds the work forward and when the cutter has passed through the cylinder it may be removed through the openings in the back of the angle plate, thus leaving a perfect finish on the walls of the cylinder. When the cutter is properly ground a very smooth accurate job can be accomplished. A feature of these gap lathes is their portable nature; the driving motor is attached to a bracket at the front end, while the countershaft is located at the rear of the

Figs. 1 to 4 through courtesy of the Barnes Drill Co., Rockford, Ill. Fig. 5 supplied by South Bend Lathe Works, South Bend, Ind.

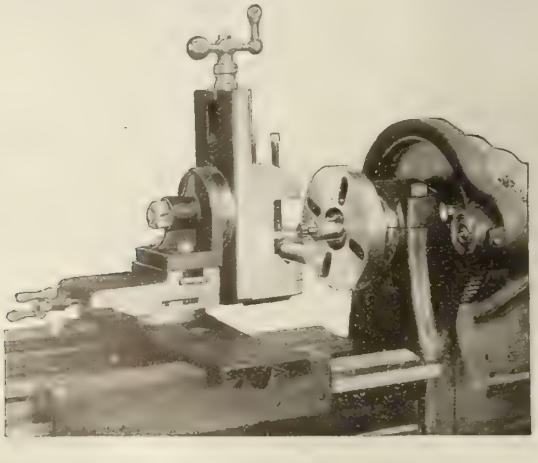


Fig. 1.—Cutting key-seat for Woodruff key.

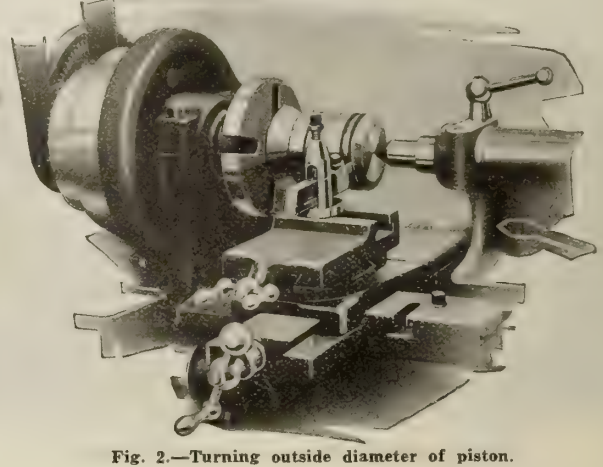


Fig. 2.—Turning outside diameter of piston.

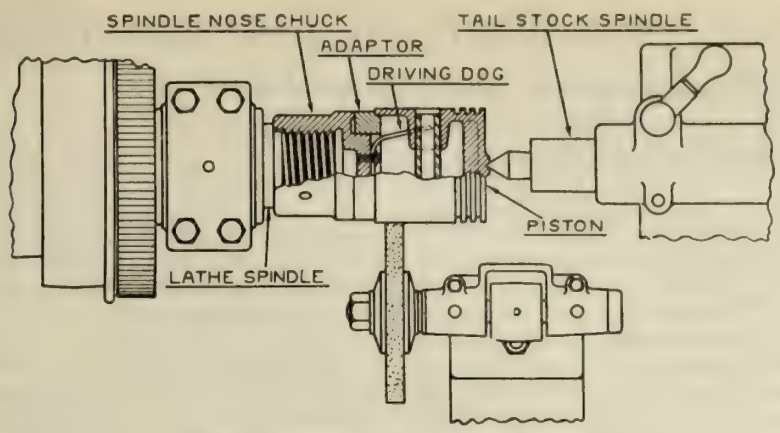


Fig. 5.—Grinding piston on special arbor.

headstock, the cones being belt connected.

Handling Pistons

For the machining of pistons special facilities are provided. In Fig. 2 is shown a piston being turned on the outer diameter. The drive is obtained by means of a combined cone centre and driving plug. The arbor which may be made to fit any spindle is threaded on the centre section, and by means of an adjusting nut back of the cone centre, the latter can be located in the exact position for effective drive, which is accomplished by means of a pin passing through the wrist pin holes of the cylinder and a flat piece inserted in the front end of the arbor.

Another method of driving pistons while the outer diameter is being ground is shown in Fig. 5. A special adapter is made to fit the nose of the lathe spindle and the outside face is turned to take a number of rings, the hole of which fits the nose of the adapter while the outer diameter of the rings are stepped to take the different sized pistons; the driving dog is made of a piece of light bar iron bolted to face of nose chuck and bearing against wrist-pin boss. The outer end of piston runs in the tail centre.

Another attachment is that devised for holding the pistons while boring the wrist pin holes. This appliance has a base for bolting to the face plate, and on the front is a slide that carries a special angle plate on which the work is supported. By means of adjusting screws the position of the work can be regulated independent of the movement of the base on the face plate. The piston is held by means of a V-shaped clamp and bolted with a large flange.

A view that illustrates clearly the range of the machine for large diameters is shown in Fig. 3. Here is shown a fly-wheel held in a chuck while being machined. The movable bed has been drawn back just sufficient to clear the wheel, to retain the maximum support to the lathe carriage. Fig. 4 shows the machine operating on a four-throw crank shaft.

In addition to the above mentioned attachments many others can be devised for facilitating the handling of a wide variety of job work.

MAKE SPECIALTY OF SPRINGS

The Ideal Fence and Spring Co. of Canada, Windsor, Ont., make various kinds of springs for the automobile trade. Here is what W. McGregor, president of the above mentioned firm, has to say regarding their activities. "We have a three story fireproof building, 60 ft. by 140 ft., devoted to the manufacture of springs, cushion seats, etc., most of which is for the automobile trade. Floor space is about 25,00 square feet. The total number of employees at this season, in this part of our factory, is about one hundred, which is normal for about six months of the year. The other six months it drops to about fifty."

MAPLE LEAF TRUCK PLANT IN MONTREAL

THE Maple Leaf Manufacturing Co. was organized in 1919, when the company bought out the Menard Motor Truck Co., of Windsor, Ont. The location of the plant was then moved to Montreal, where active operations were commenced in the spring of 1920. The company at present is engaged in the making of motor trucks ranging from 1½ to 5 ton capacity. The factory is located at 999 Christopher Columbus St. and adjoining the main line of the C. P. R. The building is of frame construction, 100ft. by 125ft.

Since the incorporation of the company, business has shown great expansion and Maple Leaf trucks are operating in all the large cities from Halifax to Vancouver. Demand for trucks has fallen off lately owing to general industrial depression, and to the fact that the Provincial Government of Quebec has recently passed legislation barring the heavier trucks from the roads in the province. It is stated that this ruling seriously affects the business of the company, and the explanation offered by truck manufacturers is that the trucks are overloaded, and as the tires are constructed for pressure per sq. in., the additional weight is destructive to the roadway.

The imported parts used in the car are the Hinckley Motor, the transmissions, front and rear axles, and the steering gear. Included in the parts purchased in Canada are the wheels, tires, bodies and cabs. The chassis are made in the Montreal factory, commercial channel structural steel is used. The plant equipment is ample for assembly, repairs and general service work.

The officers of the company are, Kenneth Molson, president, W. B. McLean, vice-president and general manager, W. F. B. Henry, secty.-treas., and Leslie W. Pearson, sales manager.

Nine hundred men are employed at the plant of the Port Arthur shipbuilding company, the majority being engaged in the construction of the steel freighter Mathewston. The ends are now being built up and the tank tops are nearing completion.

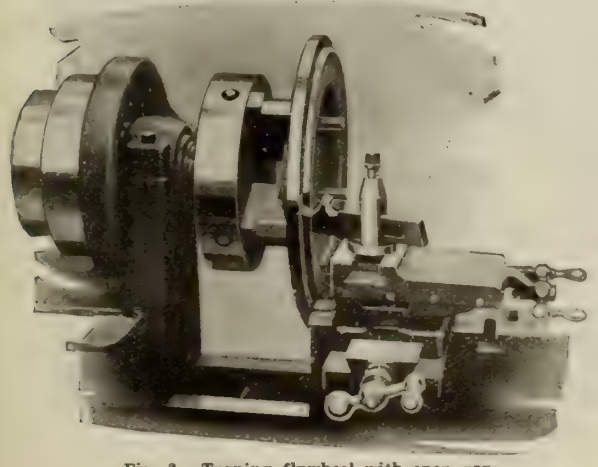


Fig. 3.—Turning flywheel with open gap.

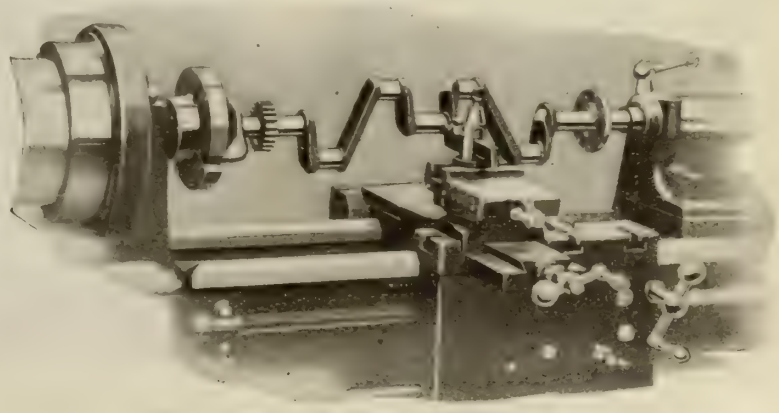


Fig. 4. Turning a four-throw crankshaft.

Birmingham Motors Open Plant in Peterborough

Thirty-Five Cars a Day to Be Produced—Unique Suspension of Front and Rear Axles—Flexibility of Car Demonstrated at Recent Exhibition—All Canadian Company

EVER-increasing demand for high grade automobiles has recently brought to Canada another classic car manufacturing concern. This new company is known as Birmingham Motors, Ltd., and early this year they acquired a factory in Peterborough with approximately 11½ acres of land. The present plant is a one-storey building 183 x 187 feet, giving a floor space of over 34,000 sq. ft.

The present value of plant and equipment is about $110,000 and it is estimated that an output of thirty-five cars a day will be obtained under intensive production. The schedule for the first year is placed at two thousand cars of the 124in. wheelbase type. In the construction of the car the company figures on using 80 per cent. of Canadian materials.

The initial effort of the company will be the assembly of cars, incorporating the most modern and efficient conventional practice. The cars will be equipped with Red Seal Continental six motors, fitted with Stromberg carburetors Bijur starting and lighting equipment, and Gemmer steering gear. The differentials are manufactured by the New Process Gear Corporation, and the transmission is built by the Detroit Gear and Machine Co. As is usual in many types of European cars the bodies will be made of wood supported on a specially designed Parrish frame.

An outstanding feature of the Birmingham car is the unique suspension provided in both front and rear axle. The design of the axles is such that, when under full load, the tie rods and springs are approximately horizontal with the road. The centre bracket of the front axle is rigidly secured to a strong frame receiving member. The tie rods oscillate on the spring coupling pins at the king pin yokes and on the pins at the centre bracket so that the wheels retain their initial position at all times, with a slight increase in tread under load. Oilless bushings are used throughout and leaf springs are made of silicon manganese steel.

The same principle of design is used in the rear axle with the addition of the driving gear. Three leaf springs are used, one above and two below. The inner ends of the tie rods are pinned to the differential housing which is securely fastened to the non-flexing frame. On either side of the housing are located the external contracting service brakes, then the universal joints, the open propeller shafts and the outer universals. It is claimed that this type of axle minimizes the sway and shock when passing over pitchholes and elevations, as the jars are not so localized as in cars with rigid axles.

The application of the spring suspension is not new, as it was originally utilized in the construction of the Cornelian car, but owing to inherent faults in the elementary design, the method did not prove practical. However, after the purchase of the patents, by the Birmingham corporation, their engineers experimented and developed the idea to such a stage that it is now claimed that all previous faults have been eliminated, giving to the present design an ease and riding efficiency of high order.

An interesting demonstration of the flexibility of this car was made at the recent Peterborough Motor Show. The car used was the first made-in-Canada Birmingham car and was driven at ten miles an hour and afterwards at thirty miles an hour, over split 1 to 17in. logs alternately and tied together with stringers. The car was equipped with Dunlop cord tires and the test was a severe one, as may be gathered from the accompanying cut, which shows the obstruction passed over at the speeds mentioned.

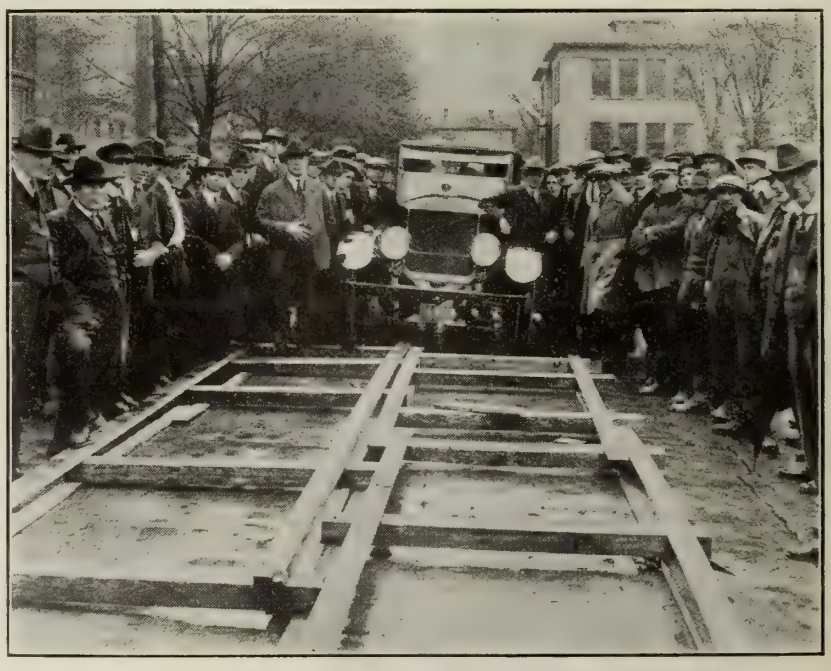
The Peterborough plant will be owned and operated by the Canadian company and will be under the managership of Byron Tederer. It is stated that, wherever possible, Canadian material will be used for construction. Present activities are devoted to the better class car, selling at approximately $2,600, but the engineers are working on a design of a four-cylinder type, with same suspension, that will sell at about $1,200. It is anticipated that this car will be completed for exhibition at the National Motor Show which will be held in conjunction with the Toronto National Exhibition in September.

RUNNING NIGHT AND DAY

SPEAKING about their tire plant at Oakville, J. B. Maus, director of sales for the Oak Tire & Rubber Co., says:—

"The valuation of our company is $250,000, and the ground covered by the factory and available space, approximately six and a half acres. We employ about 120 men, and at the present time are running both night and day to supply the demand. Our pay roll averages about $100,000 and our production at capacity is approximately one million dollars.

"The rubber and tire industry in Canada is particularly attractive and holds a very promising future for the following reasons:—First, the consumption of cars for the Dominion is about one car to every twenty of its population, while in the United States it is approximately one car to every nine, showing that our consumption of cars in the Dominion is approximately 100 per cent. less per population. It is due first to the undeveloped roads that are rapidly being improved and secondly the past high prices of cars which in recent months have been greatly reduced, and as a result the use of the automobile in the Dominion has become more popular each day, necessitating thereby the additional use of automobile tires.



Test of Birmingham car at Peterboro Motor Show.

Accurate Production Grinding of General Automotive Equipment

MEETING the growing demand for improved grinding equipment for the accurate finishing of automobile parts is a constant problem of the machine tool manufacturers. Some of the principal operations carried out in the grinding of auto parts are shown in the accompanying illustration. The success of crankshaft grinding is mainly dependent on the accurate, careful construction of the throw blocks. Those used on this machine are made with tool-room precision. The sides of the block are finished to an exact size in relation to the centre holes in the sliding blocks, this permitting the crankshaft to be readily aligned by placing the blocks on their sides upon a surface plate. Other features of these blocks are the adjustable clamp caps which provide for various diameters of shafts, the three centre holes for crankshafts of different throws, the adjustable slide for obtaining a firmer setting, and the special extension of the slide block used on the headstock end of the crankshaft. This extension, with its recess, provides for grinding flanged crankshafts.

Another noteworthy feature is the piston arbor. Motor mechanics will appreciate the time saved in mounting pistons in this convenient manner. In addition to the piston being mounted on dead centres, it is likewise ground upon its own centres, which not only assures accuracy, but trues up a seasoned piston concentric with the same axis upon which it was originally turned. Having no three-point bearing to establish, the tendency for the piston to cramp or become off centre is eliminated.

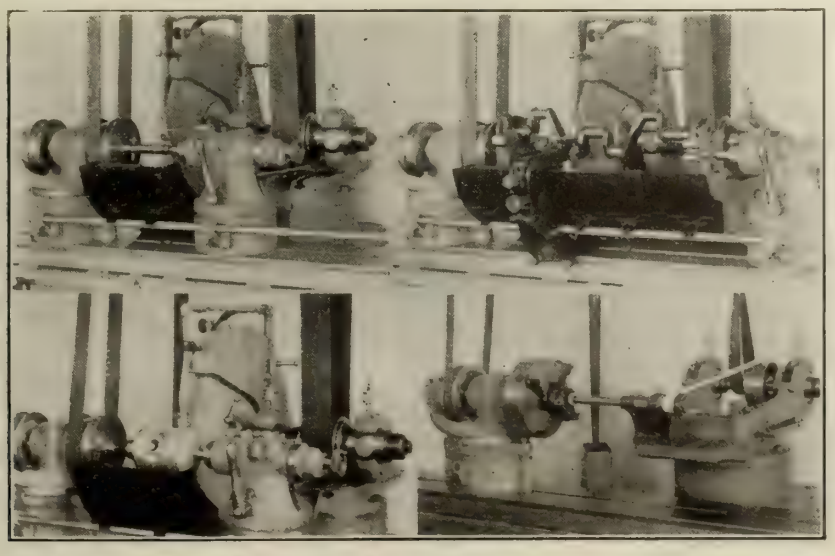
The machine itself is particularly designed for automobile production work and general repairs in large garages.

The wheel spindle of tool steel has hardened bearings, ground and lapped, running in self-aligning phosphor bronze boxes, provided with means of compensation for wear. The spindle and boxes can be easily removed to make room for the internal grinding attachment. The automatic cross feed will move the wheel from .00025in. to .004in. at each reversal of the table, as desired. It is automatically disengaged when the work is to size. The table travel is automatic and is controlled by easily adjustable dogs. The speeds and feeds of the wheel and the work table feed are entirely independent of each other. A single lever starts and stops the rotation of the work and the feed of the table. The table reversing mechanism is very accurate allowing work to be ground close to the shoulder.

The base of the machine rests on the floor at three points. This maintains the alignment of the table, preventing it from being affected by any inaccuracies of the flooring. The box-like construction of the frame with the ample overhang at each end gives firm support for the table, especially at the end of its traverse. Strong ribbing extending the entire length of the table, keeps it rigid and prevents it from sagging. The grinding wheel is 24in. in diameter, 1in. thick, and has a 5in. hole. It is amply protected by a heavy guard which helps to confine the spray and particles of abrasive. The footstock carries the holder for the carbon point and the wheel can be trued without removing the work from the centres.

The machine is equipped with a small pump for supplying water to the wheel when doing wet grinding.

Photos supplied through courtesy of Brown and Sharpe Company.



Top left.—Grinding small pins. Top right.—Grinding pins on crankshaft. Lower left. Grinding pistons. Lower right.—Grinding bore of small clutch.

Announcement has been made of the appointment of R. A. Parrish to the position of general organizer and publicity agent of the Edmonton Automobile and Good Road Association.

BRIEF REVIEW OF ACTIVITIES AT WILLYS-OVERLAND

ON January 8, 1920, we published a twelve page article entitled, "Making the Overland Four." At that time we described the factory in detail, and explained the different operations on the car. It is unnecessary to repeat the information then given, we will therefore in this article, give a brief review on the method of manufacture.

There is the assembling of chassis, the painting department, further stages of assembly, etc. Each operation is carefully inspected, and not only are the engines made at their plant, but all machining operations on front axle are completed at the main factory.

The rear axle and transmission are made at another factory, but Canadian labor is employed. In the making of the various parts, only high class equipment is used, and jigs and fixtures have been developed to a fine point. Here are a few samples.

The chassis is assembled on a specially constructed frame, the front axle is milled on a special machine and this piece is drilled on a four-spindle adjustable head drill press, a locating jig being used. The cylinder blocks are also machined on jigs, and a specially constructed eight-spindle boring mill bores out the blocks at one time. A circular table allows the operator to load and unload while the machine spindles are performing their work.

Special multiple spindle machines are used to drill the tops and bottoms of cylinder blocks and in one case a horizontal machine is used which drills 47 holes at one time. Another tool machine mills the connecting rods, on a continuous milling table, in fact, as mentioned previously, all the equipment is of the very latest type. In every case, close inspection is adhered to, and the reader's best plan would be to secure a copy of the original material and read the complete story.

Since writing our last article on January 8, 1920, several changes to the executive have occurred but the old reliable T. A. Russell is still at the helm. Following is a brief history of Mr. Russell's activities, also a short story covering two other members of the executive.

Mr. T. A. Russell is president and after being graduated from Toronto University, was secretary of the Canadian Manufacturers' Association. His organizing ability led to his selection by the Canada Cycle and Motor Co. and for a number of years he successfully directed its activities. Later on, he organized the Russell Motor Car Co. which manufactured the Russell-Knight motor car until affiliation was made with the Willys-Overland interest of the United States. Under the arrangement by which the Canadian Willys-Overland Co. undertook the manufacture of cars in Canada, the Russell factories were taken over, and Willys-Overland Ltd., now has ramifications all through Canada with its own

(Continued on page 58)

Yearly Production Averages Around Quarter of a Million

THE FOUR Wheel Drive Auto Co. at Kitchener, Ont., have a plant, with about seven acres of land, worth over $50,000. Speaking about their activities, A. M. Kerr, manager of the plant, says: "Our number of employees varies according to seasons from five, up to any number. Our yearly production averages about a quarter million dollars. We, of course, have just started in Canada, and started at a very bad time, but we expect our yearly production to rapidly increase. In time we expect to take care of a considerable amount of foreign trade. That will be made possible by the workings of our preferential tariff. Another factor which we expect will give us a great deal of business is the recent development of our railroad truck.

"This truck is our standard article with the rubber tires taken off and steel flanged wheels put on in their places. Our truck is built with a standard 56½" tread, so that no changes are necessary from an engineering standpoint to adapt it to the rails, which are 56½" gauge. We also have traction on the front wheels as well as on the rear which allows the front end to do as much as the rear end, giving a pulling capacity and traction effort which no other rear driven truck can obtain. That is going to mean a lot of business for railways operating short lines and unproductive lines with steam trains. The cost of our equipment is only a fraction of the cost of steam equipment and the operating and upkeep charges are similarly low. As we have specialized on a road building truck and a merchandise truck, for hauling trailers, so we are specializing on this railroad equipment.

"Our main factory in Clintonville builds nothing but one size and model of truck, therefore is it reasonable to suppose that they build a good one. All the changes they make from year to year do not necessitate new models as all changes are interchangeable with all trucks built from the very first.

"Business is getting more active for us, and we hope very soon to get back to normal. We consider our plant well equipped, and chief among the necessary equipment is a heat-treating plant where all steel after it has been passed as being of the proper construction, is subjected to heat at a set temperature for different lengths of time, to give it the toughness and hardness necessary. There is also the process of carbonizing steels, which consists of hardening the surface of the metal to a certain depth leaving the core soft and pliable, thus giving combined flexibility and strength and wearing qualities.

"There is also an important part in our process of manufacture and that is the gauging of all parts and bearings, with the latest type of gauges, which are proved on Swedish blocks to a very minute fraction of an inch. To the ordinary individual this would seem like unnecessary expense, but statistics show that a truck built thus, and costing a little more money than an assembled proposition, lasts a great deal longer and costs considerably less in upkeep charges, especially after the first year or two.

"With our particular truck we feel there is nothing known to motor science that is not practised in our factory. Another feature of our operations is our construction and assembly of the Four Wheel Drive principle. This is so simple, yet so effective. The application of the universal joint principle is applied the same way as that principle is applied universally by all manufacturers of motors, in their transmissions. The ball and socket support for the front axle together with the direct drive through the axle housing is the secret of the successful operation of the drive on all four wheels."

A total of 2,448 automobile licenses were issued by the Province of Manitoba license department up to the end of April this year.

BRIEF REVIEWS

(Continued from Page 57)

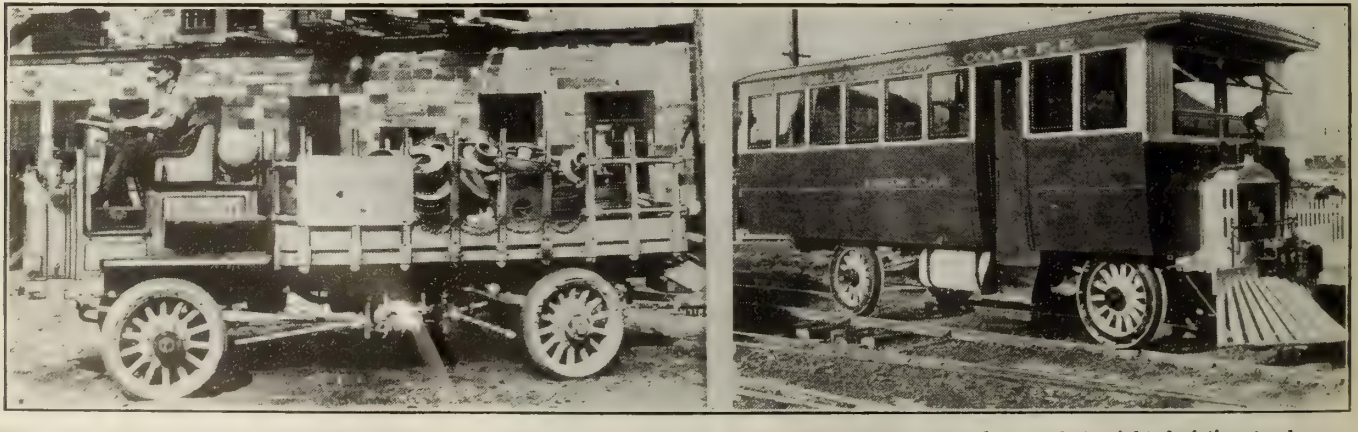
branches in Toronto, Montreal, Winnipeg and Regina. Mr. Russell not only has the active-management of Willys-Overland, but is vice-president of the Russell Motor Car Co., president of the Canada Cycle & Motor Co. and president of the Russell Gear & Machine Co., in all of which he takes an active part. He is also a director of the Canadian Bank of Commerce, and of the Canada Cement Co., and in addition to these interests he takes a very personal supervision of his splendid farm at Downsview, the home of some of Canada's best pure-bred Shorthorns.

Mr. John R. Marlow, secretary-treasurer of the company, who is also sales director, has had long experience in the automobile business, having been with Mr. Russell since the early days of his enterprises. Leaving the sales management of the old Russell Motor Car Co. to go to Montreal as branch manager, he remained in that city for a number of years, continuing as branch manager when Willys-Overland took over the Russell Motor Car Co. interests. Early in 1921 he was promoted to the office of secretary-treasurer and at the same time assumed the management of the sales division, in which he has met with marked success.

Mr. Fred G. Adams, factory superintendent, has also been connected with Mr. Russell's business activities since the early bicycle days, and had much to do with carrying out the large shell contracts which the Russell Motor Car Co. worked during the war. When the war work was completed at the Russell Motor plant, Mr. Adams came to the Willys-Overland factories and has been in charge of production since that time.

The area of plant and office buildings is approximately 5½ acres, the total floor space 311,215 sq. ft., the total valuation of plant and office buildings, $2,480,000, while the approximate value of machines and equipment in factory is about $1,620,000.

Old age has its joys but reckless men do not live to enjoy them.



Showing two extreme uses for F.W.D. motor trucks. The left view shows truck used in steel foundry, the photograph to right depicting truck on railway.

Yearly Output Totals 260,000 Automobile Wheels

Also Manufactures Front and Rear Axles—Continuous Operations on Wheel Spokes—Turret Lathes Used in Making Hubs—Every Axle Tested Before Being Shipped

TO FOLLOW the making of an automobile wheel is an interesting study. At the Hayes Wheel Co. of Canada, Chatham, Ont., they turn out enough wheels and material to accommodate 65,000 cars per year. Here we find a specialized industry which has been brought to a high point of efficiency, every operation being in sequence, both in the wood and metal working departments.

Wheels are made for Ford, Maxwell, Briscoe, Chevrolet, Gray Dort, Oldsmobile, McLaughlin, and Willys-Overland cars, also several other makes. At Chatham wooden-spoked, and steel felloe wheels are manufactured while in the other plant, which is in Windsor, the outer steel rim carriers are manufactured.

The total value of both plants is $732,000, about $532,000 of this being in the Chatham factory. In Windsor the plant covers 5 acres while in Chatham the property is about 4 acres. A total of 400 are employed, 300 in Chatham and 100 in Windsor. The average monthly pay roll in both plants is $40,000, and the two factories make about $3,000,000 sales each year. Considerable export business is done, this swelling the total.

In addition to wheels, this firm make front and rear axles, also steering gears for several types of cars. Starting with the woodworking section of the wheel plant we find that the spokes are turned on a lathe with remarkable rapidity by means of a large knife, while the end is formed to meet the hub by means of two mitre knives in a machine very much after the style of a punch press. These knives are never stopped, the operator merely slipping a spoke in place, down comes the knives, and the two bevel edges are trimmed.

The moment this is done, the operator tosses the spoke down a chute, where it is lifted up with a belt to a sander which finishes the rough turned spoke. Next they are assembled to the outside rim and the metal hub, being squeezed up into place by an air-driven machine worked on the tire setter principle.

Digressing for a moment to the metal hub, we shall follow the method employed in finishing this part. Everyone is familiar with the appearance of a hub for a wheel, so no sketch is necessary. A series of turret lathes, both single and double spindle, are tooled in step-up operations, the parts progressing along the line until completion. The flange is turned, the hub bored, faced and threaded. These are the principal steps, and standard tooling is used. These hubs are completed in a separate part of the plant so that the two sections, wood and metals, do not conflict.

After the hubs have been assembled to the rim and spokes, the bolts are tightened, and the wheel passed along a chute to be painted. An automatic dipping tub is used for the painting. After this operation the wheels are shipped to whatever factory requires them.

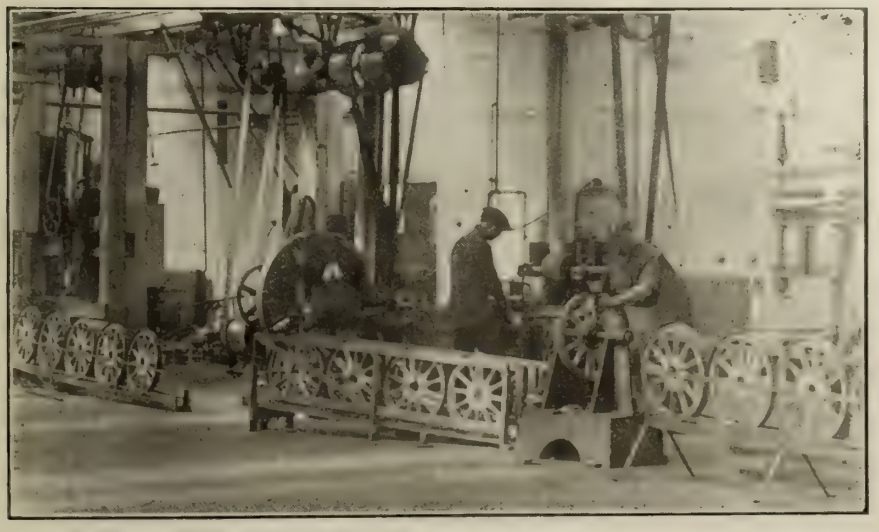
Making The Axle

In making the front axles, it must be understood that the drop forgings are made at an outside plant. The machinery operations are simple yet effective. The axle is drilled in a multiple spindle drill, and held in a jig with floating Vee blocks. The holes for knuckle pin at end, also spring pad holes are drilled at this operation.

On an ordinary milling machine the bosses on the forked ends of axle are milled to width, also the spring pads. The knuckles are machines on turret lathes, and as this merely consists of taper turning and threading we need not dwell at length on the matter. The assembly is practically a duplicate of the methods adopted in the other automobile plants discussed in this issue.

The making of the rear axle is a different proposition, and the gears used in same are not cut in Chatham, but are purchased from an outside firm. The housings are machined on lathes, and after being assembled to the tubular sections, the gears are placed in position with axle and gears, after which every axle is tested for smooth running qualities. In a general article of this nature it is not necessary to dwell on any particular operation, but rather touch on the routine. To give some idea of how much material was purchased from other Canadian firms in the making of these four lines, wheels, front and rear axles, and steering gear, we find that over one million dollars is spent yearly in Canada on miscellaneous metals and parts.

To keep production up in these varied lines, the following personnel lend their executive ability: president, C. B. Hayes; general manager, Wm. Kistler; factory manager, W. A. Wecker; sales manager, V. B. Moorey; purchasing agent, H. W. Taylor; auditor, Wilfred Peck; engineer, J. E. McCauley; supt. axles, Robert Milhiser; supt. wheels, C. Kistler; supt. rims, forgings, R. B. Craig; tool maintenance, Joseph Sullivan, and chief inspector, R. D. Evans.



Making wheels at the Hayes plant.

MAKE AUTOMOBILE BOWS

Merritt & Co., Chatham, Ont., make all sorts of bent shapes, such as automobile bows, etc., for the automobile trade. At present they are exceptionally busy, and following are some particulars regarding their plant:—

Value of plant about $60,000.00, floor space approximately 16,000 sq. ft., number of employees at present, 18, monthly pay roll $1,500.00, yearly production, $115,000.00. About 85 per cent. of their raw material comes from the hardwood regions of the Southern States.

C. H. Merritt is manager and secretary-treasurer, Mr. G. B. Merritt is president, while Mr. Amos Jacklin and James Tedford act as foremen in the factory.

SEVERAL GOOD METHODS OF MILLING SPLINES

The adaptability of the milling machine for the accomplishment of out of the ordinary jobs is shown in the illustration herewith. At the top left is shown a plain milling machine cutting a woodruff keyway in a small shaft. The vice is clamped to the table with the jaws parallel to the ways of the table. The cutter is located directly over the center of the shaft and the work is raised to permit the cutter to enter to the desired depth.

A simple method of cutting a keyway in a shaft is shown in the upper right hand view. The arbor is of the fly type, the cutter being a short lathe tool or bit of high speed tool ground to the width of the keyway required.

At the lower left is illustrated a method of cutting multiple splines. This is an interesting operation and one that would often be met with in motor service. The side cutters are used in pairs, set with micrometers to the desired spacing or key width. The work is mounted in the dividing head chuck with the other end in the tail centre. The table is adjusted so that the centre of the shaft or work comes directly in line with the centre of space between the cutters. Set the dividing head for the proper spline spacing. Raise the work to the desired height and allow the cutters to mill the first spline. Return work to initial position and repeat until milling is completed. The ridge left in the groove between the splines is removed by means of a fly cutter operated as mentioned previously and shown at the top centre.

The use of an end mill or fish tail cutter for the milling of keyways or grooves is illustrated in the lower centre view. Set the swivel vice on machine table and clamp the vice in such a position as will bring the taper of the work parallel with the ways of the table and raise the latter until the shaft centres coincide. The cutting is then performed in the usual way.

Still another method is shown at the lower right for cutting a keyway with a spline cutter. The arbor in this instance is supported by the pendant giving added rigidity to the cutter and permitting of speeding up production.

MAKES WINDSHIELDS AND OTHER AUTOMOTIVE PARTS, ALSO MIRRORS

AT THE motor Products Corporation, Walkerville, Ont., windshields and other automotive equipment are manufactured. The plant has a floor space of 50,199 sq. ft., and is valued at $400,000. The property owned is ample for future expansion, approximately 17½ acres completing the plant and yard. At present 150 men are employed and the average monthly wage is $25,000.

The principal line of manufacture is windshields and the average person would hardly believe that some 75 parts go into every windshield. Then there are several different models according to the make and type of car, so that to provide for all this, they have to be well equipped. Tubing products, stampings, hub caps, commercial mirrors, clutch disc pads, etc., form part of other lines produced. The glass used in the windshields and mirrors is imported from Belgium and England. This is cut to form at the Walkerville factory, the glass coming in large sheets of suitable size.

The rolling of tubing is particularly interesting. The metal is fed in strips of proper width, passes through a series of rollers, and comes out at the other end completely formed. According to the style of windshield, the form of tubing varies. The rubber weather strips are of Tee shape, fitting firmly into outside frame of shield. The process of rolling the different forms of tubing is identical, the only change being in the shape of rollers used. Running board moulding is also rolled in somewhat similar manner.

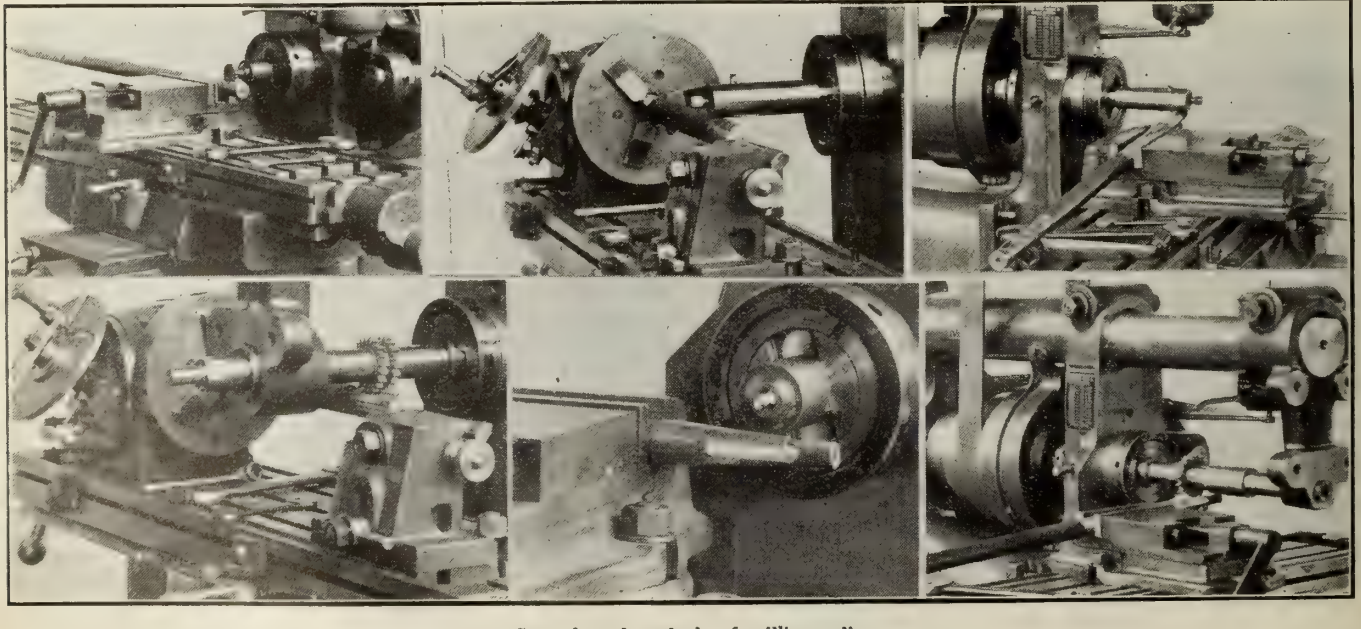
In making vision mirrors for automobiles, the small pieces of glass left over from windshields are utilized, being silvered to suit. Adjusting brackets, and other castings and sheet metal parts used on these mirrors are finished and enamelled at the plant. Other tubing parts such as radius rods for Fords, etc., are also produced.

The metal stamping section is well equipped and arranged to handle work very quickly. Steel tool boxes, robe rails, and rear curtain lights, are a few of their other lines. Close inspection is adhered to throughout the plant, and nothing is passed until absolutely correct.

H. J Stoops is general manager of the factory, E. H. Carr, office manager, and W. Thatcher, sales manager.

NEW FACTORY AT WALKERVILLE

The Timken Roller Bearings Co., factory at Walkerville, Ont., was started owing to the growing demand in Canada for this type of bearing, according to statements made by R. E. Mackenzie, of the American plant at Canton, Ohio. He says that the combined floor space of all factories in America, France, England and Canada is more than fifty acres. The Canadian plant is at present only beginning, but it is expected to develop rapidly. Mr. Mackenzie states that Canadian engineers, both in automotive and industrial machinery fields can rest assured of the same constant source of supply in Canada, as in the States or abroad.



Several good methods of milling splines.

65,000 Automobile Bodies A Year

CONTRARY to popular opinion, all automobile bodies are not completed in automotive factories. Body building is a trade in itself, and requires a large investment if reasonable production is to be secured. For this reason, several automobile factories find it much better to order the bodies from a regular body factory. Usually these are delivered in finished condition, but in some cases, the body is sent minus the finish varnish coat. Whatever plan is adopted, the task of building, ready for painting remains the same, and we will describe how the Fisher Body Co., of Canada proceeds with this work.

This firm, which has two plants in Walkerville, Ont., valued at over half a million dollars, builds practically all Ford bodies used in Canada.

In addition, they make bodies for the General Motors and other automobile concerns. As a large percentage of the building of car bodies consists in preparing the wood to size and length, they have a very large woodworking department, for between 60,000 and 75,000 bodies are finished every year. They are at present working up to full capacity, and have around 600 employees. All the lumber used is purchased in Canada, and although about 70 per cent. of the steel is bought in from the States, it is fabricated in Canada.

Wood Working

To enter into detail regarding all the woodworking operations would take a volume, for some of the parts have several operations. Enough to say that everything is shaped to standard forms, these being kept in one department on shelves similar to any pattern storage. Looking at some of the finished, peculiar shaped pieces in a body, you first wonder how they cut them all the same, but the wonder soon vanishes when you see the operation being performed.

The form holding the piece to be cut rides over a steel collar on machine. This is set a predetermined distance from the knife. The operator simply pushes the form over the collar, forgetting entirely the part inside which is being shaped, for he knows it is bound to come right.

Where the parts are large, two men usually handle the forms, and in many cases they are reversible, especially where right and left hand parts are required. That is, two rough pieces of lumber are placed in the form at one time, one at top, the other at the bottom. Then there are the curved or bent parts. These are first steamed, next bent to form, tacked in place, and set in a dry kiln until seasoned to shape.

The men work in teams when building bodies, and start somewhat after the fashion of a shipbuilder. A master frame stands on the floor, and into this the men assemble the framework piece by piece. Once this is securely fastened together, the frame is covered with the metal, that is, the sheet metal. This being completed, the upholstery is added, and the body leaves the assembly floor ready for painting. During the metalling operation, the doors are hung and other general hardware added. The doors themselves are metalled on separate assembly stands, shaped to suit the curvature of the door. This operation is generally done by one man only, and he completes a door before lifting it off the stand.

Body Painting

While there are other minor operations we have not touched upon, the important one of painting must not be overlooked. They are very proud of their painting methods, and are exceptionally careful to see that a body is absolutely clean before paint of any kind is applied. The slightest particle of grease means that the enamel will not stick to that portion, and everything possible is done to ensure against this trouble.

After cleaning, the usual wood primer is applied, also the metal primer, glaze, and two or three coats of enamel, depending upon the make of the car. The regular rubbing process occurs between each coat in order to make sure all parts are smooth and even. Nail holes, and other depressions which cannot be avoided are putty glazed to proper level before the enamel is applied. After enamelling, the bodies are dried in a large oven.

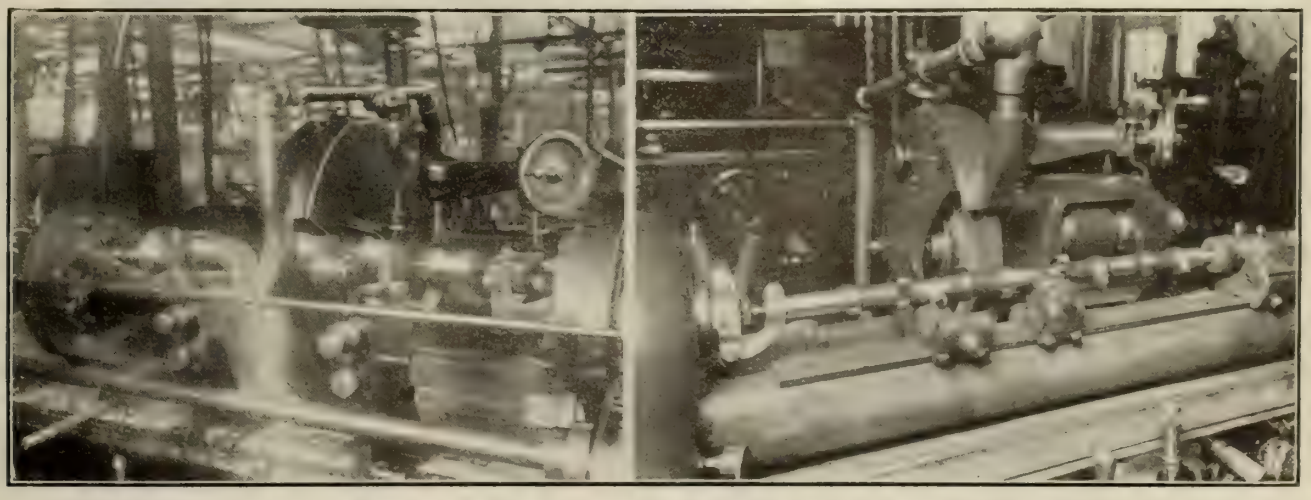
The upholstery end of the automobile business has been touched upon in another article in this issue, so no comment will be made regarding the procedure here. The making of bodies is a highly specialized business, and a tie-up in even one small section plays havoc with the schedule.

It is this thought of careful planning of operations that impresses a visitor, and The Fisher Co., here studied and mastered this phase of manufacturing. They have had nine years' experience, and in that time have made the most of their opportunities. The result is a well balanced organization, and a staff working like clockwork in the factory. Mr. Henkes is factory manager.

GRINDING CAM AND CRANK SHAFTS

Two interesting grinding operations are illustrated herewith. The view on the left shows a Mitchell crankshaft being ground in a Landis grinder. These shafts are of drop forged steel with a scleroscope hardness of 38 to 48. They are first rough turned to within 0.050 in. of finished size. The finished diameter of the pins is 2 in. with high and low limits of .001 in. The width is finished to 2.25 in. with limits either way of .0025 in. Rough grinding removes about .036 in. and from .012 to .015 in. is removed in the finish grinding operation. The machine operates at a production rate of 25 crankshafts per hour.

The view to the right shows the grinding of forged steel automobile camshafts for 4-cylinder engines. The machine used is a Landis 10 in. by 36 in. fitted with underslung cam attachment. In the roughing operation 1/16 in. of stock is removed and .010 in. is ground off in the finishing cut. The time for roughing is 8 minutes on the complete shaft and the finishing is completed in a like period of time.



Left.—Grinding Mitchell crankshaft on Landis Grinder. Right—Grinding forged steel automobile camshaft.

Safety and Production Go Hand in Hand

Mechanical Guards Provide Adequate Protection From Flying Particles of Hot Metal—Output Increased As Result of Safety Methods—Low Cost of Handling Material

IN A plant valued at $1,500,000 the Dominion Forge & Stamping Co., Walkerville, Ontario, supply to a considerable extent the Canadian automobile and allied industries with their necessary drop forgings. This plant covers nine acres and employs 200 at the present time. This is on a single shift, but during the war days as high as 450 have been employed.

The equipment in a large drop forging plant is always impressive and when you enter this factory you cannot help but realize that everyone is working with a will. When their 8,000 pound steam hammers and 3,000 pound board drop hammers get to work it is no time for pleasant conversation and the only thing you can do is to look around and make notes. When looking around however you are in no danger of being blinded by the flying particles of hot metal. Every man in this plant wears goggles and so do visitors when shown through the shops. This plant is trying to be 100 per cent. safe. The story of how goggles came to be worn generally is told on page 36 of the Canadian Machinery, May 4th issue.

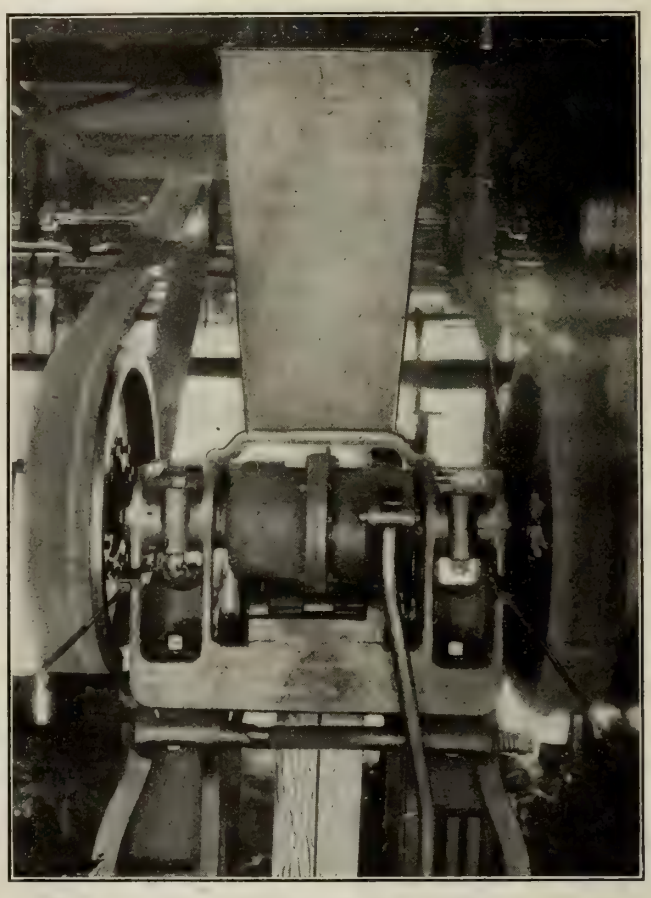
The company has systematically installed guards on every machine that it is possible to guard. A survey was made of the entire plant and every machine studied for the purpose of making it as safe as mechanical guards could make it. After the survey had been made the machines were all guarded. Board hammers were equipped with funnel-shaped boxes to catch broken boards, treadles are covered and each hammer has a suitable block for blocking the ram. Steam hammers have every known guard on them and the cold trim presses are all operated by electric tripping devices. The handling of material has been made safe by a careful study of the routine of raw and finished material and the elimination of unnecessary handling. A system of handling which combines steel boxes, barrels, crates and bins with electric trucks and hydraulic elevators, has not only reduced the number of injuries but cut the cost of handling material to a very low figure.

Not only has this company spent money in the plant to prevent injuries but it has gone outside of the plant to protect the men. Near the plant is a dangerous railway crossing. "Near accidents" were of almost daily occurrence, so the company asked the railway people to install a crossing bell. After considerable correspondence and a final refusal by the railway to provide the protection the company paid for the installation of an alarm bell. In explanation of this action the company says, "would it not be foolish to provide guards in the plant to protect the men and then fail to protect them a few hundred feet from the front door because a protective device costs $800?"

Not only has the company spent $25,000 in the past two years for installing mechanical guards in the shop and at the crossing near the plant but it has taken an active part in the public safety campaign conducted in the Border Cities.

Discipline and strict enforcement of shop safety rules play a big part in plant. The men have become convinced that the company is sincere in its efforts to prevent accidents and cooperate nicely. How important a part in the daily shop life "safety" has attained is shown in the following story: A workman reported to the safety department that a certain oiler, although he had been warned several times, persisted in oiling machinery and line shaft while in motion. The oiler was called into the safety office and asked if he had read the "safety" rules. He said he had and he was then told that apparently they did not mean much to him and that he had better read them out loud. He was given a rule book and told to read the first page out loud; "WORK SAFELY. This is your first duty to yourself, your family and your employer. There is a safe way to do every job; learn it and do it that way. Start Now." He was then told to look up rule twelve and read that out loud. Rule 12 is as follows: Cleaning and oiling machinery when in motion is prohibited.

After having read these rules he was told that further infraction might result in one of two things; that he might be instantly killed or discharged and that the manager preferred to discharge him. He was also told that he should heed the warnings and advice from the men working near him. The lesson given him that day had a lasting effect and he became enthusiastic regarding safety in his work.



Board lift drop press with protecting guard above.

The natural question, after seeing all the evidences of money having been spent is: Has all this expenditure really reduced accidents?

The answer to that question was very simple, yet effective. Four file drawers were drawn out, one each for 1918,

(Continued on page 63)

Making Springs For Various Cars

MAKING springs for automobiles is a special industry in itself. The automotive manufacturer does not care to tie up a large amount of capital in a spring plant, when he can procure all necessary springs from a factory already in operation. This practice is carried out by practically every car manufacturer, and the majority of Canadian requirements are filled at the Dowsley Spring & Axle Co., Chatham, Ont.

This plant has a total floor space of 60,000 sq. ft., and employes 140. The average monthly pay roll is about $14,000, and the yearly production would total $875,000. The ground owned covers 10 acres, so there is ample of room for expansion. About 4,000 to 5,000 tons of material is used every year, and springs are made for Gray Dort, Ford, Studebaker, Willys-Overland, and Chalmers cars. The process of manufacture sounds simple, but patient experimenting was practised before the present method was finally adopted.

Starting from the store room we have the raw stock. This is brought into one building and sheared to proper length, after which the parts are diamond trimmed, and points ground and beveled.

The eye on the large leaf is now formed, then the leafs pass to another building for heat treatment. In heat treatment, the leafs are placed in forming fires, heated to proper temperature, then on a forming jack over a tank of water. Each plate is fitted at this stage to the individual leaf of spring it has to be assembled to. In order to avoid confusion, the leafs are marked in some manner such as: 0, or 00, as the case may be. This means they would be marked, 01, 02, 03, etc., depending upon the number in the complete spring.

After this operation the leafs are reheated to 1,550 deg. F., and tempered in oil. They are next placed in the draw fire, brought to a certain heat, and peened over a block, right to standard gauges. After cooling they are buffed, and the eye on large leaf is faced on a double disc grinder. The bushing in the eye can be inserted previous to grinding if desired, but this operation is varied, and often the bushing is put in place after first forming to shape.

These steps being completed, the leafs are graphited, and clips put in place. Now comes final assembly, and once everything is locked securely, each spring is tested, then placed in stock. Note that every spring is tested, not merely one in a batch, and the test consists of similar treatment to that which the spring would get on the road when fastened to the car. They figure it is better to break the spring at the factory, rather than on the road, but owing to careful supervision, few breakages occur, even in the tests.

After the plates or leafs are fitted, they are tested to a Brinnel point of 320. This is simply a further check to see that only the best material goes into the finished product. The neatness of the entire factory is a credit to the management, for although springs are somewhat of a messy proposition to handle, the plant is well kept and arranged.

Each furnace is carefully attended to, and a quenching tank is in close proximity to each fire. Oil-fired furnaces are used, and in a year this firm uses over $40,000 worth of fuel oil. Even the bolt bill amounts to $35,000 so one can readily imagine the enormous amount spent on raw material for the springs. When walking through an automobile assembling plant, after once having seen a spring factory in operation, you cannot help but picture the workman busily bending to shape the now completed springs going into the finished car.

W. Jones, is the president of this company; W. T. Sampson the general manager; G. Hood the sales manager; G. W. Sprague, managing director and purchasing agent; C. D. Smith, Joseph Guttridge, J. A. Fisher, and G. Groome being the shop foremen in the various departments.

SAFETY AND PRODUCTION

(Continued from page 62)

1919, 1920 and 1921. The 1918 file was crammed with accident reports, the 1919 showed not quite so many, the 1920 still less and the 1921 showed a big reduction. The number of accident reports for the first four months of 1922 could be counted on the fingers of one hand. "There is your answer," we were told and, satisfied, we passed on to other matters.

So far as machine equipment is concerned they have upsetters, bull dozers, stock shears, presses of all kinds, die sinking machines, millers, shapers, planers, lathes, electric cranes, electric trucks, locomotive cranes, steam and board hammers, coal elevators and crusher. Crankshafts, cam shafts, axles, in fact all forgings going into an automobile are forged in this plant.

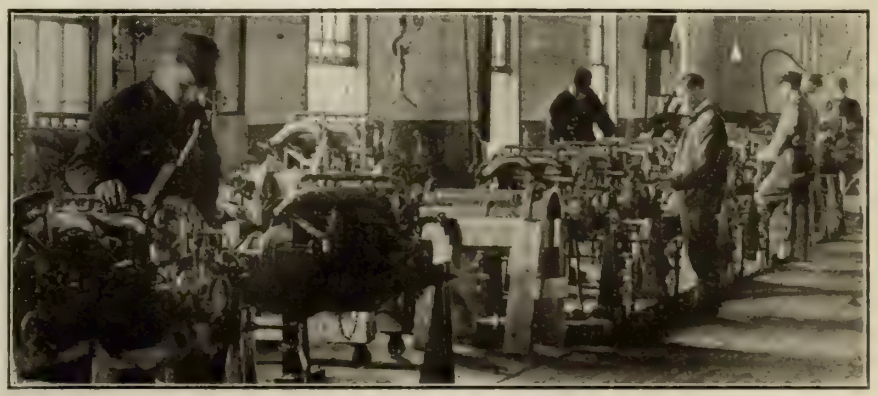
A very good method of supplying forgings to the trimming presses is in use. The parts coming from the hammers are put on to trucks, wheeled onto an elevator and raised to a gallery which completely encircles the trimming department. On this gallery floor are hopper bins and the forgings are unloaded into the bins behind the presses that are set up to trim that particular forging. The forgings are taken out from the lower opening of the bin as needed and the press man gets his supply without ever being bothered by the trucker.

An auxiliary steam plant also forms part of the plant equipment. It is of course only used when the hydro power is not available and the value of this auxiliary power was proven during the severe sleet storms of the past winter. The plant schedule was maintained while other factories were forced to shut down.

A visit to this plant clearly shows the wisdom of careful planning and expenditure of money. From the main offices to the back yard can be found evidence of careful study and wise building. The handling of all material and the comfort of the employees has received equal consideration and it all makes for smooth, efficient plant operation.

The coal situation in Montreal is gradually taking on an acute tone owing to the scarcity of anthracite in many of the yards. Dealers there are not straining themselves to renew their supplies owing to the difficulty of placing orders and the fact that freights are to be lowered on July 1.

Further steps have just been taken to again interest the government in the standardization of parts on agricultural implements. Special permission was granted to Senator A. B. McCoig to take this matter up in committee and at his solicitation another sub-committee was appointed to approach the manufacturers in regard to this matter. This new sub-committee consists of Fred Kay, Missisquoi; J. F. White, London; R. Milne, Neepawa; M. N. Campbell, Mackenzie; D. M. Kennedy, Edmonton, and J. M. Brown, Lisgar.



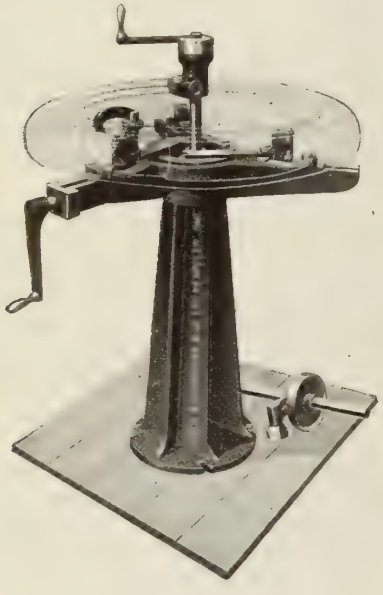
Showing Block Testing of Motors

New Things in Shop Equipment

TIRE CHANGER

One of the most recent instances in which a new line fits in exceptionally well with the regular production is that of A. B. Jardine & Co., Hespeler, and they are specializing in garage equipment—tire changers, presses, cranes and engine stands—a line which is at once co-operative with that of taps and dies, grinders, drilling machines, blowers and forges—the distinctively Jardine line of tools.

Featured in their garage equipment is a tire changer for which some outstanding claims are made. The principle of operating sliding jaws together with the compensating jaws for contracting



Tire Changer

the rim, and the rollers which operate when expanding the rim, is said to be distinctive, reducing friction to a minimum and make operation very easy on the most stubborn tire. This changer occupies floor space of 36″ x 36″ and weighs 260 lbs.

There is also in the new Jardine line a combination floor and wrecking crane, two tons tested capacity, which may be removed from its base on the floor and mounted on a truck in a few minutes for wrecking purposes. When this crane is in position to take a lift and the handle is raised, the crane is automatically locked to the floor. The floor space is 34″ x 60″. For heavy work such as trucks, there is a floor crane of two tons capacity; another crane of one ton capacity for lighter work and one of a half ton capacity for lifting engines, etc. It is equipped with wheels and ball bearing casters, enabling the workman to move the crane loaded to capacity, over the roughest floor with ease.

The Jardine line of presses includes a 42″ press with or without rack press attachment, 25 ton capacity and a 32″ press, with or without rack press attachment, capacity 25 tons. The rack press attachment is used for light and rapid work.

In Jardine crane and presses the capacity as specified is not a rated capacity but is tested before leaving the works and is absolutely guaranteed to be as represented.

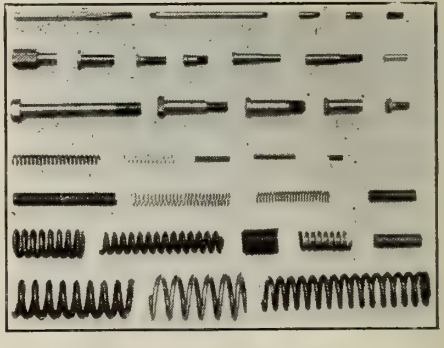
The engine stands include stationary and portable plain types for any motor including three point suspension type; stationary and portable geared for any make of engine and a stationary or portable stand to accommodate Ford and Chevrolet engines. There is also a Beuch motor support for Ford and Chevrolet engines, all having positive locking device on pivot pin.

HAND VISE LATHE

A tool of special interest to garage men has recently been placed on the market. This tool which will be known under the name Ramsdell's Hand Vise Lathe is the first successful device to enable one to make accurately from bar stock without the use of an engine lathe or automatic screw machine milled studs, set screws, cap screws, pins and many other special screws and stubs used in automotive and other machinery. Additionally this tool enables one to wind wire springs with any desired pitch. The tool is here shown cutting a chip from a bar held in the vise. The lower portion of the bar shows where a shoulder has been milled down and the end knurled by the tool. Bar stock up to and including one inch in diameter can be handled, thus enabling the operator to make hexagon head cap screws up to and including ⅝ in.; square, fillister and round head cap screws up to and including ¾ in. and flat head cap screws up to and including 9/16 in. button head up to and including ⅝ in. Other work can be handled up to and including 1 in. diameter. Any required length of screw, stud or spring can be easily made. Each set is furnished with centering bushings from ¼ in. up to and including 1 in. by sixteenths of an inch. Both standard and S. A. E. dies and taps are also part of the equipment.



Hand Vise Lathe



Parts produced in Vise Lathe

This holder is so constructed that the required die may be fitted in the upper portion of the holder and a centering bushing of the correct size in the lower portion. The distance between the center of the die and the center of the centering bushing is 9/16 in., thus giving a long bearing for the stock to be threaded. The stock to be threaded first passes through the centering bushing before being engaged by the die and it is therefore impossible to cut the thread off center. The centering bushing also prevents studs and screws being milled off center. The feeding device is hand fed, thereby allowing the operator to take a fine or heavy chip as the occasion requires. All wearing parts are machined to close dimensions and case hardened. As shown in the photograph the complete set is mounted in an attractive hinged top box with the various parts quickly accessible to hand. This tool is manufactured by the Campbell Mfg., Co., of Worcester, Mass.

CANADIAN MACHINERY
AND MANUFACTURING NEWS

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The Receipt Stamp Tax

THERE APPEARS to be among business men some doubt as to the details of the application of the new receipt stamp tax. The amendment to the budget makes it necessary for any one receiving ten dollars or over and giving a receipt for same to affix a two cent stamp to the receipt, but doubts are expressed as to whether this is to apply in the case of ordinary cash register slips.

As Mr. Fielding stated in his speech in introducing his amendments that the tax was to be similar to that imposed in Great Britain for many years past, it would seem at first sight that it would not apply to these cash slips which are not signed and which therefore legally do not constitute receipts.

The wording of his bill, however, expressly covers cases of this kind by stating that the stamp is required "whether the same (the note, memorandum, or writing) is or is not signed with the name of person."

In some cases these cash slips have the words printed on them "This is a receipt." Such a declaration by the merchant is an admission by him that he is willing to admit that any person holding the slip has paid him the sum mentioned thereon and he thereby waives any right he might otherwise have to deny having received the money by claiming that he has not signed the slip. In such a case the stamp would undoubtedly have to be affixed, as the slip is admittedly a receipt.

The point in doubt is whether it is also required when the slip is simply a record and does not claim to be a receipt. The general opinion of merchants seems to be that it is not; but judging from the wording mentioned above we are of the contrary opinion, as the words "whether the same is or is not signed" seem distinctly to imply that if any slip of paper marked with the amount paid is handed out the tax is applicable.

The tax is one which will undoubtedly bring in a considerable amount of revenue, the exact amount of which, however, it will be impossible to trace, unless special stamps are insisted upon which is not likely to be the case. For many years in England when the tax was first introduced special stamps were used, but the inconvenience caused by the difficulty of obtaining them when wanted resulted in the postage and inland revenue stamp being amalgamated into one.

Time for a Revision Downward

THE CANADIAN Railway Association, which is composed of the Canadian National, the Grand Trunk, the Canadian Pacific and various smaller corporations and branches of United States organizations, have not been slow to follow the example set by the U.S. railways in giving notice of a downward revision of wages paid to maintenance of way employes.

The reduction is not large when the high wages of railway employes compared with those in other lines of industry is considered. It amounts to approximately ten per cent. and will affect some 30,000 men or about twenty per cent. of the working forces of the lines.

Its importance lies in the tendency it will have to bring about a reduction in freight rates which is one of the heaviest handicaps from which industry in general is suffering at the present time.

Another important factor in retarding a revival of industrial activity is the failure of the building trades unions to see that it would be to the interest of the majority to agree to a revision of wages in accord with the reduced cost of living. The impetus which would be given to construction of new homes by which a reduction would provide regular work for all for a long time to come. The reduction which has taken place in the cost of building materials has already had a considerable effect in this direction, but this effect would be intensified if the unions could only see where their workers' true interests lie. Once we can get freight rates and costs of building down to a reasonable level, another era of prosperity is assured.

Make Goods of High Quality

MUCH AS every patriotic Canadian may deplore it, there is nothing to be gained by shutting our eyes to the fact that sentiment will never succeed in excluding German goods from our markets provided that price and quality are right. The plea of the Canadian manufacturer will have to be, not, "Buy my goods, because the others are German," but "Buy my goods, because mine are better or at least as good and as cheap as the others."

Under the new tariff arrangement duties will be levelled on goods basing their values upon what their value would be in Great Britain or other European countries, disregarding altogether the question of exchange.

That the Canadian manufacturer will need all the protection such a tariff can afford will be apparent when it is remembered that his chief handicap lies in the rates of pay, which are now current in Germany which are the equivalent of some four or five dollars a week at the current rate of exchange, and in the working hours which are seldom less than ten to the day without any weekly half holiday.

How the Canadian manufacturer will fare in his own markets, even with the protection of the tariff, in competition with these conditions, remains to be seen. The question as to whether he can successfully compete in the world's markets unprotected by any tariff does not appear susceptible of a very favorable answer.

The mental attitude of the workman in one of the allied countries, compared with that of the German workman is a distinct help to the German manufacturer.

The former feels that the allies having won the war, he is now entitled to the fruits of victory in the shape of an easy time with good pay. The German, on the other hand, realizes that as the loser in the game he has to pay the piper and must expect to work hard in order to do so. Unless the allied worker can be made to see the untenability of the position he is taking up the winners of victory in the field, may easily become the losers in the industrial struggle.

Steel Market Continues to Show Strength

Iron and Steel Prices Are Firm—Demand Is General and Brisk —Machine Tools Steady, Also Small Tools and Supplies—Pig Iron Quiet, Also Scrap Metals

ORE RATES AND PRICES SHOW SEVERAL CHANGES

THE Canadian steel market continues to show strength. In fact, added strength is now in evidence, with the result that prices are decidedly firm. Iron and steel bars are selling at between 2.90c and 3.00c with the small user paying the latter mentioned figure in practically every case. A few merchants are trying to boost the 3.00c price, but have not been sucessful so far. They claim it should go higher, when compared with Buffalo prices, with duty, etc., added. However, it is one thing to try and another to accomplish and the 2.90c to 3.00c quotation is likely to stand for the next few weeks at least. Even dealers admit as much, that is, those content to sell at these figures.

Practically all lines in iron and steel are brisk, but in many cases. the size of orders is not very large. However, total sales show a vast improvement.

Pig iron is quiet, but the mills are not seemingly very anxious for orders, for they are none too sure how things are going to break in the United States. The present coal strike, and the possibility of a railroad strike, has got them guessing and they seem to be playing a waiting game for the present. Prices remain unchanged.

Non-Ferrous metals have dropped back considerably during the week. but dealers feel this is only a temporary fluctuation due to an over supply on the market.

Scrap metals are quiet and no change in price, either in the above mentioned line, or in scrap has occurred. Until foundries get busier. scrap will not pick up very much.

The machine tool market holds its own, with a report of improvement from some quarters. Small tools are steady but not very brisk. There has been no change in prices of any of these lines.

Oils, waste, steel pipe, boiler tubes, and other miscellaneous lines are about the same as mentioned in last week's report, with delivery on steel pipe slow, and prices firm.

The steel market in the United States continues firm. Production is growing slightly and buying for late deliveries is increasing. Prices are stiffening and pressure for early delivery is increasing.

The present production of steel ingots represents about 75 per cent. of production capacity, but "capacity" is being forgotten under present conditions, as this no longer presents the correct viewpoint.

Premiums are usually paid when securing early deliveries and this practice seems to be increasing somewhat. Reports state that sheets have been sold August and September delivery with a price guarantee. Sellers, however, are indisposed to admit this.

Pig iron continues dull. Consumers expect a decline in prices and are disposed to stay out of the market as long as possible.

Ore prices have now declined 50 cents all round, this making the 1922 schedule the same as that obtaining in the 1917 season. Transportation matters have also been settled and freight rates from mines to lakes are down 10 per cent. The rate charged by vessels is down from 94 cents to 83 cents and these charges are included in the price of ore which is f. o. b. Lake Erie dock. Remaining charges are paid by the buyers of ore. Last season valley furnaces had 8½ cents dock charges for loading cars, plus 91 for line haul. The cost is now 8 cents and 82 respectively.

Toronto

June 21

THE steel market continues firm. Compared with last week it is even brisker and dealers feel the peak has not yet been reached.

Prices.—So far as prices are concerned, they vary accordingly to the size of order, whether the customer is an old standby and so on. For example, iron and steel bars range between 2.90c. and 3.00c. with some dealers trying to get over the 3.00c. figure. One merchant told Canadian Machinery he expected 3.15c. to prevail shortly, but such a statement has to be taken with a grain of salt. There is no question but that the market is decidedly firm, but so long as competition continues to be so keen, the 3.15c figure will not arrive for some time at least. Another merchant laughed when told of this incident and said, "Well—we keep on selling at 2.90c.

No special line seems to be featured, but rather a good general demand exists. Even the dealers are finding the going none too good, for several who have wired the mills for best delivery, have found August and even September quoted. This, of course, is no good to them but it only bears out what we said in th's letter some time ago, viz., "deliveries would soon become more extended and those requiring material should order quickly before the rise and delay occurs."

Following are present quotations. including sheets which are also in strong demand.

Iron bars	2 90 to 3 00
Steel bars	2 90 to 3 00
Reinforcing bars	2 90 to 3 00
Steel hoops	4 00
Tire steel	3 15
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in base	3 50
Small shapes	3 00
Sheets, black, No. 28	5 00
Sheets, blue ann., No. 10	4 00
Canada plates, dull, 52 sheets	6 00
Canada plates, all bright	
Galvanized Sheets, No. 28	6 00

Pig Iron—The price still remains $27.15 and there is not much material moving. The mills are not pushing sales, because with the present unsettled coal strike, and the possibility of a railroad strike, they are not anxious to tie themselves up to promises or prices. It is a case of sitting tight until they see which way the cat jumps.

Non-Ferrous Metals— Keen disappointment exists on this market, for after the strength of last week, dealers expected at least to hold their own, if not to show further improvement. Instead of that, the market has sagged considerably during the week and even the old reliable copper has also weakened. Dealers are at a loss to account for it, and the only reason advanced is probably an over supply on the market. Every merchant feels this is a temporary fluctuation and that next week will bring them back, at least, to former levels. In spite of the weak demand, however, prices have not changed and following are existing quotations.

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	6 75
Aluminum	26 00

Scrap Metals—This section is about holding its own. Prices remain the same and what demand does exist is for small quantities. Quite a spread is shown in the Montreal and Toronto scrap prices, but Toronto dealers claim they are at the correct level and Montreal too high. The Montreal figures are based on gross ton, Toronto on net. Montreal representative is investigating this matter closely and next week may see a change in that locality. Following are local quotations:

Copper, light, per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	4 85
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	11 00
Axles (wrought iron)	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axes	16 00
Mach. shop turnings	6 00
Stove plate	14 00
Cast boring	5 00

Machine Tools.— Reports vary on this market. The majority of dealers claim to be merely holding their own, while a few report improvement. Several dealers and manufacturers landed some fair contracts for some technical school equipment lately, but outside of that, the general style of order received is not for a large amount, but usually for a single tool.

Enquiries are coming in fairly good and if optimism counts for anything, there is nothing to worry about, for every merchant feels it is only a question of time before things open up.

Small Tools and Supplies—This market remains steady but shows no further improvement over last week. The demand is general and is scattered over a very wide territory.

Oils and Waste and miscellaneous—Price and demand remain unchanged. Steel pipe is also running at the same rate, the price being firm and deliveries from the mills slow. Boiler tubes are selling but not very briskly, the price being largely a question of the purchaser and quantity ordered. Nominal quotations remain the same, however, as shown on regular quotation pages. There is a possibility that nut and bolt prices may advance shortly. Nothing definite has been done as yet, but we received this from a reliable source and readers can act accordingly. Following are prices on oils, compounds and waste.

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	0 20
Palacine	0 23
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	10 80
Pure turp., single bbls. gal.	1 40
Linseed oil, raw, single bbls.	1 15

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	13
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	13	Dark colored	13
Mixed colored	14		

Montreal

June 21

BUSINESS has improved in nearly all lines of iron and steel during the week. The increased activity is largely confined to those lines that have been featured during the past few weeks as moving better than other lines. Building construction continues to be in evidence and furnishes a demand for sheets and a variety of small steel products. Merchant bars and structural steel are moving slowly. Machine tools show but little improvement. The non-ferrous metals are also quiet. Scrap metals are also rather listless.

In all lines there is still the tendency to purchase from hand to mouth. During the week inquiries were received by one local firm from two of the largest corporations in the country for small parcels of material, one was for six pounds of aluminum and the other was for a few feet of half inch diameter brass rod. This illustrates the caution that is being shown by all corporations large or small.

Activity along the harbor front, in both inland and ocean traffic, is surprising. Products of all kinds are moving in rather large quantities. In the local machine shops and manufacturing establishments business is gradually improving and with this improvement they are coming into the market for supplies in a fairly satisfactory manner.

Iron and Steel.— Shortly after navigation opened there was a very marked improvement in the demand for black and galvanized sheets. This demand continued for several weeks. Last week was a rather poor week in comparison, but again this week there has been a large business moving in these lines. One jobbing house finds it impossible to keep in stock standard sizes and gauges. They state that at present their warehouse stock is lower than it has been for months. All jobbers are enjoying a lively trade in sheets. Those British mills that are supplying the local trade are well booked with orders and in some cases there is more or less difficulty encountered in getting early deliveries. Some jobbers were fortunate enough to have booked rather heavily early in the year and are doing a big business in these lines.

Merchant bars are moving fairly well and there is a nominal demand for structural sections. Most of the rolling mills are very quiet, but they note an increasing demand for the above lines. Small steel products are moving well owing to the demand for building operations, Plates are very quiet. Railway material is quiet, and there is no material evidence that the railways are coming into the market in the near future, although they may do so with little notice at any time.

Prices remain unchanged, $2.90 being the base figure asked. The mills still ask $2.50 and $2.30 base from the jobbers and large consumers respectively. Local quotations are as follows:

Iron bars	2 90
Steel bars	2 90
Reinforcing bars	2 90
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—Little change in the pig iron situation can be reported. There is no change in the local quotation, No. 1 iron selling at $31.80. It is stated that prices have been advanced in all other sections of the country, but that owing to competition existing here no upward revision has been made. Bookings are small. The foundries are consuming but a small tonnage which is estimated at about 10 per cent. of normal.

Machine Tools and shop Supplies.—No change in the machine tool situation has occurred during the week. Sales are still of small tools only. All business is being very aggressively sought Prices remain stationary but the prospects of any material improvement in the near future are held to be remote by the local dealers as there is so much idle equipment in the local shops.

The supply business is very satisfactory. Sales in these lines are increasing of late. Keen competition exists, and although there is but little price cutting, salesmen are very aggressive. The jobbing shops are busier than they have been for months, and are responsible for the good demand. The large manufacturing plants are operating at only a small percentage of their capacity and are not a big factor in this business.

Non-Ferrous Metals.—Business in the non-ferrous metals is rather quiet. Quotations are firm but remain unchanged. The demand is somewhat better than that of last week. No large orders have been received, the business coming from all over the province, and for small lots. The local quotations are as follows:

Lake Copper	17 50
Electric Copper	17 25
Castings, Copper	17 00
Tin	35 00
Lead	6 75
Spelter	7 75
Antimony	6 50
Aluminum	23 00

Scrap Metals.—Dealers in scrap metals report that conditions remain much the same as last week. Holdings are not large and the local demand is small. Prices remain the same as they were last week.

Copper, light per 100 lbs.	10 50
Coper, crucible	15 00
Copper, heavy	15 00
Copper Wire	15 00
No. 1 composition	11 00
New brass cuttings	9 00
Red brass turnings	9 50
Yellow brass turnings	5 25
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	13 50
Boiler plate, per gross ton.	9 00
Heavy melting steel	12 00
Axles (wrought iron)	20 00
Rails (scrap)	12 00
Malleable	10 00
No. 1 machine cast iron	23 00
Pipe, wrought	7 00
Car wheel	17 00
Steel axes	19 00
Mach. shop turnings	4 00
Stove plate	19 00
Cast boring	3 50

Pittsburg

June 21

IRON and steel trade conditions have shown no important change in the past week, there being simply a continuance of the trends previously established. Production is growing a trifle, buying for late deliveries is decreasing, pressure for early deliveries is increasing, and prices are stiffening.

Production of Steel Ingots is now at a rate of about 39,000,000 gross tons a year, against a rate of about 35,000,000 tons of April 1, when the coal strike started, and a production of some 19,000,000 in 1921, that being also approximately the rate of production at the close of the year.

The present production rate of 39,000,-

000 tons a year represents barely 75 per cent. of the productive capacity, but the trade is showing less and less respect for "capacity" as developments furnish a new and more logical viewpoint. It is seen that the country is rather busy, industrially, at the present time, with nearly everybody at work, yet it is doubted whether all the steel being made is being consumed currently, and it is noted that 1912 and 1913, by far the two biggest tonnage years before the war, showed only 30,000,000 tons production each, although industry was well engaged, so that production now is 30 per cent. greater.

Just after the war, when everything was more or less in chaos, men had not gotten their bearings and simply assumed that since the steel making capacity was there it ought to operate, or business conditions would not be right. Of course there were some men with broader vision, but the attitude of 90 per cent. or more of the people was simply that there was the steel industry, called "the barometer of trade" and it had to operate or trade would be poor.

If there are any cases of consumers being unable to operate and fill their orders because they do not receive enough steel, the cases have not come to general knowledge. There is much pressure upon mills by steel buyers for better deliveries, and this pressure upon mills by steel buyers for better deliveries seems to have increased somewhat up to date but it looks as if buyers simply want to be on the safe side, fearing a curtailment in production later on account of the coal strike. The coal strike has lasted for two and a half months, and meanwhile steel production has increased by over 10 per cent.

Technically, the coal strike is two and one-half months nearer its end than it was when it began, but one cannot see any direct evidence of its being any farther along. The union operators and the United Mine Workers each occupy the same position as at the start and neither side shows any signs of weakening. Even the non-union strikes, which were not expected to last nearly as long as the regular union strike, since the non-union men have had scarcely any practice at striking, while the union miners have kept themselves in constant practice for a generation past, are almost as strong as two months ago.

In the Connellsville region there is a little more production, but hardly enough to count for anything. The strike may end next week or it may continue for months. At the beginning the predictions as to its duration ranged from two to six months, and to-day no one has a basis for changing this except to say that the strike will not last less than two and a half months, because the two and a half months are gone.

As to the total turnover in steel products, the market continues to grow less active, and this is the natural trend at this time of year, as July and August are almost invariably very dull months.

Buying for early deliveries, at the premiums that have to be paid in most cases for early delivery, is increasing somewhat, as new wants develop and cannot be met by purchases in the ordinary way. The regular manufacturing consumers who bought ahead are not placing additional tonnages to any extent.

The fininshed steel market is quotable as follows: Bars, shapes and plates, 1.60c to 1.80c; hoops and bands, 2.25c to 2.40c; blue annealed sheets, 2.40c to 2.50c; black sheets, 3.15c to 3.30c; galvanized sheets, 4.15c to 4.30c; automobile sheets 4.50c to 4.75c; wire nails, $2.40 to $2.50; standard steel pipe, 71 per cent. basing discount; tin plate, $4.75.

Mills having regular sheet mill customers in sheet bars have been covering the customers at $35, it being claimed that the sales are made for July only. Whether sheet mills that do not make their sheet bars themselves have been able to sell much tonnage beyond July is a question. There has been much talk of there being a heavy demand for sheets but it is not very clear that the demand is particularly heavy except in the case of automobile sheets, and the automobile trade of course wants its sheets for very early deliveries.

There are reports that sheets have been sold for August and September delivery with a price guarantee, either written in the contract or implied, but sellers are indisposed to admit this. A new departure in the sheet market is the disposal of sheets by consignment to jobbers in New Orleans and Birmingham, and whether this practice will grow and become common is being discussed.

The pig iron market continues very dull. Consumers, of course, expect a decline in prices when coke becomes less scarce and have been disposed to stay out of the market as long as possible. What surprises the trade is that they have been able to stay out so long, and the conclusion is that the iron foundries, as well as the smaller steel works that buy pig iron, are not as busy as are the large steel interests. Quotations, which are now largely nominal remain at $25 for Bessemer and basic and $24 to $25 for foundry, f. o. b. valley furnaces.

As reported a week ago, Lake Superior ore prices for the 1922 season have been developed, at 50 cents decline all around from 1921 prices, making the 1922 schedule the same as that obtaining in the 1917 season. Transportation matters have been settled. Freight rates from mines to the lakes are down 10 per cent., which reduces the range from the Mesabi and Vermillion ranges from 1 to 90 cents. The lake vessel rate is down 11 cents, i.e., the vessel rate proper comes down from 80 cents to 70 cents, and the dock charge at the lower end of the haul is reduced from 14 cents to 13 cents, so that the rate charged by vessels comes down from 94 cents to 83 cents. All these charges are incuded in the price of ore, which is f. o. b. Lake Erie dock, Mesabi non-Bessemer ore being $5.05, now. Remaining charges are paid by the buyers of ore. Last season the valley furnaces had 8½ cents dock charges, for loading cars, to pay, plus the line haul of 91 cents. Now they have 8 cents dock charges and 82 cents line haul.

WELL PREPARED BOOK

"Industrial Diamonds and Their Uses," is the title of a very neat and well arranged booklet prepared by Furniss-Clarke & Co., 32 McGill College Ave., Montreal, P. Q.

The pages are filled with many interesting facts regarding industrial diamonds and Canadian Machinery had the privilege of publishing this material before actual date of the book's release, thanks to the courtesy of Mr. Furniss-Clarke, general manager of the firm, who is the author.

The intention is to get a new book each month, all along the same general ines, but changing the informative matter. Thus, for the first time, those interested in industrial diamonds will be able to secure accurate information on this important subject. The books will be sent gratis to anyone requesting them.

GUELPH'S ACTIVITIES

"WE HAVE IN GUELPH, ONT., a number of industries who are manufacturing parts for automobiles," writes H. Westoby, secretary of the Guelph Chamber of Commerce. They are as follows:—

Taylor-Forbes Co. This firm manufactures engines for Ford and a number of other companies. They also manufacture door-knobs, hinges, and automobile hardware. The value of the plant would be in the neighborhood of 2½ million dollars, but the automobile portion of it could hardly be ascertained accurately.

International Malleable Iron Co. This firm makes malleable iron castings for practically all the automobile companies in Canada. The value of plant and equipment would be in the neighborhood of 1½ million dollars, but only a small proportion of this is applicable to the automobile industry.

F. E. Partridge Rubber Co. This plant is devoted exclusively to the manufacture of automobile tires, inner tubing, and rubber mats. They are capitalized at one million dollars, and give employment to about 450 men at the present time.

Guelph Spring and Axle Co. Make springs for the different automobile companies. About $150,000 would represent the outlay, and the whole of this firm's work is exclusively devoted to manufacturing springs. The number of employees in all of these factories on automobile parts would number around 750.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	41 50
Bessemer, Pittsburgh	19 50
Basic, Valley furnace	18 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 90 3 00
Steel bars, base, Toronto	2 90 3 00
Iron bars, base, Montreal	2 90
Steel bars, base, Montreal	2 90
Reinforcing bars, base	2 90
Steel hoops	4 00
Tire steel	3 15
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 40 3 50
Chequered floor plate ¼" and heavier	5 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 70
Tank plates, Pittsburgh mill price	1 70
Structural shapes, Pittsburgh mill prices	1.60
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2.38
Structural shapes	2.48
Plates	2.48
Small shapes under 3-in.	2.38

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 00
Electric copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	35 00	34 00
Spelter	7 75	7 25
Lead	6 75	7 00
Antimony	6 50	7 40
Aluminum	23 00	21 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE—WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15.30
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	65.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	84.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.27	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 9 50	$ 8 50
Copper, crucible	13 00	11 00
Copper, heavy	13 00	11 00
Copper, wire	13 00	11 00
No. 1 machine composition	10 00	9 00
New brass cuttings	7 50	6 00
Red brass turnings	8 00	6 50
Yellow brass turnings	5 25	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	13 50	11 00
	Per Ton	Gross
Boiler plate	$9 00	$ 7 00
Heavy melting steel	12 00	10 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	12 00	11 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	23 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	19 00	15 00
Mach. shop turnings	4 00	6 00
Stove plate	19 00	14 00
Cast boring	3 50	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., corru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in. x 4 in. and larger	$28 00 to $30 00
Open-hearth billets	28 00 to 30 00
O. H. sheet bars	29 00 to 30 00
Forging billets	32 00 to 35 00
Wire rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

ROPE AND PACKING

Plumbers' oakum, per cwt.	6 30
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	60
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	**less 50-60**
Taps, hand, under 1"	**less 40-50**
Chucking reamers	30 off
Hand reamers	**25**
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	**plus 40**

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	**$4.50 base**
Hexagons and flats	$5.00 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 40	$5 00
Sheets, blue ann., No. 10	3 80	4 00
Canada plates, dull, 52 sheets	5 50	6 00
Can. plates all bright	7 00	
Galvanized sheets, No. 28		6 00
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis. 28 B.W.G.	7 00	
Gorbal's Best, No 28...		
Colbornes Crown. No. 28.		
Premier, No. 28, U. S.	6 45	6 00
Premier 10¾ oz.	6 00	6 40
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	18.00	$
1¼ in.	20.00	
1½ in.	19.00	
1¾ in.	20.00	
2 in.	19.00	16.00
2¼ in.	22.00	19.00
2½ in.	25.00	19.00
3 in.	29.00	24.00
3½ in.	34.00	26.80
4 in.	43.00	34.25

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royaline, per gal., bulk	20
Palacine	23
Machine oil, per gal.	33
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal.	1.40
Linseed oil, raw, single bbls.	1 10

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets, 24 gauge and heavier, base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White	18	Dark colored	13
Mixed colored	14		

This list subject to trade discount

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Copper Bars, ½ to 2 in	$29 00	$28 00
Copper wire, list plus 10..		
Plain sheets, 16 oz., in. 30 x 72	30 00	29 00
Copper sheet, tinned, 14 oz.	37 00	36 00
Copper sheet, planished, 16 oz. base	42 00	41 00
Braziers', in sheets, 6 x 4 base	30 00	29 00
Copper tubing, seamless		29

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 00
Sheets, 3 1-2 lbs sq. ft.	8 50	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 25	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.15
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

Production of Steel—Iron Ore to Finished Product

Production Methods Past and Present—Sales and Purchasing Philosophy—Relation Between Purchasing Agent and Salesman —Study of Human Nature Essential, Also Co-operation Between Both Parties

By GEORGE A. SIMPSON

IT IS NOT often that purchasing agents have the opportunity of listening to such an able talk as was given to them the other evening at their monthly meeting in the Board of Trade rooms, Royal Bank Building, Toronto, by George A. Simpson, vice-president of Dominion Alloy Steel Corporation. Mr. Simpson described in a non-technical way, the production of steel from the iron ore to the finished product. He first told of his start in the steel industry in England, mentioning how, as a boy, he went to sea, being an apprentice on a sailing ship, later, on leaving the ship how he happened to get into a small town which had a rolling mill, and being on his uppers, and a fairly good scholar, he applied for a position in the mill.

To use his own words, he did not secure a position, but a job. He started in as a weigh boy, that is to say, he weighed puddlers' iron, and for this he received the princely wage of $1,-75 per week. From then on, he tried his hand at about everything around the mill, including firing boilers, running engines, working around the hollow fires, puddling furnaces, etc., etc., until finally he was operating the steam hammers.

Mr. Simpson very ably described the old time method of making steel, and told how the gangs used to work around the open-hearth furnaces. He pictured to those present, men picking up the scrap by hand and throwing it into the furnace until the charge was complete. He next branched out into the modern method of making steel and without any actual illustrations successfully pictured to everyone present a modern steel mill. Instead of the old time method of charging, he described the new charging machine which is operated by one man. He told how the huge ram runs in and out, picking up a box filled with scrap and pushes it into the furnace, turns it over emptying the scrap into the furnace and returns for another box. In the course of his remarks he mentioned that from fifty to sixty tons of metal could be charged in this manner in a fraction of the time that six or seven tons of scrap could be handled in the old way.

Handling of Ores

His next step was to carry his hearers on to Pittsburgh and other places in the United States where he had worked in the steel mills. All this was exceedingly interesting and he talked to his fellow-laymen giving them a chance to understand in a non-technical manner what he was picturing to them. He then took up the subject of ores and mentioned that at present, the largest percentage of ores used in the making of steel in Canada comes from the United States. He felt that later on with our wonderful mineral resources we might be more dependent on Canadian ore.

After describing the general appearance of the different ores, and how an enormous tonnage was loaded into boats at Duluth and other points in a few hours for their trip down the lakes to the places where they were unload-



GEORGE A. SIMPSON,
Vice-President of the Dominion Alloy Steel Corporation.

ed almost as quickly, how the ore was placed into steel cars for delivery to the furnaces, he mentioned how it came into the furnace yards in a rough looking state, later going to the blast furnace. He went on to describe what a blast-furnace consisted of, and how the burden was placed into the furnace previous to melting. He told how the ore, coke and limestone were charged into the furnace and in a very simple yet efficient manner took his hearers into the interior of a blast furnace. By the time he got through one could almost picture the material being melted.

He also commented on the great care that was taken in supplying the proper mixture, that is. to put in the proper amount of the various ingredients. In fact, he said, it reminded him of a druggist mixing up a prescription, so much of this and so much of that in proper proportions. "You have to put in at the top of the furnace what you hope to take out at the bottom," remarked Mr. Simpson. He then described the old method of casting pig iron when they used to tap the furnace and allow the molten metal to run on to the casting floor and be cast in molds in the sand. He pointed out how much labor was wasted and the large floor space that was necessary for that operation. He next explained the modern method, showing how the molten metal ran direct from the furnace into large ladles, how a locomotive took this molten metal over to a big casting machine which in appearance is very much like an incline railway going up to a considerable height and equipped with an endless sprocket chain to which are attached cast iron molds.

He pictured how the molten metal was poured into these molds, carried up to the top, sprayed with water, then dropped into a car underneath, later being quenched by means of a hose. This report is of course only a mere skeleton of the details into which Mr. Simpson took his hearers. He next described the making of open-hearth steel, explaining how basic pig iron was made, how the ladles were taken to the open-hearth furnaces and so on. He mentioned that a tilting mixing furnace was used when the furnace to be charged was not ready for the hot metal coming from the blast furnace. He showed how this modern method was very much ahead of the old time system, and he so thoroughly explained that there is no appreciable loss of heat as the material passes along, in other words, it is a more direct process and a great saving in time, heat and labor.

Stripping The Ingot

He also explained the Bessemer process and gave a very interesting talk on some experiences he had met with in the various steel mills. He mentioned several important men in the English steel industry whom he had met and taken through American mills, and one striking coincidence was the fact that, when the members of the British Iron and Steel Institute visited the United States as the guests of the American Iron and Steel Institute, he directed a party of English iron masters through the Homestead mills ,and one of the party was a part owner of the mills in which he, the speaker had worked in England as a boy. Thus he had the privilege and satisfaction of showing his former employer one of the largest and most modern steel mills in the world.

From then on he described how ingots were cast, stripped, taken to the

soaking pits and later to the blooming mill to break them down. Again he emphasized the fact that there was very little heat lost in the process, everything being done in sequence so that the greatest efficiency would result. He next pictured the type of rolling mills used, how the ingot was placed on the roll tables and how the men up on the deck, or pulpit as it is called, operated by means of levers a huge roller table which carried the ingot to and fro to the rolls. He caused quite a bit of laughter by remarking that boys could easily handle an ingot weighing from two to three tons unaided where by the old method twelve or fifteen men would be struggling with bars and hooks around a one ton ingot, in other words, said Mr. Simpson, "the modern steel mill is very much of a man-less proposition. You can see the material passing along but very seldom do you see many men around. It is largely a mechanical proposition and the wizardry and bigness of it seems to fascinate and hold those who became connected with the industry."

He went on to describe how the ingots rush through the rolls back and forth and so on until eventually they were reduced to the desired size for further work.

He explained the operation of the flying shear and how it came down at exactly the proper time and cut off the billets to the proper length. After this operation the billets go out into the yard until they are assigned to the various departments to make bars or whatever products in finished form are to be turned out.

He then, in a brief manner described a modern rod mill, how the automatic furnaces were arranged, and how the material being heated in the furnaces was passed through various sized rolls until it would come out the proper size at the finishing end of the operation. He told how this modern method is away ahead of the old method and mentioned that even the material was weighed on a scale after completion, and as the desired amount rested on the scale it clicked and sent the rods or bars down to be bundled, packed and tied, to be later on forwarded to the customer.

He also described the making of wire, and the production of sheets, and mentioned how the sheet bars were sent to the rolls, and told how the sheets were re-heated and doubled. He mentioned that sometimes finished sheets were rolled four at one time and after being sheared, opened up quite easily. He described how this hot rolled sheet was a little rough and how the cold rolling operation polished it. He explained that a one-pass cold-roll and box-annealed sheet meant that the material had been passed once through the cold roll, and later was packed in a large cast iron inverted pot and placed in an annealing furnace. He also described blue annealed sheets and different other grades and the purpose for which they were used. He touched on several other important lines and operations connected with the steel industry which unfortunately we have not the space to describe.

Taken in all, the address was one of the finest talks on the steel industry from start to finish we have ever listened to. After concluding his talk on the steel industry, Mr. Simpson accepted the invitation of the chairman of the meeting to speak to the purchasing agents as a master salesman to the purchasing agent. As our readers are well aware, Mr. Simpson was sales manager for the Steel Company of Canada for many years and can speak with authority on the subject of salesmanship, and this he did, and we feel sure that never before have purchasing agents received so much first-hand information and in such a candid manner.

Relation Between Salesmen and Purchasing Agent

Mr. Simpson told them what he thought the proper relation should be between a salesman and purchasing agent. He stated that he did not know of any two bodies of men who could exert a greater influence to bring about a higher standard of business ethics than the purchasing agents and salesmen. He mentioned that if he were going to be a purchasing agent, the first thing he would do would be to take a course in the study of human nature, "as I believe," he said, "that is one of the greatest essentials of a successful purchasing agent. Know your man, and you will then know whether to place confidence in him or not. Many a purchasing agent has lost thousands of dollars to his company through not watching this very important point.

"The salesman may not be aggressive but he may be sincere," continued Mr. Simpson, "and he may be trying to give you the very best price and conditions to which you are entitled, but through lack of confidence and knowledge of human nature you may lose an opportunity to put through a profitable deal for your company.

"I realize," continued Mr. Simpson, "that you often meet a salesman of the other type, and there again your good judgment and careful study of human nature comes in.

"Never hold a club over the other man's head," said Mr. Simpson, "it is a false and unsound position to occupy. The purchasing agent and salesman should work together in absolute harmony, and the utmost confidence should exist between them. Once you secure the co-operation of the salesman you cannot reckon in dollars and cents the value it will be to you. He will assist you in getting material when you most require it. Sometimes when other sources have absolutely failed."

To prove this point the speaker cited various instances where had it not been for the salesman, the material on orders which was badly needed would not have come through in time to help the manufacturer out. In fact he showed convincingly that plants would have been closed down had it not been for the salesman interceding in behalf of the purchasing agent.

Without going into any further detail on this subject, sufficient to say, the speaker left the impression with his audience, that the salesman should receive the greatest consideration from the purchasing agent, and that in turn, if the purchasing agent did give the salesman his co-operation, he, in, turn, would get the very best price and service possible. According to Mr. Simpson's philosophy, the bond of confidence between the buyer and the seller should be so sound that open orders, "Best Price and Terms" should be the rule, rather than the very extreme exception. He pointed out that in many cases the salesman can be developed into a profitable source of information for the purchasing agent, and that in turn the purchasing agent can often furnish the salesman with information of great value to him. "In other words," said the speaker, "if they work together, they make an ideal team and a mutually profitable one."

After Mr. Simpson had concluded his remarks a vote of thanks was moved and seconded and a hearty round of applause was given to the speaker. The chairman of the meeting in closing said, "Mr. Simpson, it is seldom we have such an interesting and well-attended meeting, and I cannot remember any other meeting where at least a few of our members did not leave before the conclusion of the address. You will notice to-night that no one left the room, which I think is a decided compliment to you." We can heartily concur with the chairman's remarks as the entire address was a very interesting one from our point of view.

MOTORS IN CANADA

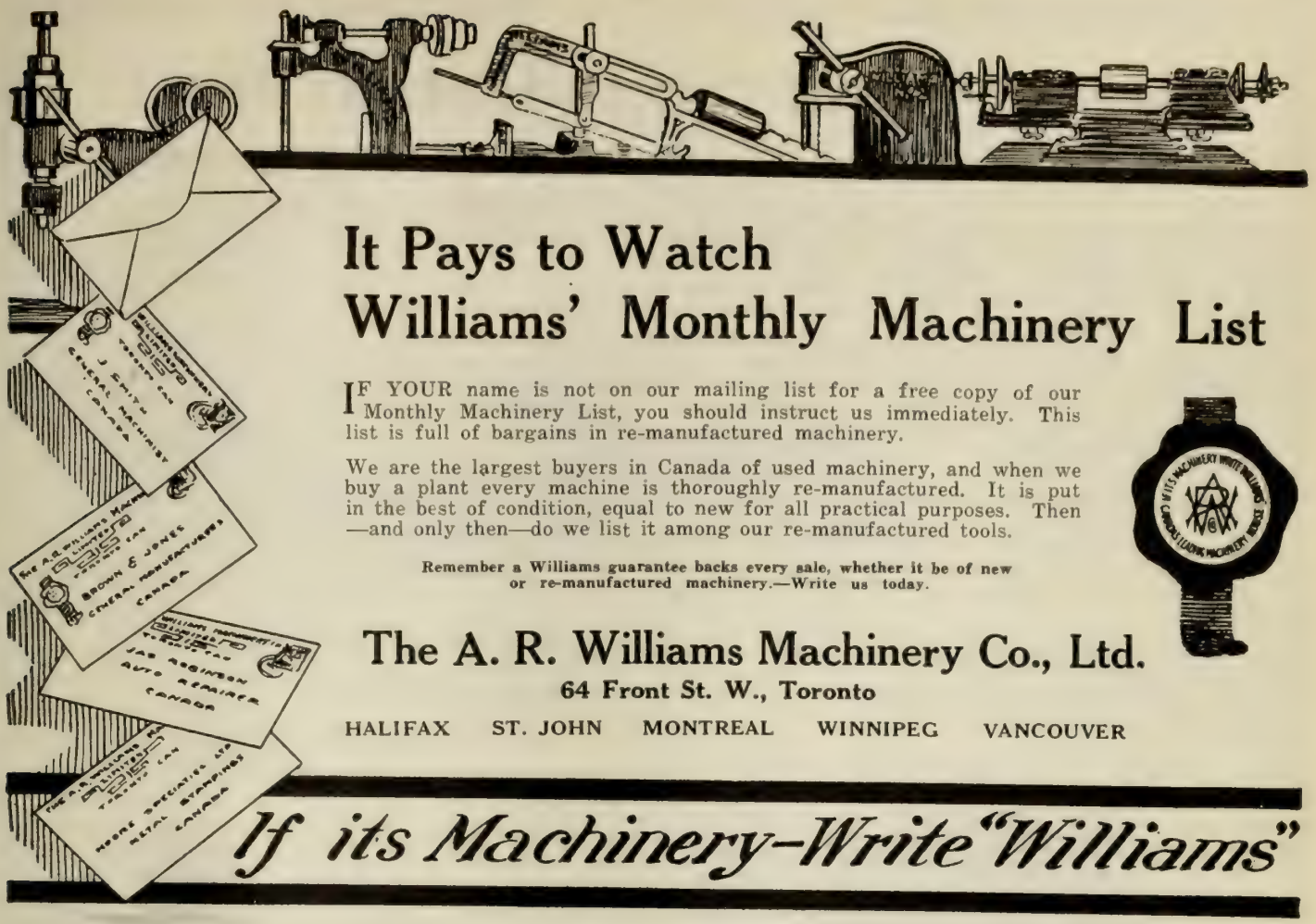
There are at present about 500,000 motor cars in Canada, and with a population of approximately 9,000,000 would figure out at one motor vehicle for every eighteen inhabitants. The report of the Dominion government bureau of statistics shows that in the last year over 60,000 new motor vehicles have been licensed. "The most surprising increase," said a provincial government official, "occurred in the western provinces. Saskatchewan, which but a comparatively short time ago was a playground for the buffalo, to-day has 62,638 motor vehicles, mostly automobiles. Manitoba has 40,430, Alberta 38,750, and British Columbia 31,000.

ONTARIO'S MOTOR CARS

Below are the official figures of the number of motor cars now operating under license in the Province of Ontario:—

	Owned by Farmers 1920		Owned by Farmers 1921	
Pas. Cars	155,861	57,429	181,978	64.045
Trucks	16,204	1,273	19,554	1,859

Increase—Passenger Cars 26,117
Trucks 3,350



It Pays to Watch Williams' Monthly Machinery List

IF YOUR name is not on our mailing list for a free copy of our Monthly Machinery List, you should instruct us immediately. This list is full of bargains in re-manufactured machinery.

We are the largest buyers in Canada of used machinery, and when we buy a plant every machine is thoroughly re-manufactured. It is put in the best of condition, equal to new for all practical purposes. Then —and only then—do we list it among our re-manufactured tools.

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64 Front St. W., Toronto

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

PURCHASE MAJORITY OF MATERIAL USED FROM CANADIAN FIRMS

NO matter what Canadian-made car you drive, ten chances to one the upholstering in it, and the top which covers your head from the blazing sun, was made at the Walkerville, Ontario, plant of the American Auto Trim Co. The more you investigate the automotive industry the more you find it consists of a number of specialized trades, of which trimming is a very important one.

In this plant, which has a total floor space of 160,000 sq. ft. and is valued at a million dollars, we find 350 employees busily engaged in turning out all upholstering parts for a car such as seats, side curtains, tops, etc. Canada receives considerable benefit from this industry because about 80 per cent. of the material used, is purchased in Canada. This includes springs, fabrikod, bows, cardboard, webbing, felt pads, nuts and bolts, tacks, glass, paints, hardware, cotton bats, burlap, etc.

Not only are the various upholstering units made in this plant, but they are also assembled to bodies, these being painted at a later stage and shipped practically in finished condition to various automobile firms. Ford bodies are the feature but other types made are Maxwell, Overland, Dodge and some General Motor work.

The average monthly pay roll is about $35,000, and this year they expect to produce 70,000 auto tops, and 50,000 bodies completely upholstered. Of the 70,000 tops made, about 60,000 of these will be used on Ford cars. The plant is roughly speaking divided as follows: The first floor consists of stock room and offices, and the stock room is admirably well kept. A large number of parts go into the upholstering of a car, but everything is labelled and close tab is kept on the quantity on hand. On the second floor the tops are trimmed. Cutting benches, sewing machines and general trimming equipment are also on this floor. The third storey is used for the first stages of painting while the fourth is used for painting and rubbing. The fifth floor is a sort of general storeroom.

The method of making what is known as a combination binding and cushion welt is very interesting. This welt is the material which goes around the edges of cushions, seat upholstering and so on. The material, in large widths, first passes through a Cameron cutter. This has a series of knives which cuts the material into strips of proper width. After passing through the machine, these strips are wound on a reel, and are taken from the machine to a bench where several small reels are made into one large continuous reel, the ends being glued to make an endless strip.

The next step is to take the goods to the welt forming machine. The material from the large reel passes over hot glue rolls, into a forming die, goes through still further until it meets with a line of good heavy twine, which is so arranged that the cord passes with the material through finishing rolls, and is formed in with welt. This makes a good strong binding, and of course, as the material has passed over hot glue rolls to start with, the pressure of the finish form roll glues everything together securely.

Another operation is the cutting to shape of the different upholstering parts. An electric knife is used, and from 50 to 85 thicknesses of material can be cut at one time. Large rollers at the end of cutting bench, which is extremely long, holds the upholstering fabric. The workmen get a hold of the end of this, walk the length of the bench, then cut off at the roll. This leaves one layer, and the performance is repeated until sufficient layers rest upon the cutting table.

The layout man now takes his standard forms, or templets, places these on the top sheet of fabrics, and proceeds to mark off as many as possible on the area of material presented. Careful thought in this matter has resulted in very little waste, and where possible any fabric left over from the cutting of larger parts is used for smaller pieces.

News From the Industrial Field

A contract for the construction of twelve miles of railway west of Rimbley, Alta., has been given to W. A. Dutton of Winnipeg. The cost will be approximately $225,000.

The general contract for the erection of a pulp mill at Three Rivers, for the Three Rivers Pulp and Paper Co., has been awardd to Thompson Starrett Co., 910 Drummond Bldg., Montreal. The cost will be about $4,000,000.

McDonald Construction Co., Pickford & Blacks Wharf, Halifax, has received the general contract for the construction of the trestle for railway cars and pockets for Geo. T. Vanbuskirk Co. of Halifax.

The Dominion Bridge Co., has secured the contract for the steel work in connection with the $180,000 factory to be erected for the Western Clock Co., at Peterboro.

Lower prices of building materials have stimulated home building in Fort William and many residences of the $5,000 type are being erected. A year ago this type of building would have cost approximately $1,000 more.

The steamship W. Grant Morden, of the Canada Steamship Lines, cleared from Fort William last week for Buffalo with a cargo of 450,000 bushels of wheat. With wheat at $1.23 per bushel her cargo represents a value of $553,000.

Rapid progress is being made by the Barnett and McQueen company in the construction of the two million bushel capacity concrete elevator for the Northwestern Elevator company, in West Fort William. The grain storage tanks are fifty per cent. completed and the contractors expect to finish their contract early in August.

Fire loss in Fort William for the month of May totalled $20,541.50, the principle item being the loss incurred in the fire which damaged the plant of the Northern Engineering and Supply Co., to the extent of approximately $18,000, including building and stock.

The Fegel's Construction Co., Fort William, have been awarded the contract for the construction of a concrete and brick grain elevator for the Pillsbury Flour Mills Co., at Atchison, Kansas. Material is now being assembled and erection will be commenced immediately.

W. H. Bischoff has rejoined the staff of the Dominion Iron and Steel Co., and will take the office of general superintendent. For the past three years he has been with the Lubin Iron and Steel Co. of Coatesville, Pa., prior to which he was assistant superintendent to H. E. Price at the Sydney plant of the Dominion Iron and Steel Co.

Winnipeg, Manitoba.—In the year 1921 there was a total of 38,566 tons of binder twine available for consumption in Canada, of which 16,176 tons were manufactured in Canada and the remainder imported. The value of binder twine and rope manufactured in Canada last year was $6,297,142; exports $1,194,475. Imports were valued at $7,372,691, while the value of total available for Canadian consumption was $12,475,358.

Ottawa.—The tender of Alex Garvock in the sum of $294,782 on the masonry, brick and carpentry work for the new civic hospital was accepted by the city council and the contract awarded at that figure. The council also awarded a contract for a five-ton street flusher to the International Harvester Co., at $9,240.

Ottawa.—The last of the saw mills in the Ottawa Valley got under way on Tuesday, June 6, when the Shepard and Morse plant commenced operations, giving employment to about 165 hands. The opening of this mill was postponed about a month on account of high water, which, early in May, caused the breaking of several log booms owned by the company.

The Board of Trustees of the Ottawa civic hospital will recommend to the city council that the contract for the electric wiring of the new hospital be let to Fred Wilson at $33,527, that the contract for heating and ventilation be let to W. G. Edge Ltd., at $105,581, and that for the plumbing and drainage to The Garth Co., of Montreal, at $111,000; these being the lowest tenderers for the work.

Shawinigan Falls, Quebec.—A machine building to house two newsprint machines, each of which will have a width of 228 inches, is being erected by the Belgian Industrial Company here. Only one machine will be installed at the present time and it is estimated to have a daily capacity of 80 tons. The expenditure involved in the erection of the building will be about $1,000,000.

Ioco, B. C.—The town of Ioco has sprung into existence in a single year through the location of the Imperial Oil Company's refinery here. Where a little more than twelve months ago was a tangled jungle more than one hundred modern residences have sprung up. The town is practically completed with all modern conveniences installed and operating. The company's wage disbursements at the refinery now total $750,000 a year.

Nelson, British Columbia.—The Consolidated Mining and Smelting Co., has announced the immediate commencement upon the construction of a 500 tons concentrator at Kimberley. The plant will be ten times as large as the largest concentrator in the Kootenay country with the exception of that at Trail and will cost more than $1,250,000. It is expected it will be ready for operation early in 1923.

Toronto, Ontario.—During May construction contracts awarded in Canada, according to McLean's Building Reports, Ltd., amounted to $34,827,300, compared with $29,428,400 in April and $26,859,500 in May, 1921. This is the second largest monthly figure on record since 1914. The value of contemplated new work reported during May was $28,871,500.

BUSINESS FOUNDED OVER THREE GENERATIONS AGO

(Continued from page 44)

Coming to the assembly line, we find that they follow the recognized style of Automobile Assembly, viz., rivet the frames at their plant, then start assembling to these frames the springs, axles, etc. There is no need to go into the assembly step by step, as that has already been explained in another article in this issue.

The process is practically the same. The motors are then assembled to the frame, and electrical units added. Before placing the engine on the chassis it is tested on blocks as shown in one of the illustrations accompanying this article.

Once the frame is complete, the body is placed in position, after which a test run is made. Special runways have been effected which are so inclined that the car gets an actual hill test. Every car tester is an inspector, and without his O. K., the car is not allowed to pass. During the assembly process periodical inspections also take place, and should any defect occur it is instantly removed. When a car is sent to the shipping department it must be ready for the owner to drive.

To show the importance of this industry to not only its locality, but to Canada, the following figures are appended. Every year this firm pays approximately in wages, buys from other Canadian firms, goods valued at approximately one million dollars and keeps in employment in Chatham alone, about 700 men. This last figure includes other firms making material for use in the finished car. Robert Gray is president and general manager, William M. Gray, vice-president and general manager, while J. Fairbrother attends to the sales end of the business.

Right on the Lead



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100% Geometric

Nothing but Geometrics in the Buffalo shop where these two jobs are done

160 of the Large Pieces Turned and Threaded Each Day.

100 an Hour of the Smaller Pieces.

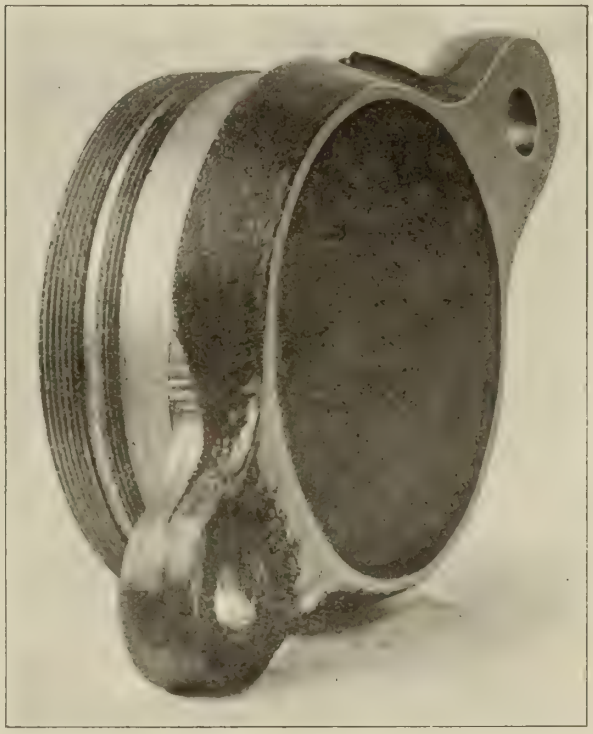
Turned Off 1/16 Oversize and Threaded, All in One Operation.

Not Alone Are They Pleased With This Work, But Believe It Very Wonderful

All Other Die Heads and Taps Have Been Discarded There

Geometric Self-Opening Die Heads and Geometric Collapsing Taps are in use on the turrets of all makes of Screw Machines and Turret Lathes.

Ask us more about them



THE GEOMETRIC TOOL COMPANY

NEW HAVEN **CONNECTICUT**

Canadian Agents:

Williams & Wilson, Ltd. Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S., Vancouver, B.C.

Montreal, P. Q.—G. and J. Weir (Canada) Ltd., have just completed in their local shops two large boiler feed pumps, which are to be shortly installed in the new Mount Royal Hotel, where they will feed the two thousand boiler horse power that is being installed there at the present time.

W. M. Tilley, K. C., of Toronto, has been appointed a director of the C. P. R., filling the vacancy caused by the death of Sir John Eaton. Mr. Tilley has been filling the position of consulting council for the railroad from the time the office was created in December, 1918.

Announcement has been made that the Lyall Construction Co. of Montreal have obtained the contract for the continued construction work on sections 3 and 4 of the Welland Canal. Prior to the letting of this contract the work had been carried on by day labor under contract of Quinlan Robertson Co.

Plans for a unique bridge to span the Detroit River, between Detroit and Walkerville, have been prepared by Dennis H. O'Meara, a Detroit engineer. The bridge specifications are highly interesting as they call for large office buildings at both approaches to the bridge the stores located in the piers. The bridge will have a width of 125 ft. and will cost in the aggregate about $40,000,000.

Montreal, P. Q.—Two Canadian Goverment Merchant Marine steamers are at present in Montreal Harbor laid up. These are the Canadian Ranger and Canadian Rancher. Four other Canadian Government Merchant Marine steamers have been laid up for some time past, but are about to be commissioned for trips to Glasgow, Cardiff, and Swansea.

Montreal, P. Q.—The Bailey Meter Co. Cleveland, Ohio, opened up a Canadian factory in January 1922. They have well established themselves in the last six months, sales have been increasing and the outlook for the future is considered very bright. Practically all parts are made in the local factory, only a few being imported from the parent works. It is hoped to soon have the shop arranged to take care of all the manufacturing, and the range of meters covers the complete range of boiler requirements.

J. R. Burpee, of the firm of D. C. Burpee and Son, Devon, M. B., has just returned from a trip to Presque Isle, Me., where he successfully negotiated a contract for the rebuilding of the power plant of the Maine and New Brunswick Power Co. at Aroostook Falls. He also secured contracts for the construction of four miles of railroad for the Aroostook Valley Railway Co. It is estimated that the value of the contracts will approximate $200,000. D. C. Burpee and Son have recently completed the construction of the substructure of the new international bridge across the St. John River at Edmundston.

The manufacturers of pulp and paper in Canada have gone on record through the Canadian Pulp & Paper Association as being in favor of a general reduction in freight rates. Their statement which goes into the matter very fully is based on eight separate claims, and is now filed with the select committee of parliament dealing with the problems. It favors a revision of freight rates to the levels that were prevalent prior to September 13th, 1920, which it is declared would still allow the railways to charge rates approximately 42 per cent above those in existence before the war.

Montreal, P. Q.—On Saturday morning, June 10th, 225 representatives of the Rochester N. Y. Chamber of Commerce, with other guests from that city as well as representatives of various Montreal Trade Organizations, were the guests of the Montreal Harbor Commissioners on the Steamer "Three Rivers" for a tour of the harbor. The guests gathered about ten o'clock Saturday morning at the foot of McGill St., and boarded the steamer. The tour included a trip down the whole thirteen miles of harbor front, with an inspection of the cold storage plants. The grain handling facilities, as well as the cold storage capacity, were points of particular interest to the visitors.

Ottawa.—Building permits for the month of May more than sustained the promise of activity in the building trades indicated in the earlier months of the year. For the first five months of 1922 the total has now passed the two million dollar mark. In May 189 permits were issued calling for new construction having an estimated cost of $867,351, which is an increase of $625,201 over the corresponding period in 1921 when 96 permits were issued. The total for the first five months of 1922 is $2,017,296 with 461 permits granted as against $1,000,385 on 245 permits in the same months last year. Thus the increase this year for the five months period over last spring is approximately one hundred per cent. both as regards the number of permits issued and the estimated value of new construction. The largest permit issued during May was for the new Hydro Electric plant to be erected on the corner of Carling Avenue and Bank Street which will cost in the neighborhood of $181,000.

Montreal, P. Q.—At the session of the Dominion Council of the Navy League held recently in Montreal, Mr. Sam Harris, the newly elected president, expressed himself in no uncertain way along the line of Canada's need for increased foreign trade. He stated that he would like to see the Navy League a real factor in promoting this branch of commerce. He concluded his remarks by stating that he was perfecting plans to provide an advertising ship for Canadian goods. He hoped that he would be able to make arrangements to have this ship tour the seven seas and act as a national marine drummer for the Dominion. He stated further that he believed the move would prove worth its weight in gold to Canada in trade returns, and he hoped to see it sail on its advertising trip before another year had passed. The visiting members of the Empire often asked him why Canada did not extend her trade. The only answer to that question, he thought, is that it was due to apathy. Leadership is needed and the Navy League is now going to give this leadership in a practical way.

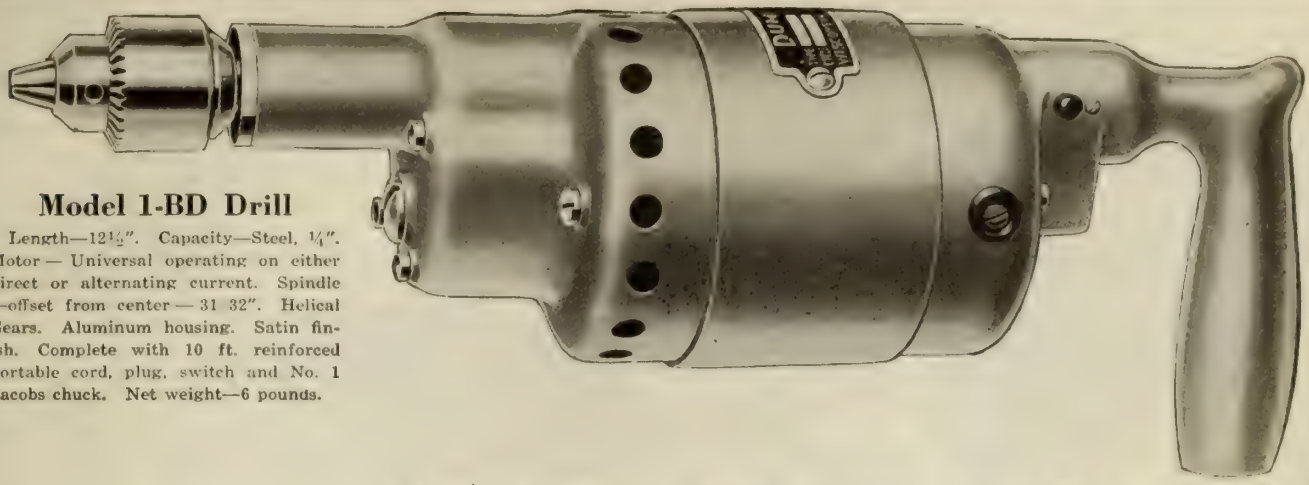
A new era in the use of airplanes for forest and similar air observations was marked recently, by the arrival at Lachine of the Amphibian Viking airplane of the Laurentide Air Services, recently organized, which stopped off for a short time on her way to Northern Ontario to engage in Government service in aerial observation and photography work for the Ontario Government. The Amphibian Viking is the first flying vessel of her class to reach Canada and represents the latest thing in post-war airplane construction both as to the plane itself and its engine. The machine has a capacity for four or five passengers with a pilot and a quantity of baggage in addition. It has a speed of over 100 miles an hour and when in a hurry can do better than this. It is equipped with a 450-horse power engine of the Napier Lion type which is the latest British type of airplane engine.

Montreal, P. Q.—The Montreal Tramways recently conducted a large number of its employees, including executives and many members of its various office staffs, over its different properties in the city. The sub-stations, power houses, shops and barns were visited and the general functioning of these various units explained. The greatest interest was manifested in the Youville shops, which are completely equipped for the entire construction of cars. At present no car building is in progress but the shop is taking care of all repairs and of the installation of the various pieces of accessory equipment that are rapidly being standardized on all up-to-date tram cars. At the shops it was learned that about 900 cars are in daily use in the city of Montreal.

The trip was planned with a view of educating the office staff of the Company so that they would better appreciate its varied activities and could take care of their various duties in a more intelligent manner.

WORKING TO CAPACITY

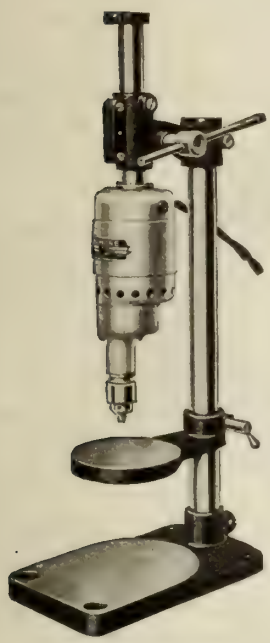
The Auto Specialties Mfg. Co., Windsor, Ont., was opened for business in August 1920, and has since developed rapidly in the making of malleable iron castings. Their plant covers approximately 60,000 square feet, is built of concrete and steel, equipped with labor saving devices and up-to-date machine equipment. A varied line of castings is made for agricultural, railroad, and automotive industries, and production has been up to capacity now for some months.



Model 1-BD Drill

Length—12½". Capacity—Steel, ¼". Motor — Universal operating on either direct or alternating current. Spindle —offset from center — 31 32". Helical Gears. Aluminum housing. Satin finish. Complete with 10 ft. reinforced portable cord, plug, switch and No. 1 Jacobs chuck. Net weight—6 pounds.

Handy—Efficient—Powerful



Model 2-BD Bench Drill

Motor specifications identical with Model 1-BD.
Height—20½".
Stroke—3¼".
Rack and pinion feed.
Capacity—Steel, ¼".
Drills to center of 7⅞" piece. Ball Bearing thrust. Aluminum housing. Adjustable table. Complete with 10 ft. reinforced portable cord, switch, plug and No. 1 Jacobs chuck. Net weight 21 pounds.

DESIGNED by men who know the practical advantages of small, light tools that get to the spot where needed without waste of time, Dumore Drills save time, money and energy. Equipped with perfectly balanced motors, Dumore Drills are accurately built and have an almost unlimited range of usefulness. For speed and accuracy on fine and sensitive jobs Dumore Drills will supplement the work of your big machines—adding to the capacity of your shop and cutting down production costs on many classes of work.

Send for details of how you can use Dumore Drills to advantage.

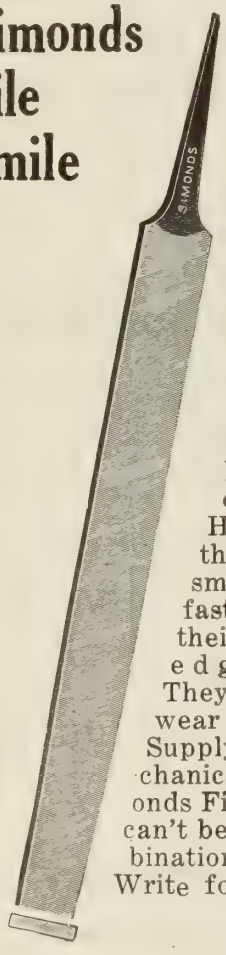
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DUMORE GEARED ELECTRIC DRILLS



The Simonds File Smile



A good mechanic is pleased when he has Simonds Files. He knows that they cut smooth and fast and hold their cutting edge longer. They will outwear other files. Supply your mechanics with Simonds Files and you can't beat the combination.
Write for prices.

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PROSPECTS FOR BUSINESS IN VARIOUS COUNTIES

JAMES WEIR of the firm of G. & J. Weir, Glasgow, Scotland, was in Montreal recently visiting the Canadian headquarters of his firm's activities. Mr. Weir has almost accomplished a trip around the world in the interests of his business. He states that industrially France is in good condition, and that she is in a fair way to come out of the reconstruction period stronger than ever before. Germany has less unemployment than any country Mr. Weir visited. He says that labor is putting in long hours and that it is well paid. A large number of the skilled workmen have acquired their own residences since the war. The number of home owners is increasing very rapidly among the industrial workers and thrift is everywhere in evidence among the factory workers, and in practically every instance the savings of the family are invested in homes or other ways equally as safe.

Mr. Weir had occasion to visit Italy, as an Italian firm had offered to sell their plant to his firm. Conditions there were very bad, as far as the metal working industries were concerned, and for that reason it was not deemed advisable to extend manufacturing activities in that country at present.

In India prospects for better business in his line were good. In the Straits Settlements and Burmah conditions were very encouraging. Several large pumping installations were inspected by Mr. Weir. His firm had not only manufactured the pumps but had been called in, in an advisory capacity, to discuss the various propositions, which were to pump oil great distances. One installation called for pumps to force oil through several hundred miles of pipe across a desert. The Weir pumps were handling the work satisfactorily.

In Japan this company have an extensive manufacturing establishment, for the last two years has been very busy, and only now is running into the trade depression that made itself manifest in America two years ago. It was stated that for several years the Weir Co. had done ten times the business in China that it had done in Canada.

Mr. Weir was very enthusiastic about the radical improvement that had been made in the parent factory in Glasgow. Automatic machinery and labor saving devices had been installed in every department of the works. In the foundry it is now possible to employ girls to take care of the major part of the moulding operations. Costs had been cut in two in some departments, and in no place were greater savings made than in the foundry. The firm were now ready to make a considerable reduction in quotations on their product. For the first time in the history of the firm the parent plant was making certain parts cheaper than the Japanese plant and these parts are now being shipped to Japan. Mr. Weir's impression was that business was now on the upgrade.

RUST NEUTRALIZER

The American Chemical Paint Co. of Philadelphia, Pa., state that they have perfected a system whereby such work as automobile bodies, or any materials that are soldered, metal finished and painted, may have these operations performed with a minimum amount of rust to be removed in the paint room. This process has been in the course of development for several years and has finally reached the point where it has become an economical and commercial asset. The process consists in a special soldering flux called Flosol. One of its advantages, it is claimed, is that it both cleans and fluxes at one operation, and that it is no longer necessary to use raw acid to remove the rust and dirt, or to scrape the surface with an abrasive. It is claimed that work soldered with this flux is practically free from cells and pockets which break during the painting operation. Flosol is neutralized by a weak solution of Deoxylyte for the purpose of preventing oxidation before it can actually form. It is claimed that this property of neutralization of rust formation eliminates the possibility of defects under the paint.

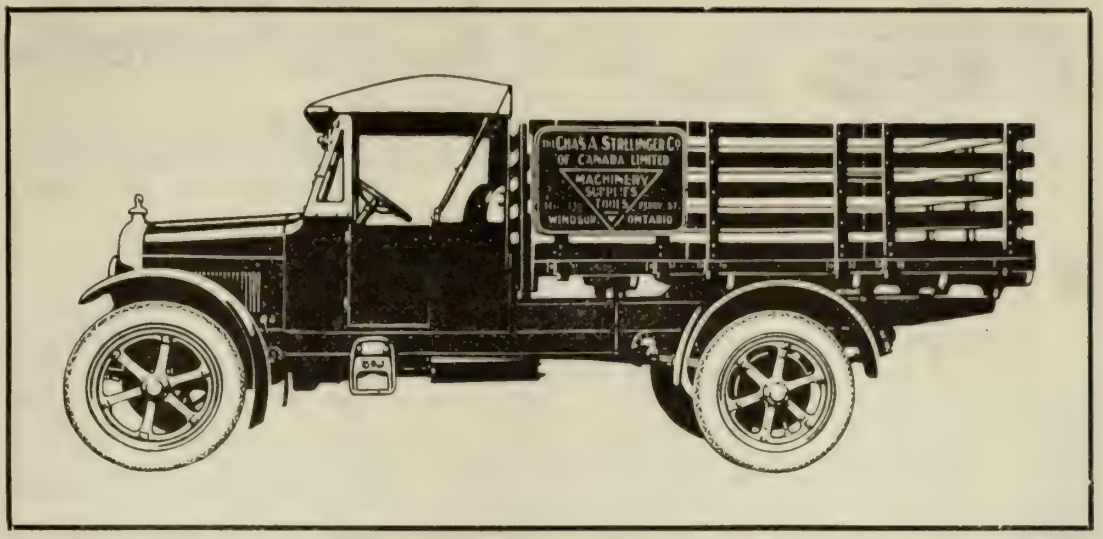
JOIN ADVERTISING FIRM

Major W. J. Baxter, on June 15th joined the directorate of McConnell & Ferguson, Limited, advertising agency, at London, Ont. Major Baxter was born and educated at Windsor, and left the city editor's desk of the old Windsor Record in 1914 to take a commission as lieutenant in the 18th Battalion. After distinguished services in France, where he was awarded the Military Cross, and on demobilization, he became secretary of the Essex Border Utilities Commission. He resigned in March, 1920, to take control of the advertising department of the Ford Motor Co. of Canada, which he now gives up to join the staff of McConnell & Ferguson, Limited, where his wide experience should be of great value to advertisers in general.

DURANT ACQUIRES WILLYS PLANT

W. C. Durant, head of the Durant Motors Co., has purchased the plant and holdings of the Willys Corporation of New York, for the sum of $5,525,000. It is reported that the object behind this move is to acquire a ready equipped plant for the manufacture of the new Star car, plans for the building of which have been completed.

The recent report of Elmer C. Dover, asst. sec'y of the treasury at Washington, on existing business conditions in America, after a tour of 22 States, was of a very encouraging nature. Mr. Dover's trip was made to survey conditions, and conferences were held with prominent business men. He is reported as having told the President that, in his many conferences, he had not heard one dissent from the general opinion that business was picking up rapidly.



G&J

Built for heavy loads and fast hauling, G & J trucks above all else are profitable hauling units. They pay their way from the start.

Their rugged durability insures a running life of 100,000 miles and more, which spreads their cost over many years. 20 to 25 miles from a gallon of gasoline - 250 miles from a quart of oil (on the one ton Speedtruck) tells the story of their economy.

The organization which builds the G & J is amply well financed. They have made a heavy investment to insure efficient, economical manufacturing, and the permanency of the truck.

Any G & J dealer, and factory branches in Montreal, Toronto and Hamilton will be glad to furnish the facts on what G & J motor transportation will do for your business. *Write for a folder.*

Factory Branches:

TORONTO	MONTREAL	HAMILTON
242-244 Spadina Ave.	*142-144 Bleury Street*	*20 Charles Street*

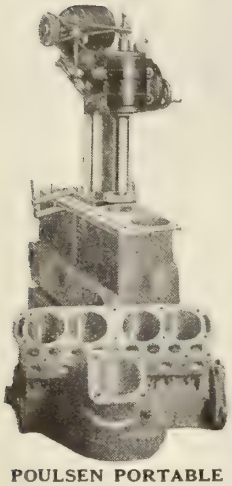
GOTFREDSON TRUCK CORPORATION
LIMITED
WALKERVILLE ONT.

Made in Canada

Here's Something

of Interest to Every

Auto Repair Shop or Garage



POULSEN PORTABLE

A portable Cylinder Grinder for regrinding cylinders—will also grind them without removing engine. Self centering—operated from light socket. Will grind cylinders perfectly round and parallel. Space will not permit to give you details. We have a circular which outlines fully, we'll gladly send you or would be pleased to talk over personally the possibilities of this machine in your shop.

A. POULSEN & CO.

21 Arthur Ave. S.

HAMILTON - ONTARIO

Expert
Drafting Office Service

Special Jigs and Fixtures
and
Machinery of all Kinds.

With our special knowledge of the automotive industry we are in a position to give the highest form of service. Send us your sketches or samples and we will save you time and trouble.

E. N. Gougeon (A.S.M.E.) **T. J. Tubielewicz**
E. G. Rousseau

364 University St. - Montreal, Que.

The Lion and The Mouse

DO YOU remember reading in the school books about the great big lion who was caught and trapped in a gigantic net by hunters? Then along came the little teeney mouse who nibbled away at the netting and was successful in setting the lion at liberty again. The net was too strong for the lion to break but the constant nibbling of the mouse, breaking mesh after mesh, was able to perform the seemingly impossible.

A person who is not subscribing to CANADIAN MACHINERY is in exactly the same circumstances as the lion imprisoned in a corner—not being able to enjoy the freedom of expanding his capacity for knowledge.

CANADIAN MACHINERY acts as the mouse. Week by week it will give information—which, on account of the lack of it, has tied you up in an industrial way—will nibble away the meshes, one at a time, that are keeping you from getting the results you want.

Ask us to send you a sample copy. It will not obligate you and it will be a pleasure to us.

CANADIAN MACHINERY,
143 University Ave.,
Toronto, Canada.

Please send me a sample copy of your paper and oblige.

Name .....

Street Address .....

Province..... Occupation.....

This Tire Fact is Certain --DUNLOP Dominates

Dunlop Tires can be bought at your nearest Garage. Note the word *nearest*. We sell to every legitimate dealer—play no favorites. That means not less than 7,500 Garages or Tire Dealers throughout Canada are prepared to look after your tire needs immediately.

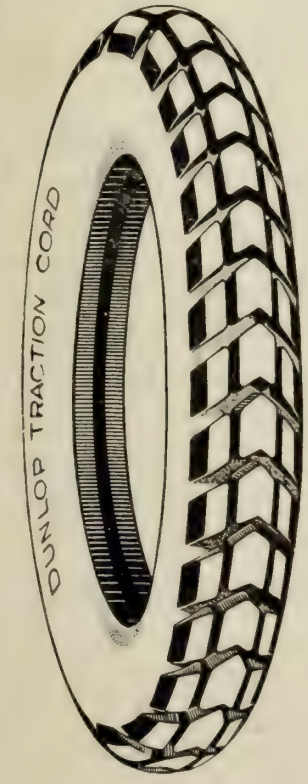
Sometimes when in quest of a tire you are advised to try this place or that place. Not so with Dunlop. *If he sells tires he stocks Dunlop.*

Because Dunlop Tires have a greater distribution than any other make, they have become known, not only as

The Tire That's Easiest to Get

But

The Tire That's Easiest to Get Mileage Out Of



If you want concrete evidence of just how good Dunlop "Cords" or "Fabrics" are to-day, turn this fact over in your mind:—

All Mileage Records in Canada Have Been Completely Eclipsed This Year by Dunlop Cord and Fabric Tires

Dunlop Tires, with Dunlop Extra-Heavy Tubes, challenge the world for Mileage, Comfort, Safety, Endurance and General Appearance.

Dunlop Tire & Rubber Goods Co., Ltd.

Head Office and Factories: Toronto

Branches in the Leading Cities

DUNLOP TIRES
CORD AND FABRIC
Master Mileage Makers

ANNOUNCING *the wonderful*
REGO "LITTLE SIX" OUTFIT

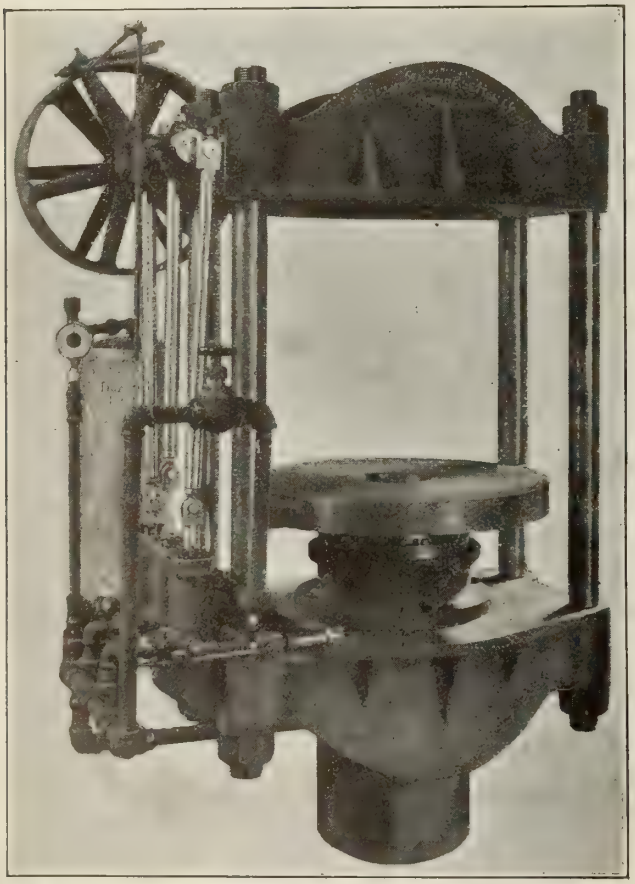
It Welds Everything in Connection With Cars, Trucks and Tractors

It consists of a welding, cutting, carbon-removing, battery, and lead-burning outfits, complete in a carrying case for the special price of $75.00 f.o.b. Toronto.

We will instruct how to operate this plant, free of charge. No garage or machine shop is properly equipped without one of these outfits. The REGO torch does not flash and is the most economical torch on the market.

Send for a descriptive folder. Place your order NOW, as there is a big run on the market for these outfits.

THE CARTER WELDING CO. OF TORONTO
LIMITED



Cast Steel and Structural Steel Presses

250 Ton Cast Steel Presses for putting on and taking off Rubber Tires

Our Shop Facilities enable us to build Presses of the highest efficiency, cast steel or structural, 100 to 300 tons, promptly and efficiently.

Modest Profits; Quick Service; Plus Maximum Value, are the Watchwords of our Success.

If you want more for your money than you have deemed possible in the past, tell us about your requirements. We will convince you.

Special heavy Machinery built to order.

YOU KNOW US,—we are the manufacturers of the famous Rochester Helve Hammers, West Tire Setters and Hub Banders, also Excelsior Rim Tools.

The West Tire Setter Co., Rochester, N.Y., U.S.A.

GARLOCK MACHINERY'S LIST

of Metal Working Machines in Stock for Immediate Shipment. Prices Right.

SHAPERS

No.

MILLING MACHINES

671 1 Briggs, Type A, 22" traverse Manufacturing Miller.
2089, 1050, 1062, 3 Chicago Pedestal type, Hand Millers.
2088, 2088A, 618 3 Standard Pedestal Type Hand Millers.
1061 1 Garvin No. 2 Pedestal Type Hand Millers.
1072 1 Barber-Coleman No. 3 Tread Miller.
2075, 2086 11 Burke No. 1 Hand Millers, bench type, table 12 x 3½.
2087 1 Toledo Hand Miller, table 23" x 5".
876 1 Plain Dividing Head for No. 3 Miller.
1055, 1056 2 Pratt & Whitney 4½" x 12" Thread Miller with C/S.
642 1 Castellating Attachment for Miller.

BENCH LATHES

1029 1 Hardinge (Cataract) 7" x 32" Bench Lathe with head and tailstock, compound rest, plain rest.
734 1 Hardinge (Cataract) 7" x 32" Bench Lathe, with head and tailstock, compound rest, plain rest chasing attachment.

PRODUCTION LATHES

2005, 2012 8 Leblonde 17" x 8' Heavy Duty with C/S.
1098, 2004 6 Leblonde 17" x 6' Heavy Duty with C/S.
2013, 2016 3 Leblonde 17" x 6" Rapid Production with C/S.
2017 1 Reed 14" x 6" Extra Heavy Duty with C/S.

HACK SAWS

661 1 Peerless 6" x 6".
951 1 Perfect No. 3 6" x 6".

TURRET LATHES

1031, 1040 4 No. 3 Foster, capacity 1 5/8 in. spindle C/S.
1041, 1043 3 No. 2 Foster, capacity 1 1/16 in. Spindle C/S.
2023, 2043 20 16" x 16" Bliss Heavy Duty.
2044, 2054 10 No. 2 Foster with round turret, capacity 1 1/16 in. spindle, C/S.
2055, 2058 3 No. 3 Foster with round turret, back geared capacity, 1⅝ in. spindle, C/S.
2061, 2065 4 No. 3 Foster with hexagon, turret, back geared, capacity 1⅝ in. spindle C/S.
2065 1 J. & L. 15" Turret, round turret, 1¼" hollow spindle.
2067 1 16" x 6' McGregor-Gourlay Turret Lathe.
2068 1 18" x 6' McGregor-Gourlay Turret Lathe.
2069 1 20" x No. 4 Bullard with hexagon turret.
2070, 2070a 2 16" Warner & Swasey Geared Head.
2073 1 17" x 6" Davis Lathe with round turret.
819 1 Oliver 18" Turret with C/S.
818 1 B. & O. 16" Turret with C/S.
815, 816 3 Davis 24" Turret Lathes with power cross feed.
1 Warner-Swasey Turret Lathe No. 6.

GRINDERS

590 1 Bench Type Double End, two stop cone pulley on spindle, no C/S.
1079 1 Wells Toolroom Grinder.
1067 1 Bench Type Double End, single pulley on spindle no C/S.
1069 1 Gardner No. 24 Grinder.

GRINDERS—(Cont'd)

1070 1 Double End Emery Grinder on pedestal, two step cone pulley on spindle, 1" dia. spindle, C. S.
2109, 2110, 2 Perfect No. 6 pedestal Grinders.
2117 1 Sellers 5/16 x 3" Drill Grinder.
898 1 Lafayette Universal Motor Driven Tool Grinder for lathe work.
1064 1 Symington Plain Grinder C/S.

DRILLS

1 Reed Four Spindle Drill Press.
1048 1 Barnes 15" Sensitive.
1065 1 Perfect 14" Sensitive.
1085 1 Perfect 15" Sensitive.
954 1 Edlund 15" High Speed Ball Bearing Drill Press.
675 2 Woodward 4 Spindle Drill Presses.

SCREW MACHINES

1057, 1058, 1059, 3 Acme No. 55 4 Spindle Automatics.
1093, 1094 2 Garvin No. 1 Wire Feed C/S.
2071, 2072, 2 Warner & Swasey No. 6 with geared head, automatic chuck C/S.

ENGINE LATHES

1047 1 Cincinnati 16" x 8' D.B.G. screw feed, chuck, 2 face plated C/S.
1073 1 L'Blonde 17" x 6" S.B.G., Q.C.G. rapid production rod feed, chuck, face plate, C/S.
1038 1 13" x 5" Lathe Chuck face plate and C S not screw cutting.
1081 1 Leblonde 16" x 6' S.B.G. Q.C.G. chuck, face plates, Screw Feed, C/S.
1082 1 Hamilton 16" x 8' S.B.G. Q.C.G. screw feed chuck, face plates, C/S.
2018 1 Stevens 16" x 6' Engine Lathe screw cutting C/S.
2019 1 McGregor-Gourlay 16" x 7" Engine Lathe, screw cutting C/S.
2020 1 Stevens 16 x 8 Engine Lathe, screw cutting C/S.
2021 1 Stevens 18 x 8 Engine Lathe, screw cutting C/S.
812 1 Putnam 36 x 18" S.B.G. Screw cutting, face plates C/S.
810 1 McKechnie-Bertram 20" x 10'. S.B.G., face plates C/S.
666 1 Rae 18" x 8" D.B.G Q.C.G. face plate C/S.

BUFFING MACHINES

051-3, 3 Perfect 36" Pedestal Type 1¼ Spindle.
627 1 24" Perfect 36" Pedestal Type 1" Spindle.

TAPPING MACHINES

1063 1 Ricker Schaufer ⅜ Friction feed.
733 1 Burke Bench Type, horizontal ¼" capacity.
602 1 Burke Bench Type horizontal ¾" capacity.

PRESSES, PUNCHES & SHEARS

944 1 Greenard No. 3½ Arbor Press.
742 1 Niagara No. 3 Arbor Press, pedestal type.
741 1 Niagara No. 3½ Arbor Press, pedestal type.
822 1 Stiles No. 172 Punch Press.
1020 1 Bench Type Punch.
1021 1 Bench Type Shear.
2108 1 Toledo No. 57½ Back Geared Power Press, 4 tee rods, 12" stroke, 140 tons cap. 6" Crank shaft, 24½" between uprights weighs approximately 35,000 lbs. Also a number of Bliss Inclinable Presses.

BLOWERS

A number of Buffalo, Sheldon, Soot Blowers of varying sizes and capacities.

PUMPS, ACCUMULATORS

834 1 Vertical 2 plunger, hydraulic 2½" dia. x 6" stroke 1¼ inlet and d charge.
813 1 Northey Duplex, 6" x 4" x 7".
780 1 Goldie-McCulloch, 2" suction 1½" discharge.
799 1 Smart-Turner 4½" x 2¾" x 6".
2090 1 West Tire, No. 3, 2 cylinder plunger pump.
2091 1 Gould Triplex Plunger Pump.
2092 1 Perrin Triplex Plunger Pump.
2093 1 Small Size Two Plunger Pump.
2119 1 Hydraulic Accumulator, 6 x 8 ram, capacity 10 Imperial Gallons, 1500 lbs.
2137 A number of lubricating pumps for use on Lathes, etc.

MOTORS AND ELECTRICAL EQUIPMENT

1031 1 Lincoln 20 H.P. 3 phase, 60 cycle, 220 volts. 1200 r.p.m. with base and pulley.
634 1 Can. Allis-Chalmers 5 H.P. 3 phase, 60 cy. 550 volts 1200 r.p.m. with base and pulley.
2096 1 Robins & Myers ½ H.P. 1 ph. 25 cy. 110 volts.
2097 1 Westinghouse 50 H.P. 3 phase, 25 cy. 550 volts with base and pulley.
2096 1 Chapman Walker 40 H.P. 3 ph. 25 cy. 550 volts with base and pulley. 750 r. p. m.
1 Westinghouse 35 h.p. motor, 3 ph. 25 cy., 550 volts, with base and pulley.

MISCELLANEOUS

2099, 2102, 3 Strong-Carlisle-Hammond Continuous Annealing Furnaces, 22" long x 3" x 2½" opening.
2103 3 Strong, Carlisle-Hammond Furnaces
2106 for heating drop forge work.
2127 1 Brown Pyrometer 2000° Fahr.
2153 2 Southwark Hydraulic Physical Test-
2154 ing Presses, 2000 lbs. per sq. in. pressure, 2 column type fitted with intensifier ram, revolving table guard and suitable drain basin, mounted on pedestal and arranged for single lever control.
2155 Metalwood Hydraulic Testing Press similar to above.
1032 1 Jardine No. 50 Power Hammer.
1019 2 Sand Riddles.
946 1 Bellevue Oil Furnace.
888 1 Gas Furnace, 12" x 15" x 8" two burners, size of door opening 1"x8".
689 1 Gas Furnace 18 x 11½ x 8" 2 burners, door opening 10 x 8.
2113 2 Bertram Stenciling Machines
2114 Steel.
2115 1 Holden Morgan Stenciling Machine.
2116 1 Burring Machine.
2118 1 Four pt. tapalog complete (Wilson-Maulin.)
2121 3 Brantford Counter Scales
2123, 2124, 2125, 2 LeVilbiss No. 13 S.M. 152 Internal Varnishing machines.
Quantity of Wood Split, Steel Split Pulleys, Hangers, Belting, various sizes
1 Blacksmith Forge.
1 small Anvil.
1 Barrett 15 ton jack
1 Garvin No. 1 Slotter.

GARLOCK MACHINERY LIMITED

Montreal **TORONTO** **Winnipeg**

163 Dufferin Street

Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

The old established firm. Patents everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.
FETHERSTONHAUGH & CO.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine work—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

FOR SALE

"RICARDO" ENGINES, PETROL OR PARAFfin, excellent for marine, commercial or stationary use. Brand new. 100 h.p. 4-cylinder, 150 h.p. and 250 h.p. 6-cylinder, 300 h.p. 12-cylinder, Thirty shillings per horse-power sterling London. Sykes, Patching, Sussex, England.

FOR SALE:—COMPLETE EQUIPMENT FOR small machine shop, consisting of 16" Davis screw-cutting lathe, hack saw, shaper, drill, buffer, grinder, and forge. Will sell reasonably and terms to responsible party. This is a snap for someone starting in business. Would sell separately. Apply Box 811, Canadian Machinery. (C23M.)

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings; Capacity 15 tons per day. Expert Metal and Wood Pattern Work. Our advice and estimates will save you money. Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US.
THE KATIE FOUNDRY, GALT, ONT.

REGO
WELDING
and
CUTTING
APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co.
of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524

ATTENTION
AUTOMOTIVE PARTS MANUFACTURERS
Will sell or license new process for the manufacturer of gears which produce highest accuracy and lower production costs 50 per cent. Two large concerns in the States already using it and others negotiating. Address Box 813 Canadian Machinery.

SITUATIONS WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c28m)

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium and heavy work, green and dry sand. Bench, floor and machine molding, melt by analysis, and thoroughly competent on cupola practice. Good reference. Box 804, Canadian Machinery. (C11M.)

WANTED

MACHINERY SALESMAN WANTED, SPEAKing English and French. Apply Electric Motor and Machinery Co. 417, St. James St., Montreal, Que.

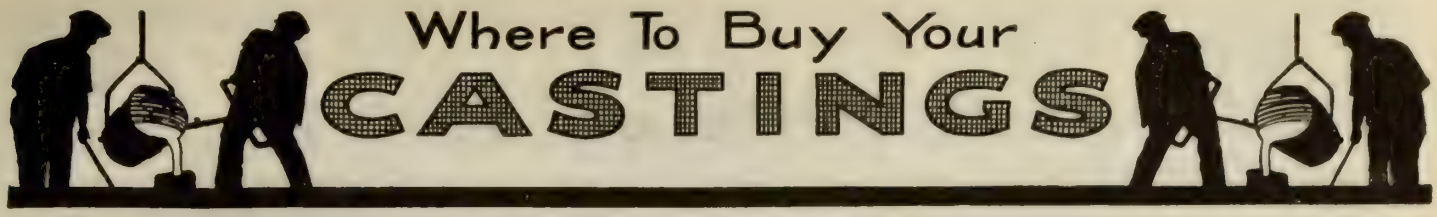
CASH REGISTER WANTED—SINGLE DRAWer. Receipt printer. Must be in excellent condition. Box No. 807L Canadian Machinery.

Do You Read These Advertisements?

Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force can not replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every week will keep you posted on the latest developments for machinery equipment.



The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

HANNA

HANNA

M.A. HANNA & CO.

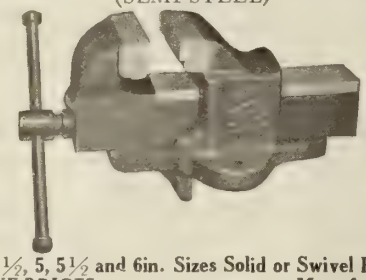
Chicago Toronto Cincinnati
Pittsburgh Buffalo Detroit
Philadelphia New York Toledo
Williamsport, Pa.

HINTS TO BUYERS

BEAVER VISES

A Thorough Canadian Product

(SEMI-STEEL)



Super-Strength Fine Workmanship

Good Appearance The All-Purpose Vise

4, 4½, 5, 5½ and 6in. Sizes Solid or Swivel Bases

ATTRACTIVE PRICES; Manufactured by

Philip Gies Foundry, Kitchener, Ont.

TESTING MACHINES

FOR

The AUTOMOBILE TRADE

Write for Circulars

PITTSBURGH INSTRUMENT & MACHINE COMPANY

40 Water St., Pittsburgh, Pa., U.S.A.

ATKINS Sterling Quality SAWS

When in need of Circular Metal Cutting Saws, Hack Saw Blades, Hack Saw Frames, Kwik-Kut Power and Metal Cutting Band Saw Machines we will be pleased to have your specifications.

"A BETTER SAW FOR EVERY USE"

Address the nearest point below

E. C. ATKINS & CO.

Canadian Factory, Hamilton, Ontario
Branch House, Vancouver.

DROP FORGINGS

And STAMPINGS

Very best workmanship at lowest prices. Enquiries with blue prints solicited.

General Forgings and Stampings LIMITED

Merritton, Ontario.

J.C.McLAREN BELTING

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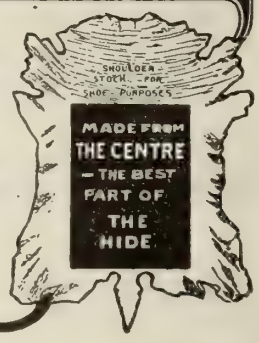
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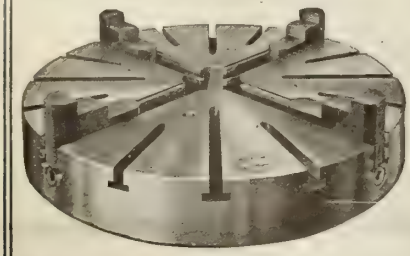
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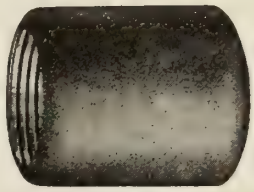
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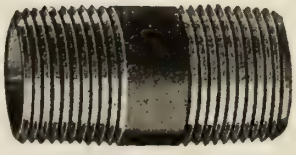
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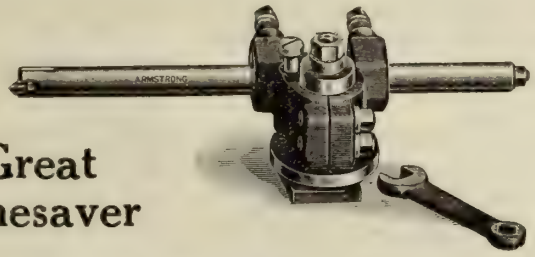
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Butterfield & Co., Inc., Rock Island, Q Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Greenfield Tap & Die Corp., Galt, Ont
Kearney & Trecker Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

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Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

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Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

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Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

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Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

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Armstrong Bros. Tool Co., Chicago, Ill.

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Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

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Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton.
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Wheel Trueing Co., Windsor, Ont.
Ford-Smith Co., Hamilton.

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Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

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Fisher Motor Co., Ltd., Orillia, Ont.

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Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont
Preston & Schwartz Galt, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio
Hendley Machine Co., Torrington, Conn.
Kearney & Treacker Co., Milwaukee, Wis
Petrie, Ltd., H. W Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton
Wheel Trueing Co., Windsor, Ont

DRESSING TOOLS
Canadian Desmond Stephan Mfg. Co., Hamilton, Ont
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut., Ohio.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd, Montreal, Que.
Lovejoy Tool Works, Chicago, Ill.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Wiliams Machinery Co., A. R., Toronto.

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin
Williams Machinery Co., A. R. Toronto

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, COMBINATION CENTRE
Preston & Schwartz, Galt, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks Morse Co., Ltd., Montreal, Que
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford Mass
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros. Tool Co., Chicago, Ill
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.
Lovejoy Tool Works, Chicago, Ill.
Morse Twist Drill & Machine Co., New Bedford, Mass

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que
Greenfield Tap & Die Corp., Galt, Ont.

DRILL SLEEVES
Lovejoy Tool Works, Chicago, Ill

DROP FORGINGS
Steel Co. of Canada, Ltd., Hamilton.

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada, Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto,

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J.

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
Canada Metal Co., Toronto, Ont.
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.
National Electro Products Co., Ltd.,

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd, The John, Dundas Ont
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton,

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES, LAPWELDED
Beardmore & Co., Ltd., Wm., Montreal, Que.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GARAGE EQUIPMENT
A. B. Jardine Co., Hespeler, Ont

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd., Toronto, Ont.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Ford-Smith Co., Hamilton, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto. Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester,

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Pliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto,

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. P., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

HYDROGEN
National Electro Products, Ltd., Toronto, Ont.

HYDROGENATING PLANTS
National Electro Products, Ltd., Toronto, Ont.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Prantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich.

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich.

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd. H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Plount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Perfect Machine Co. Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

BUYERS' DIRECTORY

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto,
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton,

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings Limited Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATES, BOILER AND SHEET
Beardmore & Co., Ltd., Wm., Montreal, Que.

PNEUMATIC TOOLS
Beardmore & Co., Ltd., Wm. Montreal.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R. Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilon.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton,
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa.

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound Ont.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, CENTRIFUGAL
Beardmore & Co., Ltd., Wm., Montreal

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
[illegible] & Co., Ltd., Toronto.
[illegible] & Forge Co., Ltd., Kitchener, Ont.
[illegible] Ltd., T., Toronto, Ont.
[illegible] Co., Ltd., R., Galt, Ont.

PUMPS, POWER
[illegible] & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
[illegible] Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUMPS, SEMI-ROTARY WING
Beardmore & Co., Ltd., Wm., Montreal.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams, Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER DRIVE
Geo. H. Blettner Co., Chicago, Ill.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton.

RIVETS, CHAIN
Pittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Prybil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc.. Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SECTIONS, SHIP AND BOILER
Beardmore & Co., Ltd., Wm., Montreal, Que.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS
Beardmore & Co., Ltd., Wm., Montreal. Que.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL CASTINGS
Beardmore & Co., Ltd., Wm., Montreal.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

STEEL FORGINGS
Beardmore & Co., Ltd., Wm., Montreal.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Beardmore & Co., Ltd., Wm., Montreal.
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Toronto Iron Works, Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.
Vanadium Iron Works, Toronto, Ont.

STEELS, ALLOY, OPEN HEARTH AND ELECTRIC
United Alloy Steel Corp., Canton, Ohio.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton. Ont.
United Alloy Steel Corp. Canton, Ohio.
Vanadium Alloys Steel, Latrobe, Pa.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.
Vanadium Alloys Steel, Latrobe, Pa.

STEEL, MAGNET
Vanadium Alloys Steel, Latrobe, Pa.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

STUD SETTERS, SELF-OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.
Toronto Iron Works, Toronto, Ont.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Ltd., Galt, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Preston & Schwartz, Galt, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.
Lovejoy Tool Works, Chicago, Ill.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundaas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Preston & Schwartz, Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S. Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A.R., Toronto,

TOOLS: CYLINDER, REBORING, VALVE RESEATING
Hinckley Machine Works, Hinckley, Ill.

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
National Electric Products Ltd., Toronto.
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TREATED BITS
Vanadium Alloys Steel, Latrobe, Pa.

TROLLEYS AND TRAMWAYS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin

TURRETS, TOOL POST
Gisholt Machine Co Madison, Wis

TYRES
Beardmore & Co., Ltd., Wm., Montreal, Que.

UNIONS, PIPE
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont
Can. Fairbanks-Morse Co., Ltd., Mon-
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., B., Galt, Ont.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Toronto, Ont.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
Imperial Brass Mfg. Co., Chicago, Ill.
National Electro Products Co., Ltd., Toronto, Ont.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd., Toronto, Ont

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd., Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Canada Metal Co., Ltd., Toronto, Ont.
Carter Metal Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd., Toronto
Liquide Air Company, Toronto, Ont.
National Electro Products Co., Ltd., Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.
National Electro Products Co., Ltd., Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm. Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

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Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co. of Canada, Ltd., Hamilton, Ontario.

WIRE LEAD
Canada Metal Co., Ltd., Toronto, Ont.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.
Shuster, Co., F. B., New Haven, Conn.

WIRE, WELDING
Canada Metal Co., Toronto, Ont
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co,. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
National Electro Products Ltd., Toronto.

WIRES, SPECIAL
Canada Metal Co., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill
Canada Foundries & Forgings Co., Welland, Ont.

List of Directory of Dealers will be Found above Advertising Index

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

MACHINE TOOLS, ETC.

Bertram & Sons, Ltd., John, Dundas, Ont.

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

SHOP and FACTORY SUPPLIES

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

POWER EQUIPMENT, ETC.

The Canadian Fairbanks-Morse Co., Montreal, Que.

H. W. Petrie Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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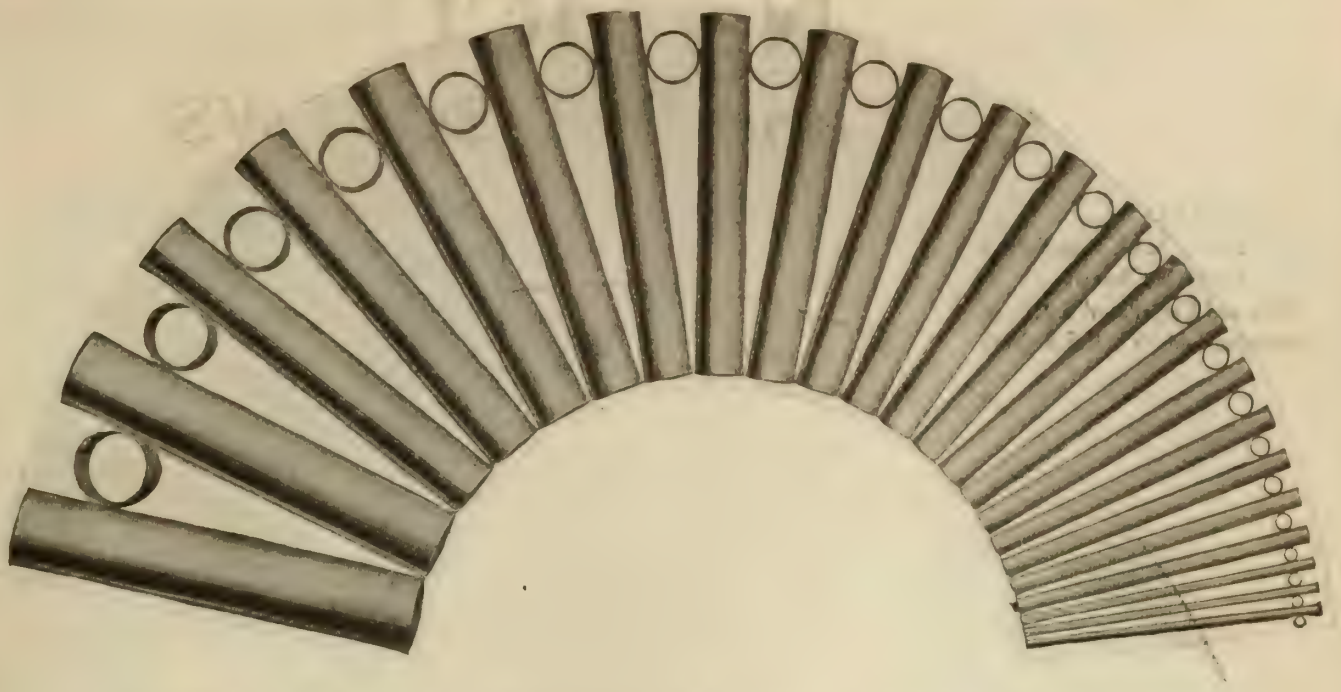
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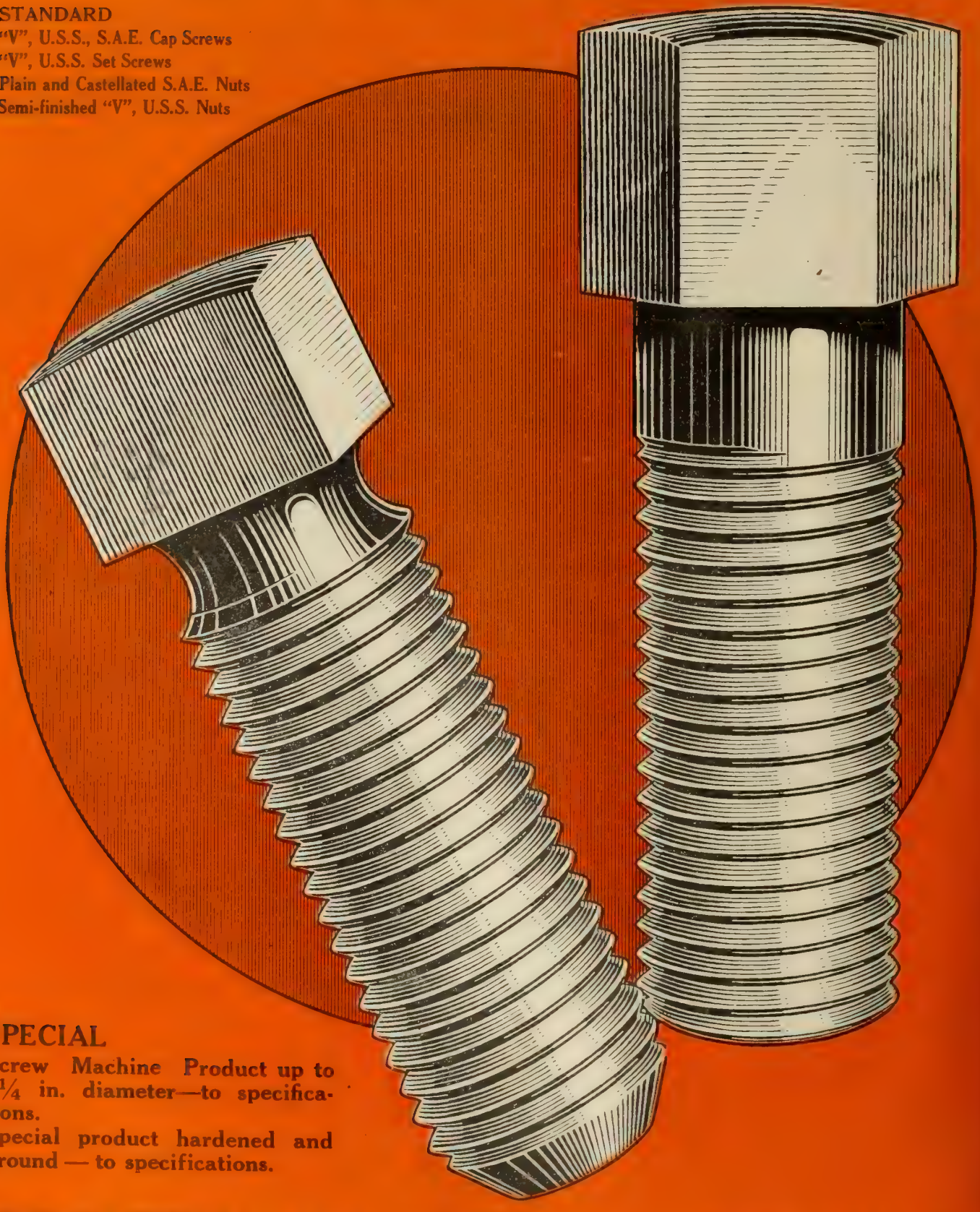
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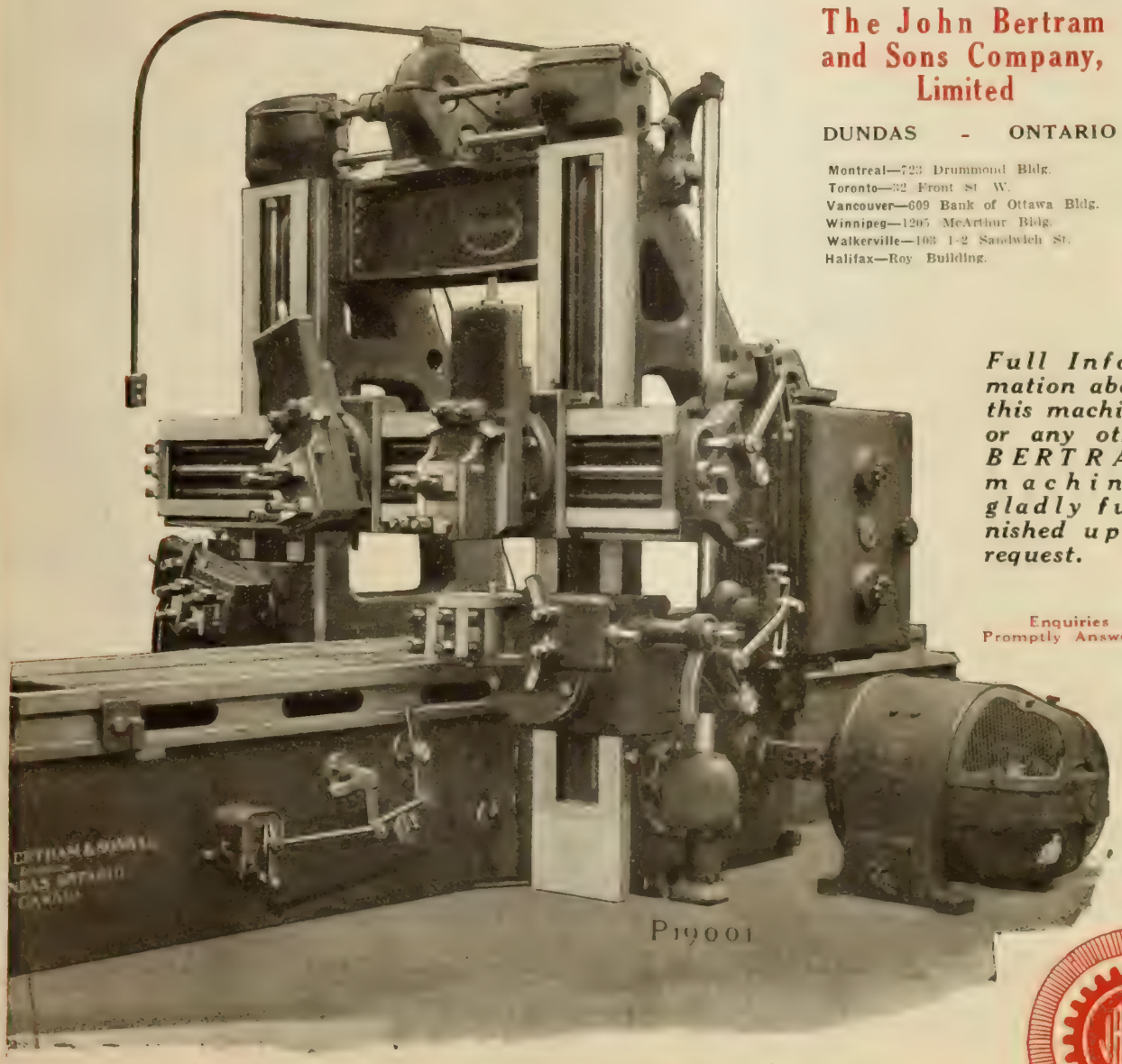
Vol. XXVII. No. 26 | Published Weekly by the MacLean Publishing Company, Limited, Toronto, Ont. | June 29, 1922 | $4.00 a Year Subscription Price

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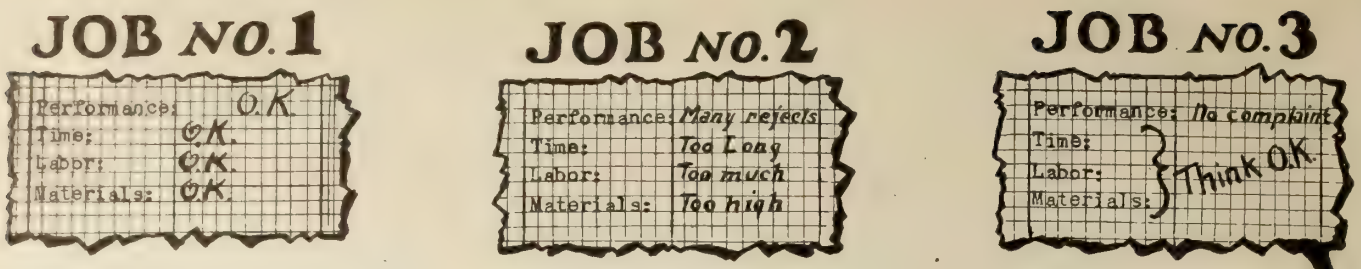
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The BERTRAM Page

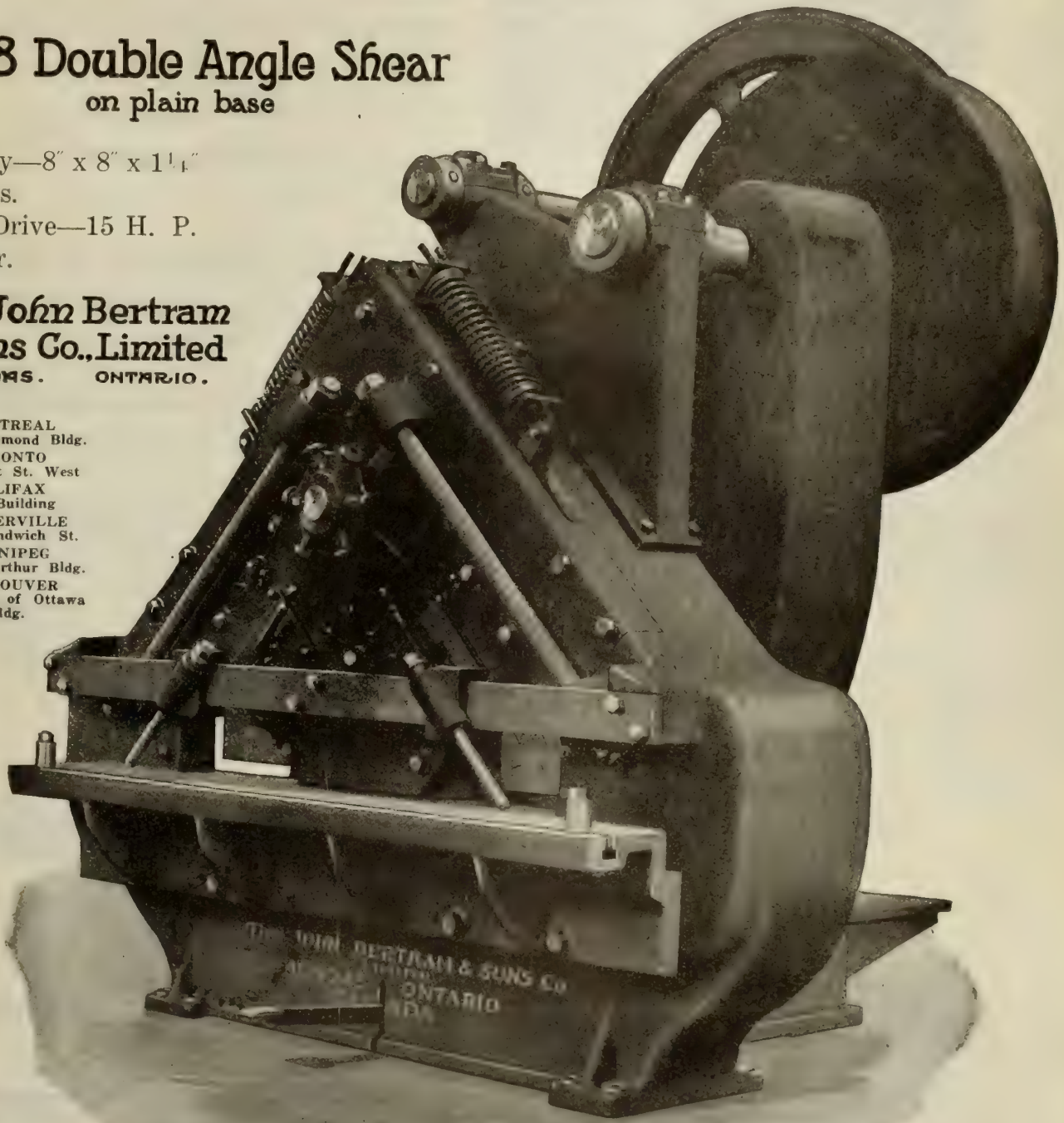
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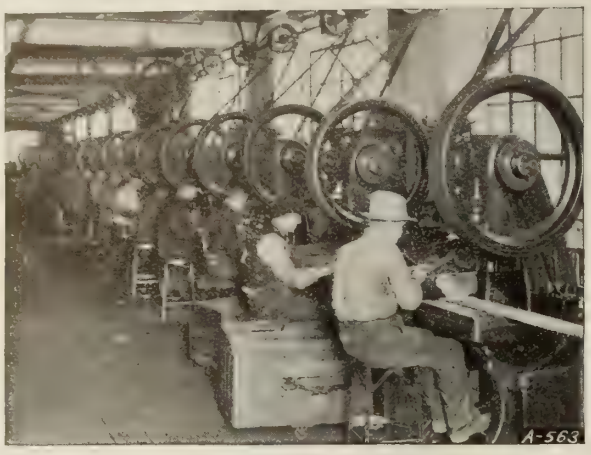


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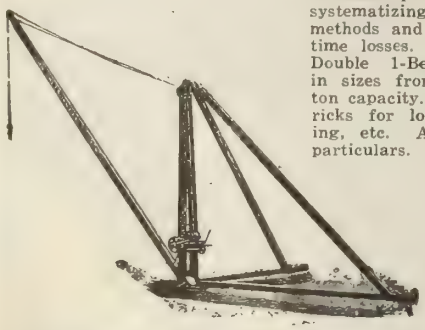
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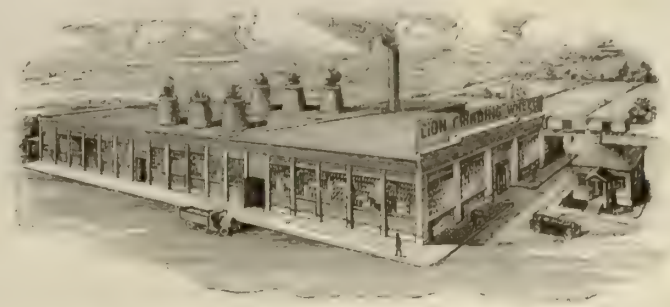
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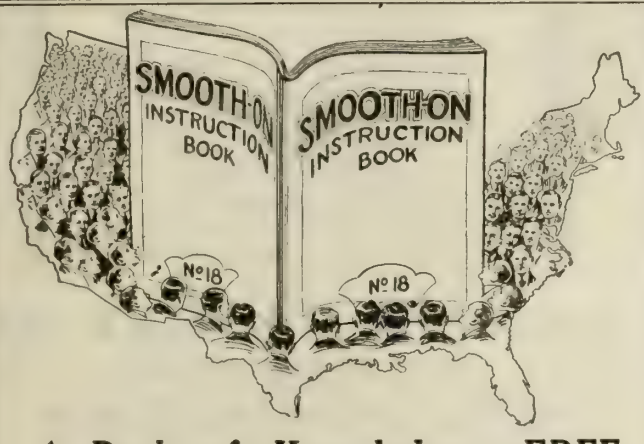
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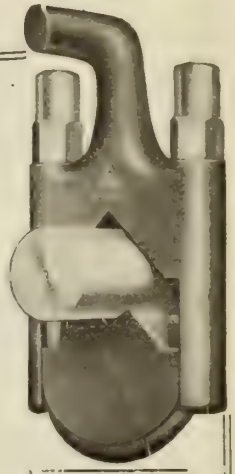
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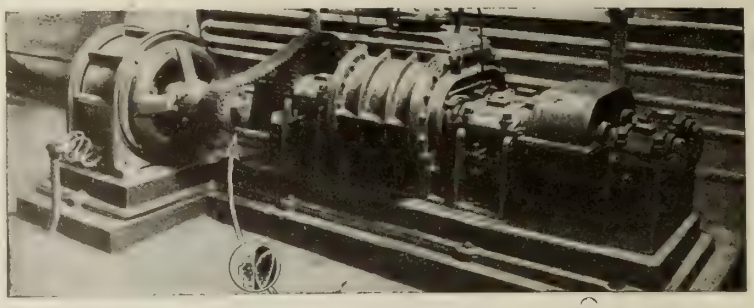
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We are using your Blast Gate as an outlet valve on a starch tank. This tank contains a very heavy grade of starch—just liquid enough to flow. This heavy substance clogs the ordinary valve but your blast gate has, to date, given perfect satisfaction.
C. H. Masland & Sons, Inc.

Hundreds of former valve users have found the remedy by installing Rockwell New Air-Tight Blast Gates.

This wonderful control device has proved an ideal substitute for expensive, heavy, cumbersome and slow-acting gate and globe valves when used for:

Air and Gases of Various kinds

Blast furnace coal and lime dust
Counteracting back pressures
Distillation processes
Pulverized coal
Chemicals handled through pipes
Gas engine exhaust lines
Soot chutes
Starch

Present industrial conditions make it urgent that you investigate the economy and efficiency of this New Air-Tight Blast Gate. Ask our Canadian distributor for Circular 210-T.

W. S. ROCKWELL COMPANY
Furnace Engineers and Contractors
50 Church St. (Hudson Terminal Building) New York
CANADIAN DISTRIBUTOR: Drummond, McCall & Co. Ltd., Montreal
BRITISH REPRESENTATIVE: Gibbons Bros., Ltd., Dudley, Worcester, England.

Effective Cooperation

THE three newspapers you see illustrated here belong to the MacLean Technical Group.

If you are a manufacturer of equipment that can be used in machine shops, metalworking plants, power plants, or foundries, one or all of these papers can give you effective cooperation in increasing sales. Tell the consumer about your products in the columns of these publications. The men who buy industrial equipment read them. Your products may have advantages over other products of their kind. Tell the consumer what they are. Create a desire in his mind to buy your lines when ordering from the dealer.

An effective message in MacLean Technical Newspapers will prove effective cooperation for the promotion of sales, and the group you can use to greatest advantage includes:

CANADIAN MACHINERY
AND MANUFACTURING NEWS

POWER HOUSE

CANADIAN FOUNDRYMAN
AND METAL INDUSTRY NEWS

Canadian Machinery serves the iron and steel and general metal working industries.

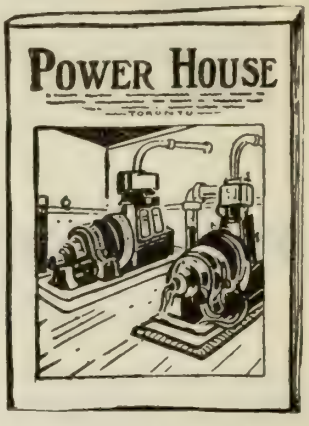
Power House serves steam, electrical, water and gas power plants.

Canadian Foundryman serves the grey iron, steel and non-ferrous foundries.

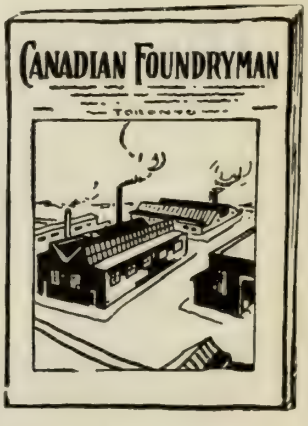
Each of these papers covers their respective fields almost exclusively. They are "Canadian National" in scope and are read by the men you are anxious to reach—proprietors, managers, superintendents, purchasing agents and foremen. Attract the attention of these men with a strong appeal in their favorite technical newspaper—the MacLean service staff will assist you.



Weekly



Semi-Monthly



Monthly

MacLean Technical Newspapers
153 University Avenue
TORONTO

Montreal **Winnipeg** **Vancouver**

Complete information respecting circulation, advertising rates and other data promptly furnished.

What do you look for —in a Spring?



DO YOU look for quality — so high that the spring will function efficiently under all conditions; that it will "stand up" under the severest usage; that it will outlive several others in usefulness?

These are attributes long associated with RAYMOND SPRINGS and which owe their being to scientific heat treatment by experts and the facilities of our up-to-date plant.

There is a RAYMOND SPRING for every purpose.

Raymond Mfg. Co., Ltd.

Corry, Pa., U.S.A.



WHEN you buy Hoists—Buy the Wright High Speed.

It's the most reliable, speediest, safest and easiest operated, one-man hoist that you can get.

All steel construction with large overload c. pacity. Built in sizes from 1 to 10 tons. Investigate and be convinced.

We have the proof. Shall we send it?

Canadian Distributors:
The A. R. Williams Machinery Co., St. John Halifax Toronto. Winnipeg, Vancouver, Montreal.

WRIGHT MANUFACTURING COMPANY
LISBON OHIO.

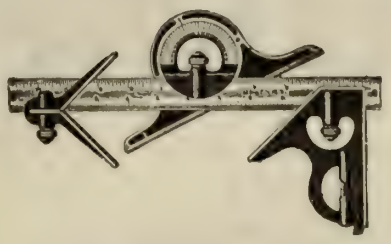
Do You Read These Advertisements?

Every advertisement in this magazine is worth reading. It is the product of some concern that is using a modern method of making sales, viz., technical paper advertising, in order to present most effectively to you the leading features of its line.

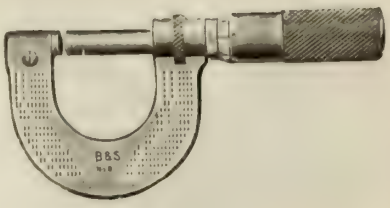
These advertisers are making it easier for you to buy intelligently with the least waste of your time and theirs. They realize that a sales force can not replace this service at equal cost. They know that advertising is good business, for the manufacturer who does not advertise cannot save the cost of advertising. Consistent advertisers are progressive merchandisers. They are saving your money and their own; and it pays to do business with them.

Don't miss your opportunities. These advertisements are interesting. Many are distinctly instructive, and a glance through them every week will keep you posted on the latest developments for machinery equipment.

75 Years of Successful Service



to manufacturing plants, machine shops and foundries is the reason we can guarantee you complete satisfaction from all orders placed with our house. We are prepared to make prompt delivery on



Various Kinds of Iron and Steel

Bar Iron
Sheet Iron (Black and Galvanized)
Mild Steel
Machine Steel
Cast Steel
High Speed Steel
Carbon Steel
Cold Rolled Steel

Machinists' Supplies

Hack Saw Blades
Machine Screws
Cap Screws
Drills (Carbon and High Speed)
Machinists' Tools
Starrett; Brown Co. Sharpe, etc.,
Files

Let Us Know Your Requirements

Rice Lewis & Son, Limited

Established 1847 **TORONTO, ONT.** 19 Victoria Street



WILLIAMS' SUPERIOR

DROP-FORGED

WRENCHES

Over 40 Standard Patterns in 1000 Sizes

J. H. WILLIAMS & CO., Limited

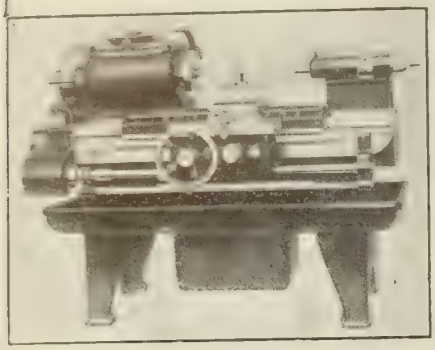
"The Wrench People"

45 Thorold Road St. Catharines, Ontario

THE JOHNSON FRICTION CLUTCH

AS USED ON THE

"NEW" 12 IN. SUNDSTRAND MANUFACTURING LATHE



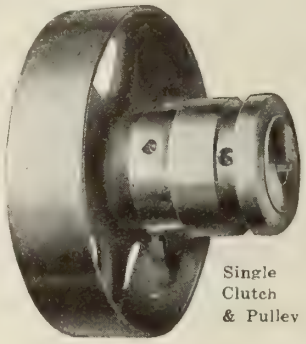
Progress in machine tool design demands a reliable and powerful friction clutch.

The Johnson Friction Clutch is proving of great value in machine tool designing.

Courtesy: The Rockford Tool Co., Rockford, Ill.

The main drive pulley is mounted on a No. 5 single clutch hub. The same movement that disengages the clutch automatically applies a brake which stops the spindle instantly. The sliding sleeve is machined to act as a brake.

A feature of the Johnson Friction Clutch is the ease of application to particular machine requirements.



Single Clutch & Pulley

WRITE FOR STOCK LIST AND YELLOW CATALOG

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER·CONN

STEEL CASTINGS

QUICK DELIVERIES

High Carbon Steel
Manganese Steel
Chrome Steel
Mild Steel

QUALITY GUARANTEED

Sizes—½lb. to 5,000 lbs.

THE WILLIAM KENNEDY & SONS LIMITED
OWEN SOUND, ONTARIO
ESTABLISHED 1860



CLEVELAND "FOUNDRY" CHIPPERS

Are Dust-Proof *Easy To Hold* *Easy To Control*

A Remarkable Tool for Fast Chipping

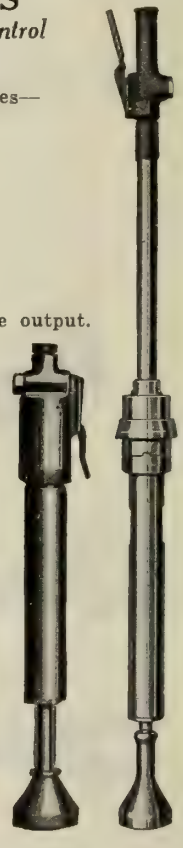
Made in "Seventeen" sizes with "Open" or "Enclosed" handles—Outside or Inside Latch.

CLEVELAND SAND RAMMERS

For Floor, Flask, Bench and Core

Size No. 4F, for heavy floor and pit work.
Size No. 1HF, for light floor work.
Size No. 1H, for bench and core work.

They have high speed, no recoil and are dust proof. They increase output.



PORTABLE AIR GRINDERS



The size G, illustrated, is a "one man grinder," has 3,300 r.p.m. Weight, 19 lbs. Adapted for grinding castings, etc.

BOWES AIR HOSE COUPLINGS

AIR  TIGHT

The Bowes is instantly connected or disconnected. Always air tight. Write for special Bulletins Nos. 50 and 51.

CLEVELAND PNEUMATIC TOOL CO., OF CANADA, LIMITED
84 Chestnut St., Toronto, Ont. **337 Craig St.W., Montreal, Que.**

A Micrometer Depth Gage *with a 1-inch screw movement*





Starrett

Micrometer Depth Gage No. 440

Here it is!—the tool many machinists have been asking for—a Starrett Micrometer Depth Gage with a 1-inch screw movement.

Measures 0 to 3 inches by thousandths of an inch. Made with either 2½-inch or 4-inch base. This new No. 440 Micrometer Depth Gage is fully described and illustrated, with other new tools interesting to every machinist, in a special Supplement (just published) to the Starrett Catalog No. 22 3. Copies of either Supplement or Catalog—or both—sent free at your request.

THE L. S. STARRETT CO.
The World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
ATHOL, MASS.

42-341

Use Starrett Tools

"Joy Shots" That Lead to Hell

By JUDGE EMILY F. MURPHY (*Janey Canuck*)

THIS IS the first of two articles in which Judge Murphy describes the menace that exists in Canada to-day in regard to the illegal traffic in narcotics. It gives actual facts from many Canadian cities and shows how the hypodermic needle is an even greater evil to combat than the opium pipe. The second of these articles will likely be in the July 15th issue.

Is Bootlegging a Passing Phase?

How common is bootlegging in Canada today? How do the members of the bootlegging profession carry on their business and what is their relationship to the officers of the law? These are two of the questions which are answered by A. Innes MacKenzie in a very colorful article describing the adventures, the fortunes and humorous rencontres of Canadian bootleggers from the Atlantic to the Pacific. Mr. MacKenzie writes whereof he knows, as he has spent several months studying this question and even associatting with many of the bootleggers themselves, in the interests of the readers of MACLEAN'S MAGAZINE.

Other Features in the

JUNE 15th MACLEAN'S

What Will Radio Do to Us?
by J. L. Rutledge.

What Shall I Do With My B.A.?
by G. E. S. Pringle.

Babs and the Manager
by Leslie Gordon Barnard.

The Golden Fleece
A long "short" story
by Bertrand W. Sinclair.

A Ruthenian Wedding
by Clara Ward.

Barnstorming on the Chautauqua
by Agnes C. Laut.

The Valley of Bleached Bones
by Madge MacBeth.

Ovington's Bank
An intensely interesting serial
by Stanley J. Weyman.

Is the Canadian Flapper a Menace?

This is a question raised by Mrs. Gertrude S. Pringle in a startling article dealing with conditions as they too frequently exist in some Canadian centres. Extraordinary conditions are described by Mrs. Pringle, who is a thorough and conservative investigator. It is only too true, evidence regretfully shows, that some Canadian flappers are very much akin to their American sister who "parks her corsets and indulges in petting parties."

At All News Stands 20c

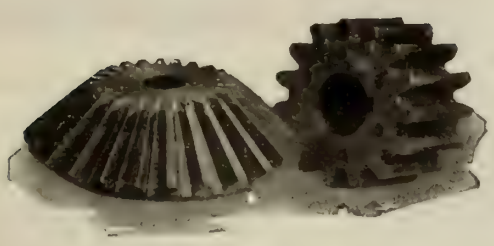
MACLEAN'S
"CANADA'S NATIONAL MAGAZINE"

Get Yours Today 20c

Or send $3.00 for a Year's Subscription to MACLEAN'S MAGAZINE, 143-153 University Ave., Toronto.

Quiet Gears





Why Tolerate Noise?

Use our efficient and durable Celeron or Rawhide Pinions

GEAR DATA FOR YOUR NOTE BOOK

Cut This Out—More Coming Later

SILENT PINIONS

From the Hamilton Gear & Machine Co., Toronto

NON-METALLIC PINIONS should be used wherever noisy gears would be objectionable. When well made they are really quiet. They have about the same strength as cast iron at slow speeds, and at high speeds they will carry more load than cast iron on account of their elasticity and smooth running. Rawhide will not stand oil or water. For such service use a pinion made in the same manner, but with Celeron instead of hide.

For best service and quietness make the face wide enough so that the metal mate does not touch the flanges of the pinion. When used on a motor add to the face the amount of the end play on the motor. Do not drive rawhide pinions by a set screw in one hub. Use preferably a key to distribute the load to both flanges and put less strain on the rivets. Flanges should always be made the full outside diameter of the pinion. Red brass is the most suitable material.

We carry a good stock of both celeron and rawhide of superior quality and can make very quick delivery on pinions, especially standard styles without hubs.

Remember—Our Non-Metallic Pinions are Quiet and Serviceable. We make the best quality and quickest delivery.

Write for Quotations

Hamilton Gear & Machine Co.

76 Van Horne St. TORONTO

Spending Coppers to Save Dollars

To use a file after it has begun to get dull is to waste effort.

Don't do it! A few cents spent on a new file means dollars saved in labor-time.

Maximum service from every file is assured when you buy one of these standard brands.

Kearney & Foot
Great Western
American
Arcade
Globe

NICHOLSON FILE COMPANY

PORT HOPE ONTARIO

HINTS TO BUYERS

For Hardness Testing



In shop and laboratory use the

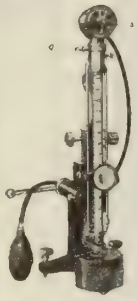
Standard Scleroscope

Universally adopted; direct reading; inexpensive, and the only instrument that agrees with others of its kind in all parts of the world, thus solving problems of ordering materials to specification.

BOOKLET FREE.

Heat Indication

by optical means is fast becoming the correct thing. The PYROSCOPE has solved the problem.



THE PYROSCOPE

THE SCLEROSCOPE (Set)

Perfect constancy, inexpensive, no electricity used. Built to stand rough usage, and upon common-sense lines. Used by the Government and best firms.

The Shore Instrument & Mfg. Co. Van Wyck Ave. & Carll St. JAMAICA, N.Y.

A. R. Williams Machinery Co., Ltd., Toronto, Canada



A BALATA BELTING

Which We Guarantee Second To None And Entirely Satisfactory

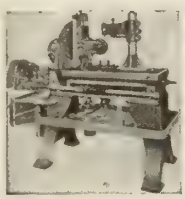
Try One And Be Convinced

J.C.McLAREN BELTING CO. Limited

MONTREAL TORONTO WINNIPEG

TRADE MARK

THE J.C. McLAREN BELTING Co LIMITED



Gear Cutting Machines

Hand Feed

Semi-Automatic, Fully Automatic

Also Lathe Chucks and Centering Machines

THE D. E. WHITON MACHINE CO.

NEW LONDON. CONN., U. S. A.

ROOM 52 CALL UPT. 2293

Expert Drafting Office Service

E. N. GOUGEON, (Jr. Mem. A.S.M.E.)

T. J. TUBIELEWICZ & E. G. ROUSSEAU

Machine Designers & Engineers

364 UNIVERSITY ST. MONTREAL, P.Q.

PRESSES and SHEARS

Sheet Metal Working Machinery

THE D. H. STOLL CO., INC.

26 Lansing St., BUFFALO, N.Y.

Miller Bros. & Sons, Limited

Founders, Machinists, Millwrights and Engineers

120 Dalhousie St., Montreal

Contractors' Derricks and Equipment—Belt and Chain Elevators—Conveyors—Paint Machinery



Built to Give Satisfaction

BLOUNT Grinders are built to stand up under the hard service which is the usual lot of a grinder. They are just as good in every detail as we can make them. They are fast, accurate, strong and rigid—dependable in every sense. Let us send you full particulars.

"We will accept Canadian funds at par."

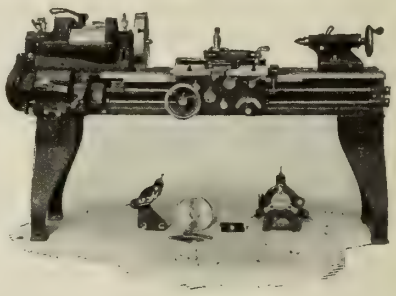
J. G. Blount Co.,

Everett, Mass. U S A

ROCKFORD "ECONOMY"

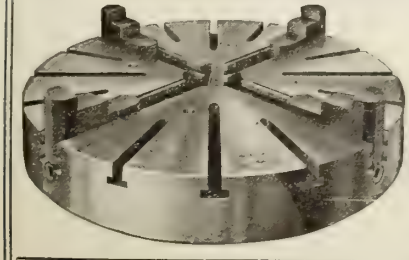
A Powerful Tool Room Lathe

SMALL in size, but big in production; 32 changes of thread without reversing; completely covered all-steel gears and other practical features go with this double back geared engine lathe. 12", 14", 18" and 22" swing.



Write for Circular

ROCKFORD LATHE & DRILL CO., Rockford, Ill.



IRON BODY INDEPENDENT CHUCKS

They represent strength and economy with high-speed cutting tools. Accurate and dependable always.

Our All-Steel Independent Chucks have established records for accurate, long-wearing qualities. We also make Geared Scroll Chucks and the Geared Scroll Combination. Ask for particulars.

UNION MANUFACTURING COMPANY

New Britain, Conn. New York Office: 26 Cortlandt Street

WHEEL TRUEING TOOL CO.

IMPORTERS OF
INDUSTRIAL DIAMONDS
Goods Submitted on Memorandum if D...
JOHN W. GORDON, Manager
James Street, ST. CATHARINES, ONTARIO

WINDSOR



MANUFACTURERS OF
DIAMOND POINTED TOOLS
All Mountings Fully Guaranteed
Office and Factory:
88 West Pitt Street, WINDSOR, ONTARIO

Strand **Flexible Shafts and Equipments**

Flexible shaft equipments for grinding, polishing, drilling, reaming, scraping, scratch brushing, power screw driving and nut setting.

Write for circulars and prices.

N. A. STRAND & Co., 625 W. Jackson Blvd., Chicago, Ill.

THE FELLOWS GEAR SHAPER

is used by the Largest Manufacturers in the Gear Industry.
Catalog and Engineering Literature sent to those interested.

Address:
THE FELLOWS GEAR SHAPER CO.
SPRINGFIELD, VERMONT, U.S.A.



THE SKINNER CHUCK COMPANY
NEW BRITAIN, CONN U.S.A

MILWAUKEE MILLING MACHINES

ACCURATE RIGID DEPENDABLE

Manufactured in various types and sizes for all classes of milling.

KEARNEY & TRECKER CORPORATION
MILWAUKEE WIS., U.S.A.

DIE-CASTINGS

ACCURACY—SERVICE

Fisher Motor Co., Ltd.
ORILLIA - ONTARIO

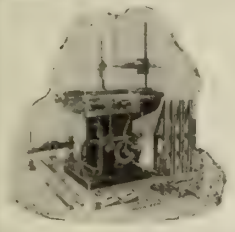


NORTON JACKS

FOR ALL KINDS OF HEAVY LIFTING

Send for complete catalogue showing 50 styles 10 to 100 tons capacity.

Made only by **A. O. NORTON, Limited**
Coaticook, Prov. Quebec, Canada



MORTON KEYSEATERS

Stationary type—18", 24", 30" and 48" stroke. Built to endure and economically perform every keyseating operation. Send for bulletin 1A.

Morton Mfg. Co, Muskegon Heights, Mich.

THOMPSON

UNIVERSAL GRINDING MACHINES

SEND FOR BULLETIN No. U-13

THE THOMPSON GRINDER CO.
SPRINGFIELD - - - OHIO

VICTORIA Special Machinery

DESIGNS PATTERNS
CASTINGS FORGINGS

Send for Catalogue

Victoria Foundry Co., Limited, Ottawa, Canada

Let Us Tell You About Our Machine

"TRY THE STEINLE"

Send Us Blueprints of Your Work

STEINLE TURRET MACHINE CO.
MADISON, WIS., U.S.A.

ROCKFORD

HORIZONTAL BORING MACHINE

Unexcelled for Continuous Service

ROCKFORD DRILLING MACHINE CO.
ROCKFORD, ILLINOIS, U.S.A.

CARBONIZING AND HARDENING

Equipped to skilfully handle Machine steel, Tool steel and High speed steel.

Phone: PARKDALE 392.

The CHAPMAN DOUBLE BALL BEARING Co.
347 Sorauren Ave., Toronto.



WE MANUFACTURE RIVETS of every description, 5/8 inch dia. and smaller

PARMENTER & BULLOCH CO., LTD.
GANANOQUE, ONT.

THE STANDARD FOR EXCELLENCE
"CUSHMAN" CHUCKS 1862
Known Everywhere
YOUR DEALER WILL FURNISH THEM

MALLEABLES
OF QUALITY SINCE 1878.
SMITH'S FALLS MALLEABLE CASTINGS LTD
SMITH'S FALLS, ONTARIO.

STEEL
Air Pressure Tanks, Air Receivers, Steel Plate Tanks, Pneumatic Tanks, Tote Boxes, Shop Barrels, Steel Factory Equipment, Smoke Stacks, Gasoline Tanks.
Write For New Catalogue
THE STEEL TROUGH & MACHINE CO. LTD.
TWEED - ONT.

"OVENS"
Japanning and Varnishing Ovens heated by Gas, Electricity, Steam or Coal. Kernchen and Apex Siphonage Ventilators. Bakers' Ovens, trucks, casters, etc. Write for Booklet.
BRANTFORD OVEN & RACK CO.
Brantford, Canada

Machine Tools
FOR SHIPBUILDERS & IRON & STEEL WORKS
BERTRAMS LIMITED
ST. CLAIR DOCK EDINBURGH

SPECIAL NOTICE TO SUBSCRIBERS

We have received some complaints from subscribers to the effect that Canadian Machinery is not being delivered. In almost every case investigation has shown that our friends have changed their addresses and have NOT notified us.

Let every subscriber look at the address on the label on this issue of Canadian Machinery, and, if it is not correct, please fill in and mail to us the following—

Name .....

Old Address .....

Change to

New Address .....

Occupation .....

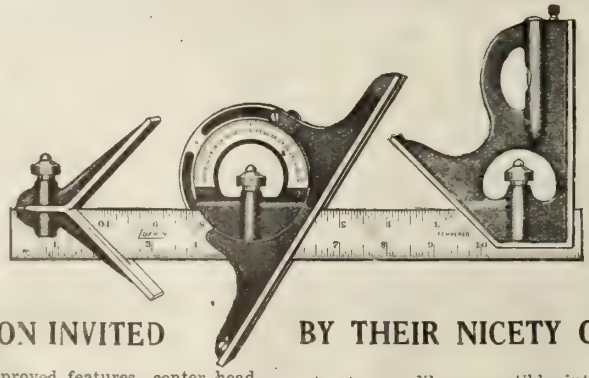
Address "Canadian Machinery"
143 University Ave., Toronto, Ont.

DUMORE HIGH SPEED GRINDERS
combine perfect balance with correct speed to insure a degree of accuracy never before obtained with portable grinders. Write for information concerning what they will do for you.
WISCONSIN ELECTRIC CO. 2940 Sixteenth St., Racine, Wis.

When you write to an advertiser if you will say "Referring to your advertisement in CANADIAN MACHINERY" you will please the advertiser and you will render to this paper a service that will be appreciated. Such an act of courtesy on your part will not cost you anything and yet it will add to the splendid reputation enjoyed by CANADIAN MACHINERY as being a paper that produces results for its advertisers.

Classified Opportunities on Page 48

LUFKIN
COMBINATION SQUARES



LUFKIN
BEVEL PROTRACTORS
COMBINATION SETS

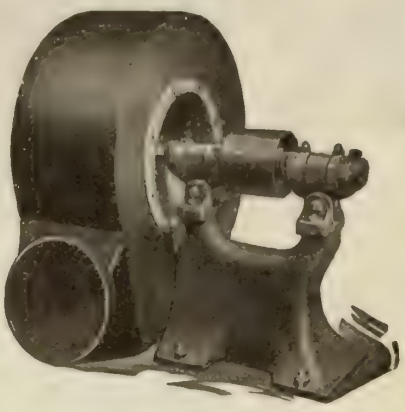
YOUR CLOSE INSPECTION INVITED
You will then see, among other improved features, center head with both legs exactly same length and ends formed, insuring accuracy on any circumference, large or small. Double protractor readily convertible into single protractor, serving perfectly for every sort of work.

BY THEIR NICETY OF DESIGN AND FINISH

THE LUFKIN RULE CO. OF CANADA, LTD. WINDSOR, ONT.

"CANADIAN" MILL EXHAUSTERS

Handle Any Material



The Canadian Standard Mill Exhauster will handle any kind of material efficiently—sawdust, shavings, cotton lint, or stringy material, gases, fumes, smoke, etc.



They are adjustable to any angle of discharge instantly—have universal type of wheel and carefully constructed, self-aligning oil-ring bearings.

Catalog 410-77—gives technical data and prices. Write for a copy.

Canadian Blower & Forge Co., Ltd.

KITCHENER, ONT.

McDOUGALL

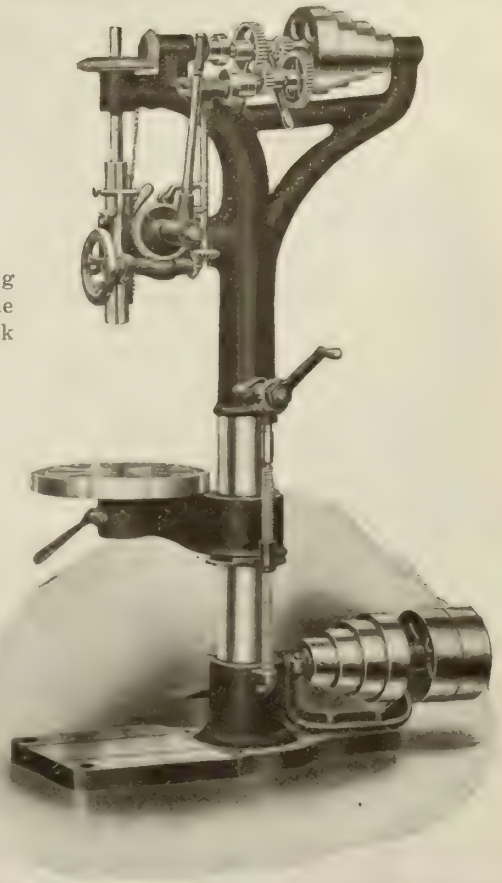
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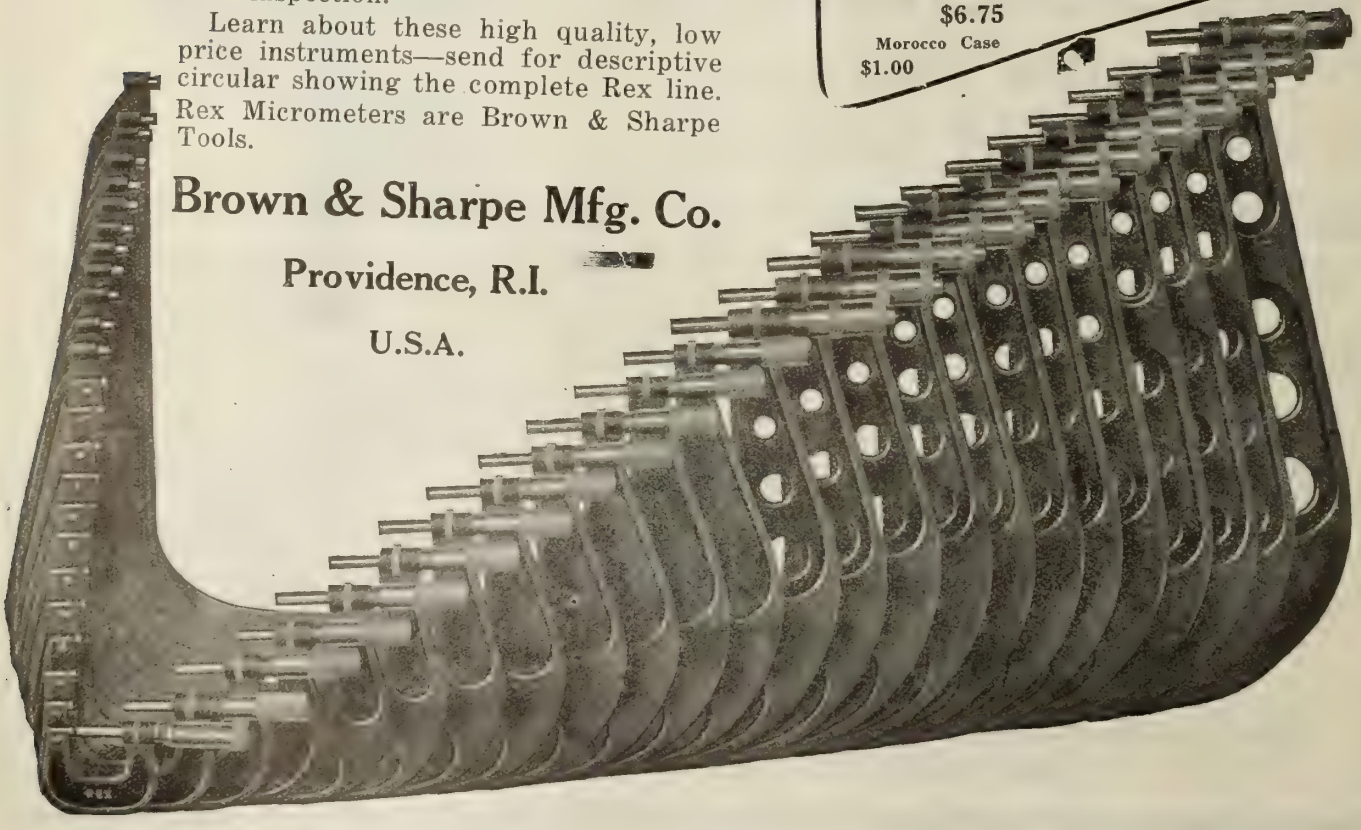
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Stamping and Forging Sheet Metal in Power Presses

Development of Punch Press Has Attained a High Degree of Accuracy—Toggle Operated Blank Holder Prevents Wrinkling of Work While Drawing—Trimming Drop Forgings

NO CLASS of machinery engines or tools have helped more to develop the metal working industry to the present high standard of efficiency and production than the stamping and forging presses and special equipment used in manufacturing all parts and articles made from sheet metal of all description.

The start in this direction, on a commercial basis, was made about 1867, when small foot operated pendulum presses were used for the purpose of plain blanking, perforating and forming dies. The demand soon came for increased output and power presses were constructed, giving greater accuracy to the work produced and greatly reducing the maintenance cost on the puhches, and dies. In a short time the use of power presses had become more general, the field for the use of these having been greatly increased by the development and designing of combination dies and other tools which permitted of rapidly transforming flat sheets into finished or partially finished shapes. The progress in recent years in working sheet metal into commercial articles has been rapid and has covered the stamping not only of the lighter gauge metals by the cold process, but also sheet metals as heavy as one half inch and as large as the frame of an auto truck, and the end of a steel freight car without heating the metal. In fact from a very crude beginning in 1867, this art has developed into such an elaborate science, so much, that the power press with its many sided applications has to-day become recognized as an absolute necessity in plants where sheet metal is used, and they are directly responsible for making it possible to sell automobiles, and other utilities at their present price.

In former years the machines used in working sheet metal were exceedingly simple but the constant demand for cheaper and more uniform products has developed mechanical presses which now actually stamp many articles and parts of light and heavy gauge, which formerly had to be made from castings and forgings, such as side frames, cross-members, rear axle housings, front axles, engine-pans, steering wheels, timing gears, cases, and covers. Generator and starting motor frames, wheel hubs, wheels, rims, spring brackets, brake drums, connecting rods, universal joint casings, radiator shells, etc. Particularly interesting are the presses and tools which have been developed for stamping and forming automobile bodies, fenders, cowls, radiators, shells, etc. In forming the above mentioned shapes, it is necessary to hold the flat sheet under sufficient pressure to prevent same from wrinkling and in the earlier days when we had but single acting presses, it was necessary to apply enormous springs, against the pressure plate to accomplish this.

Experience, however, especially on large forming dies, has shown that the spring pressure device was not reliable not giving uniform results and limiting the depth of draw, also in stretching the metal. In the new type of presses used for the above mentioned parts, we eliminated the spring pressure device and are operating the pressure plate, or as known by all, the blankholder, by a simple arrangement of toggle links, giving a positive and uniform pressure, no matter if the draw is 1in. deep or 20in. deep. Besides this, it eliminates the pressure against the crankshaft due to the resistance of the springs, as the toggle links are operated directly

Cuts 1 and 2 by courtesy of the E. W. Bliss Co. Cut 3 through courtesy of Parish & Bingham of Cleveland, Ohio.

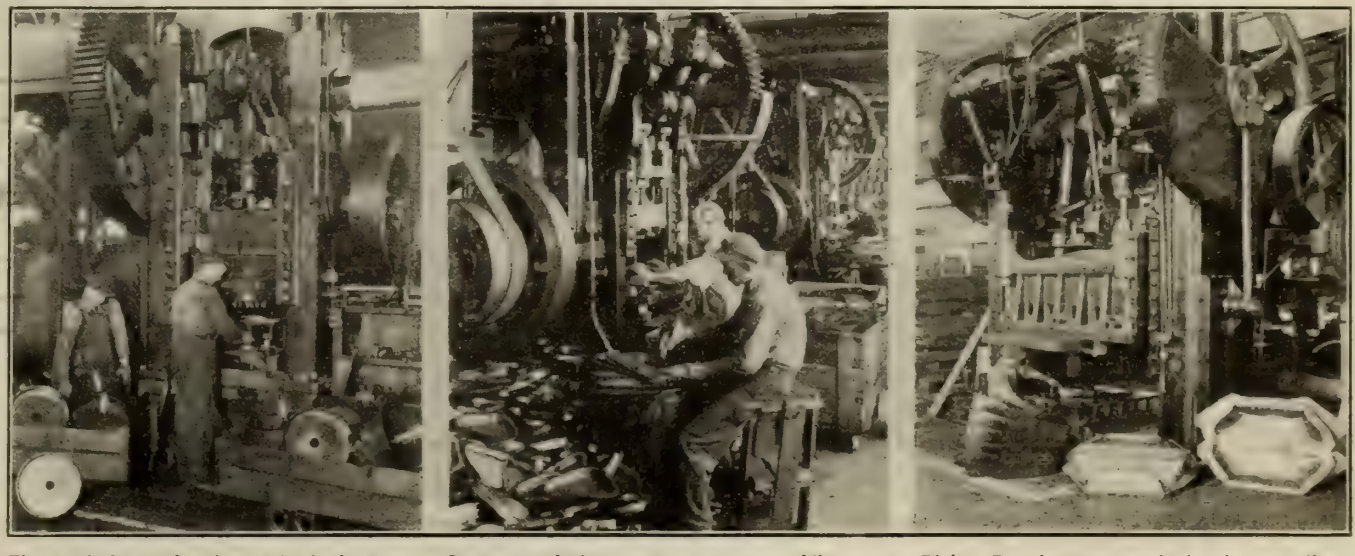


Fig. 1.—Left: Perforating 16 in. brake drums. .Centre: Producing covers for automobile gears. Right: Drawing two cowls in the one die.

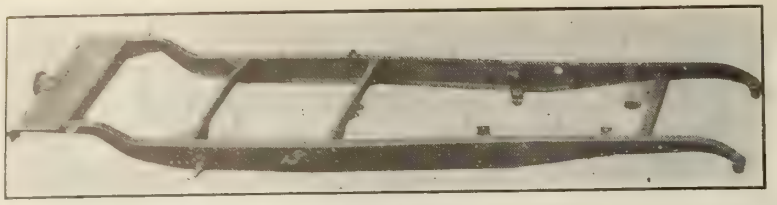


Fig. 3.—Chassis built up of pressed steel parts.

from the main gears. It might be well to mention that due to the toggle links, being operated by both main gears, it insures double safety against the breaking of any of the toggle links, or the stopping of the press, as the construction is such that either side of the driving parts is strong enough to operate the entire blankholder motion. This particular mechanism is controlled and covered by patents which are held by the E. W. Bliss Co. It will also be of interest to know that mechanical presses have practically eliminated the hydraulic presses in forming side rails. About six years ago, the first mechanical press was built to produce a right and left hand Ford side rail. This press was built with a single acting motion operating the slide, carrying the die, and forming the metal around the punch. The latest type of these presses has a double acting motion, one for operating the punch and one for operating the blankholder. The object of the blankholder is to clamp the blank securely against the punch so as to keep it flat while forming up the sides. This is very desirable, as it makes it easier to fit brackets, stephangers, and cross-members. One of these presses is turning out an average 300 side rails an hour. At present presses are built weighing beyond 200 tons, to form side rails up to 21 feet long and up to ⅜in. thick.

Another interesting press development is going on in the drop forging line, especially in small and intricate forgings, such as levers, bell-cranks steering knuckles, small wheel hubs, gear blanks, etc. For years they have been made in ponderous drop and steam-hammers. With the new process of forging the parts in power presses this cost is cut down more than 50 per cent. and the products are better. We expect in a short time to see forgings weighing two pounds made from a two-pound slug and eliminating the flash altogether. Powerful knuckle joint presses are already in operation sizing and squeezing forgings.

The illustration herewith show several operations performed on large toggle draw presses in plants making parts for automobiles. At the left of Fig. 1 is seen a No 70½ straight side press producing 16in. brake drums. The operation consists of piercing 12 holes ½in. dia. in the drum. The material is hot pressed steel 3/16in. gauge. The production rate is 5,000 per ten hours. This press is likewise used for forming hub flanges from ½in. stock, hot pressed steel at rate of 4,500 per ten hours.

In the centre is shown a No. 3½-B toggle drawing press cutting and drawing covers for automobile gears from hot-rolled steel .049in. thick and 13-3/16 in. wide. In nine hours 2,500 pieces are produced. At the rear is shown another press of the same description working on the first draw for automotor water jackets. The blanks are 14in. dia. being of copper .037in. thick. The rate of production is 4,000 per 9½ hours.

An interesting press forming operation is shown to the right of Fig. 1. Previous to making these cowls in the method here illustrated they had been made singly but difficulty was always experienced in obtaining products free from wrinkles. The adoption of the duplex die solved the problem as the symmetrical form of the draw when two cowls are produced back to back provides an evenly distributed draw to the sheet and wrinkles are reduced to a minimum.

To the left of Fig. 2 is shown an improved method of producing fenders. Two of these are now made at the same time. The great difficulty of holding two separate blanks at the same time is met perfectly in this toggle press by fine and accurate adjustment of press ram and gauges. Finished product shows no signs of buckles or stretcher strains.

To the right of Fig. 2 is shown an operation of trimming a crank shaft after the forging has been produced in the adjoining press.

A good example of the class of product now being produced on power presses is illustrated in Fig. 3. This chassis is made up of different parts that have previously been produced in power forming, drawing and drop forge presses.

THE ROTASCOPE

The National Physical Laboratory, which was established near London by the British Government, has produced quite a number of scientific instruments of the highest value. One of these was recently shown at a scientific exhibition in London. Its purpose is to render a rotating object continuously visible while it appears to be at rest. The method adopted is different from that of illuminating the object by a series of brief flashes of light. The principle made use of is a property of reflection from a smooth surface which is rotated round an axis parallel to the surface and in line with the axis of the object. When this reflecting surface is rotated at half the speed of the object itself, the image in the reflecting surface appears stationary. This instrument is expected to prove useful for measuring speed and for studying the phenomena of vibration and strain in rotating objects.

IMPROVED HAND DRILL

The ordinary small hand-operated drill is widely used on account of its convenience, but it has the drawback that it is not quite so accurate in its work as a proper machine drill. With the object of getting over this disability a British firm of tool makers has designed a new type of hand drill which does as good work as the high grade machine drill, while retaining all the simplicity of the hand-drill. Both a high and a low speed are provided; and another very useful feature is the automatic action by which the drill is fed forward as it proceeds through the work. The work table of this little machine can be swung to any angle and also rotated round a vertical column, so that the drilling of holes at any angle is a comparatively easy matter. The machine is designed for hard work and can drill holes up to one inch in diameter. The height of the machine is only forty inches and it is made throughout with exactly the same minute care as is expended on the best British machine tools.



Fig. 2.—Left; producing two fenders at once. Right; trimming crankshaft after forging.

Value of Keeping Tools and Product Clean

Cleanliness An Important Part of Plant Management—Cleaning Medium Should Not Be Subject to Fire Hazard—Keep Bearing Surfaces Clean—Use of Chemical Compounds

By J. H. RODGERS

WHILE passing through a small plant recently the writer overheard the following remark: "There is an old proverb that says—'Cleanliness is next to Godliness,' but here it seems next to impossible."

The statement was made by the shop foreman and was occasioned by the unsanitary condition of the floor and the general untidy appearance of the whole establishment. One could not help but concur with the utterance of the foreman as the expression was particularly fitting in this instance. The floor was blotted in many places with patches of caked oil and dirt accumulated beneath each hanger of the main line shaft and everywhere was displayed some evidence of about 100 per cent. neglect, in the matter of clean and healthy surroundings. Men operating presses, "enjoying" the habit of the use of tobacco, would turn their heads, without any apparent consideration for their immediate neighbor or the product of the shop, and expectorate on the floor. Some would take the additional precaution of selecting a dark, unseen corner near the wall or base of the machine to deposit the fruits of their jaw labor. Of the two, the former must be given preference, as there is a remote possibility that the refuse will be gathered up and removed, while in the latter case the accumulation of filth provides an ideal nesting place for myriads of germs that eventually seek out and prey on the health of those working in the shop.

Degree of Cleanliness

What is true of plant condition is equally true in respect to the product made in the shop. Cleanliness must continue to be a dominant factor of plant management. It should be understood, however, that varying degrees of cleanliness will prevail in different establishments, based on the quality and character of the product manufactured, as it could not be expected that a brickyard would have the same standard of neatness and appearance as the assembly department of a high-grade watch-making factory. The range of manufacture is so extensive that it would not be permissible to cover this subject in its entirety so we will confine our remarks to the question as affecting metal working plants.

Cleaning of Metal Parts

The rapid development of the automotive industry has given impetus to the cleaning of parts during the process of manufacture, and it has now reached the stage when progressive executives include it among the principal factors of the production problem. The extensive use of turret lathes and automatic machines, using large quantities of lubricating oils and compounds in the machining operations, has necessitated some economic method of removing and reclaiming the oils for further service. This is essential for two prime reasons: first, the economic feature of oil conservation, and second, the advisability of keeping a product clean.

Method of Cleaning

The comparative high price of oils to-day prohibits undue waste of consumption and the washing of oily pieces as they come from the machine is very necessary. The method of cleaning may take one of many forms. The practice of using soap and water has long been discarded as an efficient means of cleaning metal parts. Alkalies in a variety of forms have been used in different ways, but in removing dirt and oil the surfaces were left covered with an insoluble soapy substance that was often difficult to remove and giving to the product a touch that was far from pleasant.

Use of Gasoline

Gasoline has been widely used as a cleaning medium, yet while serving its purpose in its main requirements, has highly objectionable features from a hazardous standpoint. The inflammable nature of gasoline detracts greatly from its otherwise beneficial characteristics. The relatively rapid evaporation of gasoline is a point in its favor, when judged as a cleaner, as the parts soon have a dry clean surface, free from the clammy, sticky touch generally associated with oil coated metal. On the other hand, the evaporation of the gasoline, when the same is open to the atmosphere, produces a condition that is not only dangerous as a fire hazard, but injurious to the health of the workmen. The air becomes so saturated with the fumes that the men suffer from headaches and temporary dizziness.

Specific Instance

On one occasion the writer was working in a plant where gasoline was used for cleaning the parts as they came from the turret lathe. The can when not in use was kept covered, but when dipping the pieces the top was removed. On this particular occasion, the cover was off and without a moments warning a flame one ft. in diameter rose to the ceiling. The operator endeavored to blow out the fire, singeing his hair and eyebrows in the effort but with no success. Another worker grabbed the lid and dashed it on the can, thus smothering the flame and arresting a stampede about to take place by the other employees. It was never definitely determined just what ignited the gasoline, but it is supposed the fire originated from a spark from an abrasive wheel, there being a universal grinder operating close by at the time.

Chemical Solutions

Chemical preparations are now largely used for removing dirt, grease and oil from metal and other surfaces and have proved highly satisfactory both from the viewpoint of efficiency and economy. The handling of a machine part that has been thoroughly cleaned of all foreign substances used in previous machining operations, gives to the workman a sense of cleanliness that seems to influence his every action, and he invariably finds greater pleasure in doing work that might otherwise be objectionable.

When metal parts are to be painted after assembly it is especially desirable that they be thoroughly cleaned with a solution that will show no tendency to develop rust spots upon the metal surface.

Keeping Bearing Surfaces Clean

The value of keeping a product clean is particularly noticeable in the case of machine tool operating on a production basis. The essential part of metal turning is to utilize the maximum amount of power delivered to the tool for the actual cutting of the stock. Any excessive power used in overcoming friction of sliding or revolving surfaces may be considered as so much waste. Every emphasis should be placed on machine operations on the subject of keeping their tools clean and suggesting regular periods when systematic cleaning shall be performed—and seeing that this work is carried out. In mentioning this the writer is reminded of the operation of a large lathe in the machining of heavy cast iron equipment. The dust and fine particles will gradually work their way into bearings and ways of the bed and cross slide, and becoming mixed with the oil form into a sticky, adhesive film, entailing extreme physical effort when moving saddle by hand, and absorbing unnecessary power when cutting is in progress. The cleaning of the ways from time to time and re-oiling (not too freely) resulted in obtaining greater production from the machine. The large bearings in the headstock were washed out once a week and this likewise proved advantageous. This shop now makes a practice of overlooking all tools and provide every means of protecting oil holes and bearing surfaces of all machines and transmission equipment, giving bearings a thorough cleaning, at least once a month, using a suitable chemical preparation for the purpose.

The practice of keeping work clean is nowhere more emphasized than in such

(Continued on page 34)

Reducing Costs By Means of the Planer

Variable Cutting Speeds First Step in Reduction of Costs—Feed Motion Should Have Ample Range for Both Stock Removing and Broad Finish Scraping—Examples of Work Completed

By J. G. STIRK

THIS problem is not one of the easiest to approach. It is not a case of the hammer, chisel and scraper versus planer, or there is no problem. It is not a case of the milling machine versus the planer, or the matter is too readily solved to be called a problem. There are jobs for which the milling machine is the obvious tool, whereas there are others where the planing machine has indisputable advantages.

The question at issue in the mind of the writer, is one of efficiency in the use of the planer. In other words there is planing, and there is planing. Are you getting the best possible service in your planing shops, and are your total production costs greater or less because of the way in which that department is equipped, organized or operated? Now, that is quite a long question, and quite a number of suggestions may be made to enable a specific answer to be returned.

First then, about the machines themselves. Single cutting speed machines have their uses. If a machine is to operate on the same job day in and day out, year in and year out, it should be easy to determine the most suitable cutting speed, and fixing on that, save both prime cost and upkeep of all unnecessary additions in the way of variable speed mechanisms. There are however the thousand and one instances where no such uniformity and continuity can be achieved, and where a real loss is incurred through inability to change speed when the fixed speed is unsuitable. If therefore, yours is one of those thousand and one cases, specify variable cutting speeds on your additional planer, or (the writer confesses himself an interested party) if you do not need an additional machine, pull out one or more of the existing machines and replace with modern variable cut planers as a first step to reducing planing costs.

Possibly a range of three or four speeds, say, 24, 36, 48, f.p.m. will cover all your requirements. In that event a belt driven planer with belt or motor driven countershaft may fill your bill. In many shops however a wide variation by the finest gradations is a vital necessity, and in such cases a direct coupled reversing motor is undoubtedly the proper thing. Equally undoubtedly some form of Ward Lennard (motor generator) drive is, to my mind, infinitely superior to any single reversing motor system. In the first place the latter can only be used where direct current is available. In the second, third, fourth and fifth place, the practicable maximum ratio of return to cutting speed is 8 to 1, against 3 to 1. There are 12 to 18 intermediate speeds, the switch gear is simple and there is a corresponding freedom from operating troubles and costly breakdowns. This system has had a great vogue in Europe and the best known examples are the Lancashire planer drive, (patented in Great Britain) and the Stirk split field drive (patented in Great Britain, Canada, United States, and many other countries).

A further advantage of these drives is the facility with which the cutting speed may be accelerated. Every shop has planing jobs where between the surfaces to be planed are intervening spaces, which under these systems can be covered at return speed. In other instances it is desirable to speed up in metal, and possibly retard again before the tool leaves the job. The Woodward and Powell accelerating cut planer is the only belt driven machine which gives even one of these features, whereas all are embodied in the Lancashire or Stirk drives.

Mechanical Details

Reverting to the mechanical details of the planer you will require a good reliable feed motion which will provide ample range for both stock removing, and broad finish scraping. You will require such strength of gearing as will stand up to the heaviest duty, and such accuracy as will ensure that wherever possible your product is finished when it comes off the planer table, especially if the cutting is of an intermittent character; but in any case, you will be well advised to specify in your new machines steel driving gears, and if possible of the "Keyless" variety. It is in this way that continuous service is obtained and costs correspondingly reduced.

So much (without in any way exhausting the subject) regarding the bare machine itself. Closely allied as cost reducing details are first, the selection of treatment of tool steel, second, gang planing, and third, special methods of setting and fixing the work.

As to No. 1, sufficient is written every month on this subject to render unnecessary the addition of a single word. Re-

Author came for a hurried visit to Canada, and while in Toronto, we requested him to give us something on planer practice. Mr. Stirk is general manager of the J. G. Stirk Planer Co., Halifax, England, and is an authority, not only in production work, but planer design.

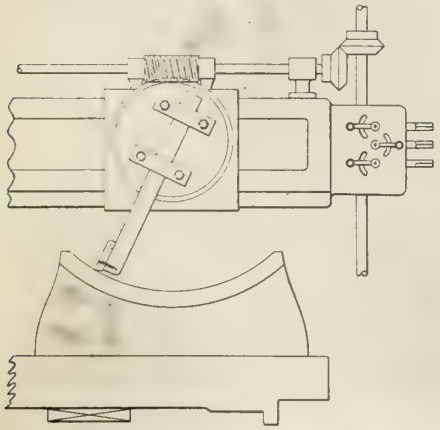


Fig. 3.—Showing method of planing out the radial segments of boiler saddles.

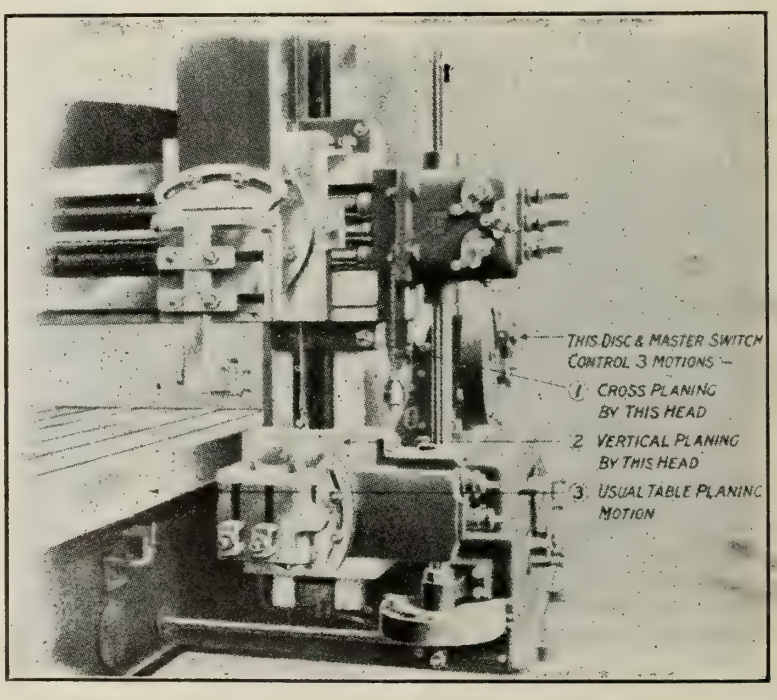


Fig. 1—Showing double ended pendant switch.

garding No. 2 this seems self evidently advantageous, but very often the capacity of existing planers precludes the possibility of machining more than one piece at once however simple the operation may be. Remember therefore the next time to look into the possibilities in this direction.

The writer recently saw both at the Great Western Railway Works at Swindon, England, and the London and North Western Railway Works at Crewe, England, crank webs being planed in large batches, and at a saving of 20 per cent. to 25 per cent. over the previous policy of machining only a few at once. This saving however was partly due to the split field drive named above.

Most remarkable reductions in costs can be achieved by special fixtures, etc. It is notorious that many planers do not actually run more than 25 or 30 per cent. of the time for which the operator is drawing his wage. As the interest on the investment is going on all the time this represents deplorable losses. The first step to cut these losses is to provide power traverses to the heads on machines of substantial size so that the operator is not expending time and energy moving the heads by a process akin to performing on that other obsolete instrument, the barrel organ. Moreover the power traverses should be readily controlled, and Fig. 1 shows a double ended pendant switch which enables the tool to be moved horizontally or vertically by as little as 1-16 in. Being portable, the switch may be held in the hand when the operator leans over to see into an awkward corner of the job. This is in marked contrast to a power traverse motion actuated by a lever in a fixed position.

Having eliminated waste of time in movement of the heads, the next thing is to consider the loss through the machine standing whilst the table is being loaded. In many instances this is an unavoidable loss and can only be reduced, not by installing this or that make of planer, but by engaging the best and most intelligent operator. There are however many other cases where the dimensions of the job are modest and the quantity great, which lend themselves to a combination of gang planing and special fixtures in a peculiar degree. Specific examples are greatly superior to vague generalizations and the writer will therefore describe a few jobs as performed by his own friends in English shops.

Some English Methods

1. Planing electric motor magnet yokes. The Electric Construction Co., Wolverhampton; Crompton and Co., Chelmsford, and some other firms plane both feet and (where yoke is split) the joint in the following manner. Only the two side heads are employed, and the yokes placed on the side with the faces to be planed outwards. They are not, however, directly bolted to the table of the planer, but to a false table approximately equal in size to the regular table and fixed thereon complete with its load of two rows of motor yokes, one row down each side. There are two of these false tables, and a competent assistant is loading one while the machine and operator are at work on the other. The planer is thus kept running practically continuously, and costs of production reduced to an amazing extent. The machines in question are fitted with stirk drives and full advantage is taken of the acceleration to save time between surfaces, the actual lengths of surface machined being quite short. Maximum return speeds are of course employed, say 180 f. p. m. on 78 in. wide machine, and the users declare that two machines so equipped produce work equal in volume to 10 machines previously used—a reduction in costs of 80 per cent.

A similar though not identical scheme is in use by the leading gas engineers, Messrs. Cockey and Co, Fromel, Messrs. Dempster and Co., Manchester, and Messrs. Drakes, Halifax, for planing tank plates. For this work 6 ft. by 16 ft. planers are made with the table in two half lengths which may be cottered together when required or run separately. While the pile of plates on table No. 1 are being planed, a similar pile is being set on No. 2 table at the rear. On completion of the first batch No. 1 table is run up against No. 2, the cotters inserted, and No. 2 table drawn into working position. The cotters are now withdrawn, and No. 1 table left at the front end of the bed to be duly loaded whilst actual cutting proceeds on No. 2. The process is repeated as each set is completed, and as with the motor yokes, something closely approaching continuous operation is achieved with corresponding reduction in costs.

Another example of special fixtures is a revolving table used by Messrs. Kitson and Co., Leeds, England, on locomotive cylinder work, whereby facings at right angles may be machined at one setting. The same end is achieved by the Midland Railway Co., Derby, by using a Hiloplane embodying automatic cross and vertical planing. By this means planing in three directions is accomplished at one setting.

Fig. 2 shows a very striking example of the adaptability of the Hiloplane, for not only are cross and vertical planing motions available, controlled by the main stroke disc but the automatic reverse may be applied to any of the motions having a self-acting feed and the illustration shows the slotting of a keyway in a large spur wheel in an emergency. This is not an outstanding example of low cost in actual time taken for the job. This was undoubtedly considerably in excess of the time which would have been taken on a standard key-seating machine, or even a good slotter, but insofar as it was an odd job not likely to be repeated, investment costs were saved through the adaptability of this particular machine.

Messrs. Armstrong Whitworth and

(Continued on page 33)

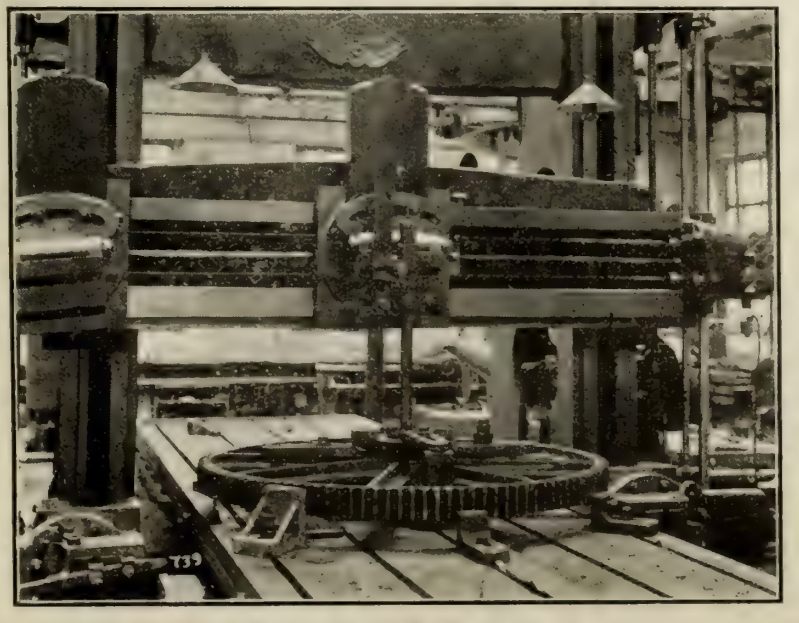


Fig. 2.—Slotting keyway on large spur gear.

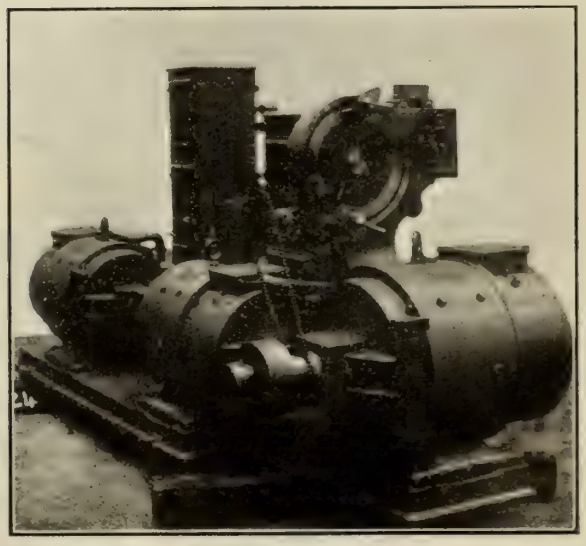


Fig. 4.—Showing the split field reversing motor drive.

Overcoming Heavy Costs of Belt Maintenance

Transmission Problems Should be in Charge of Competent Man —Inspection Should be Made Regularly—Importance of Proper Alignment—Lacing of Joints Should Be Carefully Performed

By J. H. RODGERS

BELT dressings are of two types: those intended to prevent slippage, and those used to preserve the fibre of the leather. The most common examples of the first class are perhaps soap or powdered rosin, which the average mechanic uses freely. Dressings in this class are often made of some sticky material dissolved in any oily solvent and scented to conceal their odor. Black belt dressings often have tar or asphalt for the sticky material, kerosene or turpentine for the solvent, and oil of mirbane or citronelle for the odorous constituent. Belts treated with such dressings quickly become coated over and soon both belt and pulley are glazed with a dirty surface that slips worse than before. Selecting a dressing for belts is as important as the selecting of lubricating oils for machinery. Some simple test should be used to see that they do not contain any harmful ingredients. In some fluid dressings naptha or gasolene is used. These are initial preservatives of leather and their presence often indicates other harmful ingredients which are kept in liquid form by them. Since volatile oils evaporate rapidly, dressings containing them have to be applied very often to secure any result.

Destructive Practice

When surface dressing—or as it is often called, the "belt stick"—is freely used, it is not uncommon to see pulleys in the condition shown at F, Fig. 6, where large patches of the dressing cling to the face. As said before a belt derives its power from frictional contact with the pulleys and while the pull from a well "dressed" belt may seem better, the general efficiency has not been increased. This may be made more clear when one realizes the air pockets that must be formed between the patches on the pulley surface. To this must be added the pull required when the belt is leaving the pulley. A stamp may be easily placed on an envelope but some action is required in its removal. At your next opportunity notice a drive of this description and listen to the noise when starting or stopping. Just like pulling a porous plaster from your back.

Detection of Naptha or Gasolene

Naptha or gasolene can readily be detected by putting a few drops of the dressing in the palm of the hand and rubbing it until the mixture warms slightly—the odor will be easily noticeable. If the dressing contains oils of a gummy or drying nature, harmful to the belt, they can be detected by putting a few drops on window glass. If after it is left in a dry hot place for a few days, it feels sticky, or if it becomes dry and forms a crust it would be apt to do the same thing on a belt and should not be used.

Another simple test consists in taking a piece of new leather preferably from the belt on which the dressing is to be used, putting a few drops of the dressing on the leather and laying it on the engine cylinder or steam chest until quite warm. Note the time required for the dressing to penetrate the leather. If the surface is left clean and feels sticky, it indicates that harmful ingredients are present. If all of the sample penetrates the leather, leaving no residue, and the spot where the dressing was applied feels soft and velvety, it indicates a good dressing. Common examples of the second type of dressing —intended to preserve the leather—are neatsfoot or Brockton oil, castor oil, and dubbib (a mixture of cod-oil and tallow). These, properly used, will keep leather belts thoroughly pliable, mellow and sufficiently greasy to have the maximum co-efficient of friction. These dressings penetrate the leather and depend for their effectiveness on their action on the leather, while the sticky dressings remain largely on the surface.

The use of sticky dressings often results in pulling the laps apart and peeling off the grain of the leather because of sticking of belt to pulley by the dressing; overstrain of leather due to the use of belts of inadequate size, made to carry overloads by use of such dressings; uneven frictional contact and belt strain due to accumulation of lumps of dressing and dirt on pulleys and belt —actual damage to the leather fibre from components of dressing and from excessive slippage. When a leather belt is slipping badly, because it is not tight enough or because of sudden overload, it may be permissible to use a little sticky dressing. For the continued use of sticky dressings with leather belts there can be no excuse and with the right belt no need. Practically all belt dressings of the second class cause a slight temporary increase of slippage at the time of application—the amount of this depending on the amount of dressing used and on the rapidity with which it is absorbed.

The best time to apply dressing is when the belt is idle and can stand for some time so that the dressing can penetrate into the leather. Penetration is assisted by warming the dressing also. When it is not practicable to apply dressing to the belt while idle, a piece of burlap or waste covered with dressing may be held to each surface of the belt while running and a thin film of dressing be deposited in this way on the leather. The fundamental requirement is to have a clean leather surface to which to apply the dressing. It is worse than useless to put dressing on a belt already covered with dressing, or with dirt or oil. Therefore, remove all excess dirt by means of some form of scraper. A sharp-edged block answers the purpose very well. Then, if necessary, scrub with naptha or kerosene but whether by this or some other method, be sure of a leather surface that you can recognize as leather. Put a little

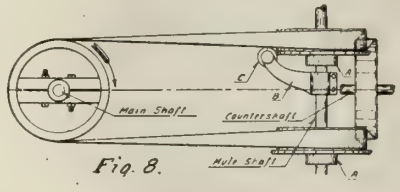
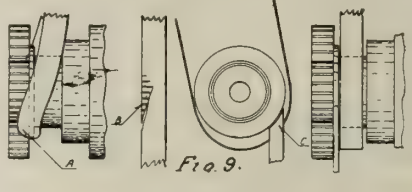


Fig. 8.


Fig. 9.

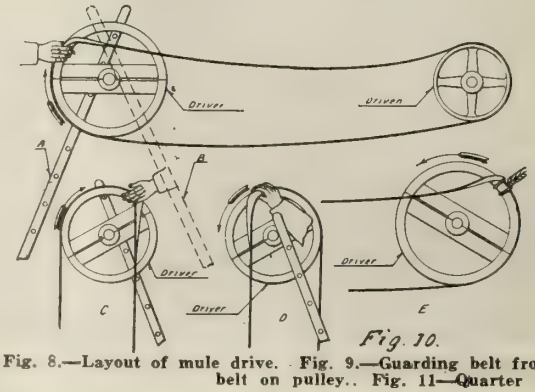


Fig. 10.

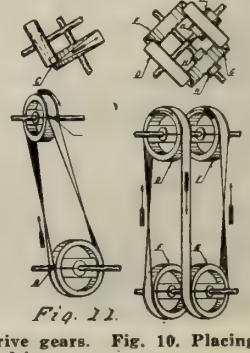

Fig. 11.

Fig. 8.—Layout of mule drive. Fig. 9.—Guarding belt from drive gears. Fig. 10. Placing belt on pulley.. Fig. 11—Quarter turn drive.

This article was prepared from material supplied by the Saddler and Haworth Co. and the experience of the author. First part appeared in the June 15 issue.

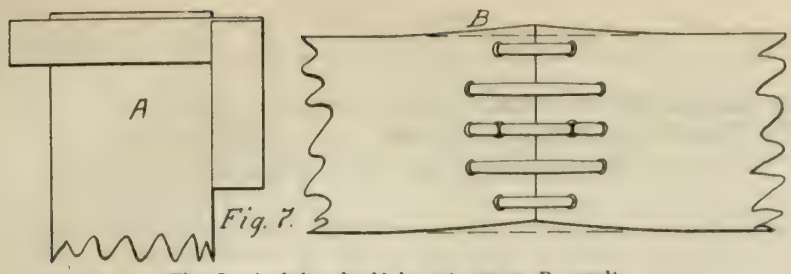


Fig. 7.—A, belts should be cut square. B, result when ends are not cut square

dressing on the driving surface, and more on the surface away from the pulley. A proper dressing will gradually work its way through the leather, and give the driving surface the necessary lubrication, causing it to have that mellow feel, readily recognized by the expert belt man. Probably the best way of doing this is to rub the belt all over with a piece of burlap covered with the dressing, having steadily in mind that too much dressing is apt to be more harmful than too little. No free grease should be apparent on the driving side of the belt after the dressing has been applied.

How To Treat New Belts

Mechanical tests show that the ordinary new belt will not carry the same load as it will after a few weeks service, by from 10 to 20%. It follows that on new belting a good light coat of dressing should be applied in the manner sugested above—before installing. Repetition at frequent intervals for the first few weeks would help, too. Remember that dressing is not put on the belt so that it may stick the belt to the pulley and thus make it pull more. It is put on so that by entering the leather fibres it may toughen them, lubricate them, and thus give longer life to the belt. Whenever the leather seems dry, harsh, tinny, does not have the right mellow feel—you may be sure dressing should be used.

Another important factor in belt economy is cleanliness, first of belt and then of pulley. A clean, soft hand will not slip easily even on smooth glass or polished wood. Leather was once skin, and smooth, clean leather will not slip easily on a smooth, bright pulley surface. Belt surface should be clean, smooth, level and comparatively dry. Tests have shown that the coefficient of friction (on iron and steel pulleys) is: .56 when dry, .36 when wet, .23 when greasy, .15 when oily. Therefore it is very important that both belt and pulley be kept as dry and clean as possible.

Too much grease is injurious to leather. Mineral oils in particular rot leather rather rapidly, and where belting is liable to become soaked with oil, mechanical means should be taken to keep the oil from the belt. Where mechanical protection is impossible, the belt should be removed from time to time and the oil extracted with some solvent such as naphtha or carbon tetrachloride.

Packing the belt in dry sawdust or shavings will sometimes answer the purpose. If it is impossible to remove the belt, wiping on the pulleys with a dry cloth or waste will help. Machine oil, in addition to its tendency to rot leather, when present in excess gives a very poor friction surface, as shown in the table preceding. Too much oil will penetrate the belt and affect the adhesive quality of the ordinary cement used in gluing belts together. Frequently, from this or other causes laps start up at the points, a result sometimes due to running belting in the wrong direction.

Direction of Travel

Another point that comes under discussion in connection with leather belts is that of the spliced joints, and their relation to the direction of travel. It is quite evident that the thin edge of the lap may show signs of parting after a period of service. For this reason some men contend that the belt should be run with the splice as shown at B, Fig 1. On this principle the action of the pulley will aid in keeping the thin edge down to its place. On the other hand, some belt men say that the action of the air on the belt surface when in motion tends to lift the edge from its place. As this air action is greatest when the joint is passing around the pulley it would appear that the subject is open to discussion. However, as slow running belts are not subjected to excessive air action it might be said that the method shown at B would be best, and that at A best suited for high speed belts. Irrespective of the advantages claimed for either method, the entire question seems to be one of careful attention in the matter of repairs and maintenance so that faults may be remedied as soon as they are observed.

Avoid Small Pulleys

In double or three ply belts these splices can be run to meet both conditions as shown. In the use of double or triple belts for heavy power drives, care should be taken to use pulleys as large as possible, consistent with speed requirements, as effective heavy drivers are impossible on pulleys of smaller diameter. This is quite clear when we consider the lack of flexibility of the heavier belts. Running over small pulleys also tends to create a fault as shown at G, Fig 1, when the ply of the belt may be losened.

A condition that sometimes arises in the case of old style lathes is that shown at Fig 9 where the belt will jump the flange and get caught in the gears. A guard will often eliminate this trouble.

Remember that because shafting was in line once it does not necessarily remain so indefinitely, and regular attention to this point will result in a large saving of time, trouble and power. Light machines, especially when not firmly fixed to the floor, are apt to get out of line a little. This misalignment is difficult to detect and always results in uneven belt strain, excessive slip and reduced delivered power.

The Mule Drive

Another drive that is occasionally used is that illustrated in Fig 8. This is known as the mule drive and is adopted where a machine is to be operated at right angles to the line shaft and where a quarter turn drive is not permissible. In the mule drive the connected shafts usually lie in the same horizontal plane, invariably at right angles, where the prolongation of the counter shaft would intersect the main shaft. The intermediate pulleys revolve in a horizontal direction on a vertical shaft. When it is desired to run the belt in either direction it is advisable to have the two main pulleys of the same diameter. Collars are necessary on the vertical shaft to support the pulleys. One bad feature in a mule drive where the load is a fluctuating one, is the tendency of the belt to run off the mule on the slack side. It is preferable to have the pull come in the lower side, but in either case the slack side should be provided with a guide pulley C, carried in a bracket B fixed to the mule shaft. This will aid in supporting the belt when the load is on the machine.

Proper Position of Ladder

When placing a belt on the pulleys it should first be located on the "dead" or driven pulley, as shown in Fig. 10, the actual running on of the belt being done on the driving pulley. As the latter is usually on the main shaft, in the majority of cases a ladder is necessary, and in placing the ladder, care should be taken to locate it on the outside of the drive, as shown at A. With the exception of special cases, where the drive shaft is located along a wall, the ladder should never be placed in the position B, and when such is absolutely necessary the shaft should be stopped and the belt run at a very slow starting speed.

When standing on a ladder for this work the body should not be in a strained position, and one hand should be placed on a fixed object for support. For the lighter sizes of belts it is seldom that the speed of the driving shaft is reduced, as the knack is soon acquired of running the belt on. On the heavier belts the work is more difficult, but dexterity is attained with practice. When the belts are very heavy or extra tight, or with a load on the belt, "snapping on" is not so easy, and slipping of the belt is often necessary, while speed is accelerating.

Periodical Overhauling Advisable

To make certain that you are getting

(Continued on page 46)

European Conditions As Seen By C. J. Warren

Representative of Remington Typewriter Co. Gives Some Interesting Side Lights on Industrial and Commercial Activities in Europe—British Ships go to Germany for Repairs

THE BRITISH people have been looking forward anxiously, and with high hopes, to the time when their exchange should improve," said C. J. Warren, of the Remington Typewriter Co., when speaking about his recent trip of eight and a half months abroad, which covered central and Western Europe as far north as Helsingfors, as far east as Dvinsk, and as far south as Northern Italy.

"The time has come, and with it disappointment," continued Mr. Warren. "They are essentially an exporting nation. When I went over this last trip the pound sterling was $3.60, to-day it is $4.46. They are finding out that their foreign customers cannot afford to pay such rates for the pound sterling, when francs, lire, marks, etc., can be bought so much more cheaply. This is hurting British business seriously. It has brought into effect various public measures to relieve unemployment.

"During 1919 and 1920 I had found a shortage of coal. That trouble no longer exists, but the prices are so high that, together with the attitude of British labor, British ship owners are being driven to send their vessels to Germany for repairs. This is unprecedented in the history of their shipping.

"Another development, of interest to Americans, is taking place. The domestic servant problem has reached the point where the Britisher, who does not know America, thinks it is simply 'awful.' This together with the high price of coal, is bringing about the introduction of 'central heating plants,' or furnaces as we would call them, to replace their customary grate fires.

"In Holland, the outstanding feature to the traveller is the high prices. Switzerland is the only European country where living is more expensive at the present time. Holland has valuable products to export, principally from her dairies. Her colonies are of great value in her economic life.

Conditions In Germany

"This trip my business took me at different times to Germany or through different parts of it en route to other countries, so that I had opportunity to study it as a whole. I made it my business to note the number of chimneys smoking, and size up in a general way the various industrial districts of that country. While of course different industries varied, it seemed to me that the country as a whole was producing about thirty-five per cent. of capacity. In talking this matter over with a prominent German who is connected with different interests, he called my attention to the fact that Germany had, during the war, doubled her pre-war productive capacity. He stated that if I would deduct half of my chimneys for wartime construction and take the percentage smoking of the remaining half, I would be remarkably close to the official figures, which showed the present German production to be just under seventy per cent. of pre-war production.

"There was more building going on in Germany than in any other country I visited. It was well distributed, both urban and rural. In Berlin I was much interested to see three large banks adding two or three stories to their present edifices. This was said to be necessary to house their increased staffs. Most of the construction, however, was of a residential nature. Occasionally new buildings were seen going up in an industrial plant.

"There was less unemployment in Germany than elsewhere. There was suffering among people with fixed incomes, such as widows, old people, also school teachers and others whose incomes have been increased but relatively little. Few people in this country realize what the drop in exchange means to the people of Europe. Before the war living was much cheaper in Germany than in the United States.

"Then a thousand marks was equal to about $250.00. Now a thousand marks is worth about $3.00 and prices of the necessities of life are much higher. We do not know what economy is in this country. If it were not for the fact that the simplest home grown products, such as potatoes, beans, etc., have not gone up in price in proportion to the drop in exchange, life would be hardly possible for some people. And yet the poor in Germany are better off than the same classes in Poland and Austria.

"Last autumn many retail stores in Berlin had practically empty shelves. Sometimes they would refuse to sell more than one pair of stockings to a person. Many stores frankly asked foreigners from 25 per cent. to 50 per cent. more than their regular prices. This did not seem unreasonable to me. I am convinced that the lack of stocks was due to the Germans themselves. When their exchange was dropping most seriously the people soon realized how much less a thousand marks would buy one week than it would have bought the week before. They decided it was bettter to save or hold most anything except money, and therefore rushed to the stores and bought articles of all kinds. It is true that the large hotels of Berlin were occupied almost exclusively by foreigners to whom most German prices looked very cheap. The total number of such travellers was not enough, however, to account for the depletion of retail stocks.

Exporters After Business

"As far as Europe is concerned, German exporters are pushing their wares more energetically in the countries of low exchange value than elsewhere. While we are feeling the German competition keenly in some markets, my feeling is that in general she is less able to supplant our foreign trade than she was before the serious drop in her exchange. This is particularly true in industries using any imported materials. Labor is generally considered less efficient than formerly. Some of her industries were so specialized that one process was finished near the coal fields. The partly finished goods were then transported to where there was a better water supply, or to where the necessary chemicals were produced.

"Their transportation system is not functioning so as to allow the regular and systematic supply of the partly finished goods to the different plants as is absolutely necessary for economic production. In some cases the new frontiers have come in between the different units necessary for the completion of a given article. This has made necessary the securing of certain passes or customs clearances for the shipment of partly finished goods from one plant to another. Delays occur in spite of all that can be done. This makes economical operation impossible in certain plants and processes.

"There are other difficulties which the manufacturer in Germany has to face; export duties and ever increasing taxes. While wage scales look cheap when reduced to dollars, it must be remembered that in many instances such scales have had to be increased at thirty-day intervals when exchange was dropping. This is one reason why some German manufacturers have refused during recent months to accept any orders, except at market prices at time of shipment."

"In considering Germany's position as a competitor it is necessary to bear in mind that she formerly drew many valuable supplies from her foreign colonies, Alsace-Lorraine, and those ports of Silesia which she no longer controls. If she gets supplies from these sources to-day, she does so in competition with others and not on any preferential basis. The lower her exchange drops, the more difficult it is for her to buy raw materials in the open market and manufacture them into merchandise which it is profitable for her to export.

"While certain kinds of goods can doubtless be manufactured to better advantage to-day in Germany than elsewhere, each line must be considered sep-

arately. Another point which must not be overlooked by any one who is considering manufacturing in Germany is that should the German exchange become stabilized or improve, prices of commodities will drop much more rapidly than will wages. Germany will then encounter the same difficulties which Great Britain has recently with the improvements in her exchange.

Situation in Denmark

"Denmark's currency has been depreciated more than that of Sweden, but less than Norway's. It is essentially an agricultural country. Its farms furnish its chief exports as well as a large share of its food. The free port at Copenhagen is important in foreign trade. While business has been dull there, it has not suffered as seriously as the other Scandinavian countries.

"Norway: Its principal industries are shipping and fishing. They have been suffering extremely during the world-wide depression. Two of the largest customers of their fishing industry were Spain and Portugal. When Norway adopted a form of prohibition which largely stopped the importation of Spanish and Portuguese wines, those countries retaliated by obtaining their supplies of fish elsewhere. The situation is still serious in Norway.

"Sweden: Sweden is an important producer of high grade iron and steel, and certain steel products, wood pulp and paper. It is a much more industrial nation than any of the other Scandinavian countries. Its agriculture, shipping and fishing are considerable. Although this country has been very pro-German throughout the war, I found much less German competition here than in countries with a more seriously depreciated currency. Stockholm is one of the European capitals where the Bolsheviks have maintained an important mission. Business is still far from normal.

"Finland: Finland's principal industries are fishing, wood pulp and its products. While the Finnish mark is not depreciated to the extent of the German mark, I could not find any cause for its being as low as it is, especially when compared with the currency of the other Scandinavian countries.

"There is little intercourse between Finland and Russia. There is no love lost between them. The Bolsheviks have crossed the border several times and then been driven back by armed force.

"The Finns are an intelligent, enterprising, industrious race. Their capital is a modern up-to-date, well kept city. Their art and architecture has a character all its own. The poem from which Longfellow took the meter, and upon which he based his Hiawatha, is Finnish.

"Esthonia: The old walled Russian city of Reval, the capital, is quite a contrast to the City of Helsingfors, we had left across the narrow gulf of Finland. The Esthonians are proud of their independence. There is regular communication with Petrograd by both rail and water. Business in this country is very limited at the present time, but there is a constant bartering trade with Russia. There is a daily sleeping car service to Riga, Latvia.

"Latvia: Riga, the capital, might be described as a typical Western European city. It has many broad streets, parks, etc. The hotel service was very good, but the buildings and equipment showed the wear and tear of six years of war, under opposite sides at different time. With their depreciated currency they could not be expected to refurnish the hotel at the present time. Until the ice closed the Baltic sea a few people there with Bolshevik trading licenses had been sending small sailing vessels into Petrograd with miscellaneous cargoes. They returned with equally miscellaneous cargoes, but the business was profitable. There is also rail communication with Russia, but direct line to Moscow, the line to Petrograd is not in operation. As trade with Russia increases and until such time as it is practicable to maintain direct relations with the leading Russian cities, Riga will, I believe, be the leading base of operations. There are through sleepers daily to Paris, and to Ostend for London.

Conditions Bad

"From here we turned east to Dvinsk on the Latvian-Bolshevik frontier. The vicinity of this city looks like a section of the western front with no sign whatever of any reconstruction. The people seem too poor and destitute to do anything. We travelled with one man who seemed as warm as we did. His coat was lined with sheep skin with the wool on and the outside was neatly patched, but some of the patches were of burlap. The place was buried in ice and snow, but children ran by us in rags and tatters through which we could actually see their skin.

"Plain food was available in the so-called hotels and restaurants to those who had the price. When we figured the prices into dollars, they seemed cheap, but to the poor man who earned rubles, they were awful. The bridges across the Dvina had all been destroyed. A temporary one had been constructed, but most of the traffic was on the ice. We secured an old army truck to take us to the Lithuanian frontier at Kalkuny.

"Lithuania: This country can barely be said to have a sea coast. It has no prominent port. In certain relations with foreign countries it acts together with the other two Baltic States. In other respects it is very closely allied with the people of Northeastern Poland. While very little business can be done there at the present time, we have found it advisable to have it handled by the Polish dealers from Warsaw.

"There are nothing but third-class carriages left on the railway across the eastern end of Lithuania. The service does not connect with that of the Polish railways.

"Poland: Turmont, on the border, is composed of an old freight car for the ticket agent, and two rough buildings of about the same size; one is the custom house and the other a buffet and waiting room. Most travelers have to stand for lack of room. There is one farm house in sight. A through train runs to Warsaw, via Wilna, daily Twice a week it carries a sleeping car. After waiting more than four hours in the cold and dark the Polish train pulled in.

"It was very pleasant to step into the clean, comfortable French sleeping car which was to take us to Warsaw. Conditions there warrant all the philanthropic work which America has been doing. Our first impressions were quite contrary. The furs, silks, and jewels displayed in the large hotels did not indicate need for any such assistance. It developed upon investigation that very little display was being made, or money spent in the large hotels except by foreigners but such foreigners include the Bolsheviki.

"In considering Poland, it should be borne in mind that this country is made up of three sections. Until recently each of these sections was under the domination of a different monarchy, and in each case was exploited for the benefit of another race. The great masses of the population were not educated to become citizens of a republic. But the better class of Poles must not be judged by these masses. They will compare with any race, or people. They have no easy road to hoe, but I have faith in the ultimate solution of the Polish problem. The situation resulting from depreciated exchange is similar to that in Germany, but worse. There are sleepers daily to each, Paris, and Ostend for London via Berlin.

Picture of Russia

"The picture I shall try to give you of this country is a composite one. It came from several men living at present in different countries just outside of Bolsheviki Russia, but each one of whom knew Russia before the war, has been in Russia more than once, and has recently come out of Russia. They are all business men, but not men who went into Russia in any such capacity that a stage was set for them as has been too often the case.

"Food and clothing can be bought in both Moscow and Petrograd, from privately owned retail stores. The wholesale trade is really under Soviet supervision, but trading licenses have been issued. Property rights up to small amounts, particularly for the peasants, have been recognized.

"The great mass of the population is destitute, broken in spirit, pitiable. They have nothing with which to buy, and until recently have not been encouraged to produce anything. The large institutions, the big accumulations of capital are gone. Those who hurried

to hide their property are mostly dead and their property gone.

"There was an old custom or habit of the Russians which is now often overlooked. The small and medium sized business men, often the leading men of the smaller communities, the backbone of the country, did not bank their money very often, they buried it. When the revolution came they did not have to hurry to hide all of their property. Out of a pre-war population of over 160,000 people, it is estimated that there may be four or five millions such people to-day. The total business such people could possibly do would be small as compared with the pre-war totals of Russian business. It is believed, however, that as soon as they feel assured on two points that considerable trading will begin. These points are: first, that when they produce the money it will not be taken from them; second, that when they have used the money in the purchase of goods that such goods will not be taken from them.

"One man living outside of Russia who has a Bolshevik trading license has been sending small trading vessels into Russia with miscellaneous cargoes, up to the time the ports were closed by ice this last season. His license read 'to trade in necessary articles.' I asked how he knew what he could send in. He replied that he did not know; that anything could be stopped, but nothing ever had been.

"This same man heard of a town where the— Soviet, if you like—but nevertheless leading men of the town, looking after their own interests wanted to import some goods. He went in person with his wife. They drew up a list of goods they wanted, mostly agricultural machinery and seed, amounting to over $300,000.00. He asked how they wished to pay for it. The reply was 'Is gold good enough?'

"With regard to the present government: it is believed that the men at the head of it are among the cleverest that ever lived anywhere, at any time. It is believed that they themselves recognize that Bolshevism or Communism is a failure and that to undertake to continue it is sure death. To frankly admit it, and right about face, would mean assassination at the hands of their own understudies and dupes. They are considered to have undertaken to swing around gradually to a capitalistic government. They are rather expected to succeed. On the other hand I was cautioned that a man who was investigating the situation as to the possibility of opening commercial relations with Russia, should know that there was a remote possibility of the worst pogrom the world has ever seen, beside which the worst Turkish massacre would seem a child's play.

"Before the war for a foreigner to take part in the diplomatic or social life of Russia the French language was necessary. On the other hand, the foreign language most useful in the ordinary commercial life of the country was German. The Germans forced this situation. The English to-day recognize this situation to the extent that they have gone so far as to organize a company in Berlin, but directed from London, with a view to taking advantage of the German entree to open business in Russia. Germany and England (the latter not too close a second) are the two European countries able to handle and already working to secure Russian trade.

"Czecho-Slovakia: Prague is an interesting city, but not a cosmopolitan capital. It is a tremendous job to organize a national government and get it running, where there has not been any. They are doing remarkably well, although there still remain serious problems to be solved. Their industries are generally more diversified and better developed than those of most of the other new European countries.

"The Germans are working this country to the utmost, but are not met with an over warm reception by the elements who have feared a possible absorption by Germany.

"Austria: As in western Europe, all roads lead to Paris, so in central and southwestern Europe all roads lead to Vienna. Some of these roads were first built by the Romans. Vienna was strategically located. No artificial political boundaries are going to change it. Vienna is going to continue to be the most important city in the commercial life of that country. Their new political neighbor on the north is an important producer of beet sugar. She undertook to rule that her sugar crop should be sold direct from Prague and not through the former channels in Vienna. Finally the unsold stocks became so large as to cripple the industry. The Government regulations were withdrawn and within two weeks after the sugar was offered on the Vienna market, the stocks were disposed of for distribution over a wide territory.

"There were over 20,000 men in the University of Vienna; of these there were 700 listed by a welfare organization who were living on from three to four meals a week, and had no rooms to sleep in. They gave a small tip to the porters of the cheap cafes which were closed at 1 p.m. and slept on the benches without bedding. Some will not live through such an experience, but our American youth must look to its laurels if it is going to be a match for the men who have gained their education at such a price.

"The political and economic situation seems in some respects to be an impossible one. Utter ruin has repeatedly been promised since the armistice. Industrious, intelligent men, with families to support, die hard. Our company is selling a very limited amount of goods there and is getting paid for them.

"Italy: Italy is in far better condition as regards labor than she was a year ago. At that time the threat of revolution was rife. Not a manufacturer or proprietor there knew 'where he was at.' They have had some hard times, but there is now no danger of revolution. Several laws have been passed for the protection of labor. Employers hesitate to take on more work than they can do with their regular number of employees, because of the legal difficulties in discharging men. Compensation for several months or even a year is allowed frequently. There is a marked tendency in this direction all over Europe which should be watched by all Americans employing men in Europe. Italy seemed to me second (Germany first) in the amount of building there was going on.

Conditions In France

"We hear much criticism of France for not demobilizing more. If the environs of New York City had been devastated as has the country near Paris, and if our arch enemy was at the unprotected Canadian border, and we had no more assurance of what our allies would do in case of another attack than has France, I doubt if we would be willing to demobilize more.

"The excitability of the Frenchman—his socialistic tendencies—are often referred to. Against this the Frenchman has a very strong safeguard which is lacking in his conservative neighbor across the channel. The average poilu, if not a property holder, is the son of a property holder. Extremists may write and talk and be quelled, but I did not find the underlying resentment towards the landlord that existed where there was the constant fear that if the next month's rent was not paid the wife and kiddies would be put on the street.

"The owner of a large property in the center of Paris could not legally raise his rents. When French exchange was lowest and coal was at its highest price, the landlord came frankly to his tenants and stated that their leases included heat. He showed them that his total income from rent would not pay his taxes and coal bill alone without allowing anything for porter and cleaning expenses regardless of upkeep and income. He stated that unless they could come to an amicable arrangement whereby the tenants would make an extra payment for coal he would be compelled to burn in the furnace only the materials gathered in the scrap baskets. The tenants recognized the justice of his position and agreed to an additional payment for coal.

"Due largely to the loss of man power and the men under arms the unemployment situation has been less serious in France than in several other countries. There is a shortage of skilled labor. In a few lines of business at least conditions are quite as encouraging in France as anywhere in Europe.

"Switzerland: This little country has no foreign colonies. Their exchange has been the first to return to the pre-war normal. Her lace, watch and dairying industries have been crippled as never before because their foreign cus-

(Continued on page 46)

News From the Welding Field

Mechanical Control of Oxy-Acetylene Torch

Cutting Metal by This Process Approaches Very Closely the Maximum Theoretical Efficiency—Obtaining Any Desired Shape By Means of Templates—Application of the Radiograph

By FRED J. MAEURER

IN bringing before you these photographs of very unusual machine cutting operations by the various types of machines, we particularly call your attention to four essentials of cutting that can be obtained only by taking away the human element and substituting electric power for motion and mechanical means for holding the torch; these four things are—low oxygen consumption, speed of cutting, accuracy and smoothness of cut.

Of the four, the consumption of oxygen is by far the most important, as engineers and plant managers are always on the watch for information that will enable their operators to cut down oxygen consumption without cutting down production. It has been proven time and time again that it can be easily done if the heads of departments would compel their operators to follow the instructions sent out by the manufacturers of equipment with each torch. Each size tip is so drilled that it operates at its highest heat efficiency if the pressures are used as prescribed. For each thickness of metal to be cut they tell you what size tip and pressure to use and also to tell you at what speed the torch should travel. This isn't guess work on their part; they know from thousands of experiments they are always carrying on that it is right, and if they can put a certain thickness with a certain tip and pressure and move the torch at a certain speed, it surely follows that you can do likewise. Our company maintains a large force of expert service operators traveling all over the country, and in all kinds of plants both large and small instructing the users of equipment to follow the instructions as to tip sizes and pressures thereby saving vast amounts of oxygen, also giving instructions as to the more modern methods. That goes for all makes and styles or oxy-acetylene welding and cutting torches on the market.

It does not take long for a hand cutting operator to get in a rut. Instead of trying to do his cutting with the least amount of oxygen, he will put into his torch a tip three or four sizes too large for the thickness to be cut, and use an oxygen pressure absolutely out of proportion to what he should use, just because it cuts easier. In a great many instances, to forcibly impress it upon his mind, we have taken his torch and actually cut metal 4 and 5 times the thickness as the metal he was cutting, using the same size tip and gas pressure as he did. It is the writer's opinion that this is the chief cause of oxygen waste and can be worked out and stopped with the proper co-operation.

Metallurgists, chemists and research men tell us that it requires a given amount of oxygen to consume or oxidize a given amount of weight of steel, and if a greater amount of oxygen is used without adding additional weight to the steel, a waste of oxygen is the result. The writer has a long laboratory report from a well-known metallurgist who claims that the most economical proportions are one cubic foot of oxygen to twenty-two hundredth pounds (.221 lbs.) of steel.

In trying to check this up, we have made some very interesting tests, covering quite a period of time with both hand cutting and machine cutting, selecting half inch steel plate to experiment on, using various size tips and pressures, and also various speeds.

Our hand cutting test was cutting over 5,000 linear feet of ½ inch plate, covering 17 days cutting at 8 hours per day, or 136 hours. This time covers moving from one side to the other, but does not include changing of cylinders, as a 10 cylinder manifold was used, cylinders being changed before starting in the mornings. Three different size tips were used at varying pressures, but the best results were had with the smaller tip. The best day's cutting was used, which was 393 linear feet cut, 565 cubic feet of oxygen consumed. This means his best average linear feet cut per hour was 49 feet. The speed of cutting averaged 8.16 inches per minute, and oxygen consumption 1.43 cubic feet per linear foot. This is truly very remarkable hand cutting which every operator well knows.

To give you an idea as to what the human element actually means in hand operation we find that on one of these seventeen days having the same identical working conditions and the same thickness of plate to be cut, weather conditions also good, he cut as low as 258 linear feet, another day 298, another day 347, and another 360. This test conclusively proves that a hand operator cannot keep up a constant speed several days at a time.

In carrying on our machine cutting tests, we used the same size tip and

This material was prepared by the author, engineer of Airco-Davis-Bournonville Co., for the American Welding Society.



Fig. 3.—Top: Cutting 14 in. square billets with radiagraph.

Fig. 8.—Lower: Edges show smoothness of cut.



Fig. 1.—Lower: Cutting circles 31 in. dia. in steel 9 in. thick.

Fig. 2.—Top: Machine at work cutting rings from plates.

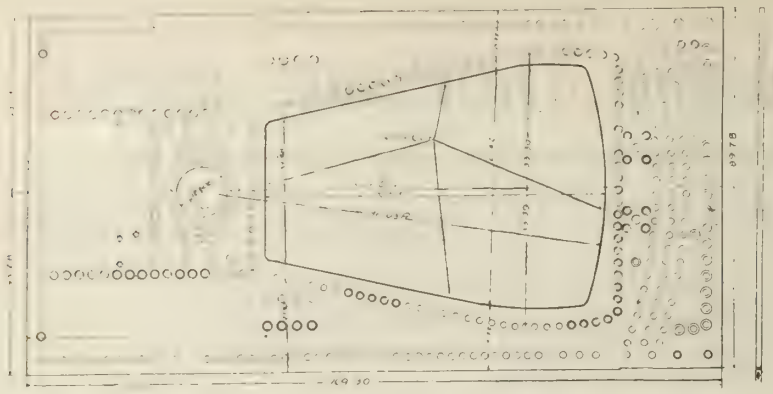


Fig. 4.—Sketch showing accuracy required in cutting plate for gun carriage.

lower oxygen pressures than the hand operator did, using half inch plate, each plate 12 feet long, and obtained a speed of 18 inch per minute and oxygen consumption 1½ cubic feet to each 18 inch of cutting. The width of cut was ⅛ inch, and as one square foot of ½ inch plate weighs 20 pounds and dividing this into 20 pounds we find that we have oxidized .21 pounds of steel with each cubic foot of oxygen consumed, which is mighty close to the figures submitted by the metallurgist. All of the machine cuts were smooth and straight. 2,500 linear feet were cut by machine.

Further checking up on this report, a large steel car plant is at the present time cutting forged steel yokes, 19 linear feet of cutting on each yoke, thickness a trifle over one inch, using the next large size tip at a speed of 12 inches per minute and oxygen consumption 2 cubic feet for each linear foot cut. Our experiments covered over a week's time using three different size tips and various pressures before we found that the tip and pressures used at the present time of these yokes were the most economical. You will note from this that we again come very close to the proportions as outlined by this same report. These cases are only a few of the many that were carried on and we believe they conclusively prove that the most economical steel cutting is done by automatic cutting machines, cutting the waste down to a minimum. These tests do not mean that the speeds mentioned above are the highest that these thicknesses of metal can be cut with machines, as the writer has successfully cut ¾-inch steel at the rate of speed of 28 inches per minute and ½-inch plate at 33 inches per minute.

With further reference to checking up the proportions of oxygen to steel to be used in cutting, we also cut a 14-inch billet, that is, the piece of steel of 14 inches square and the width of kerf was ⅜ of an inch. The oxygen consumption was 100 cubic feet. The amount of steel oxidized would naturally be ⅜ of an inch wide, 14 inches long, 14 inches deep which weighs 20.4 pounds. This shows that for each cubic foot of oxygen consumed on this cut we oxidized .20 pounds of steel.

The writer does not wish the impression created that these proportions are absolutely correct from the hand cutting or the machine cutting standpoint but realizes that it is a wonderful basis upon which we can all operate and if any operator, hand or machine, can better these figures, we can only say, "more power to him." Although we cannot vouch for the correctness of this report we do know from practical experience that we come mighty close to the figures outlined by it.

That there is a vast waste of oxygen in the larger and smaller plants there is no question and engineers are at the present time co-operating with the service men to the limit to cut it down, but due to the fact that a certain amount of their work is done in an emergency, it has been hard work to bring it to their attention, unless some unusual cutting is done in their presence, to make them fully realize that the waste is going on.

I have in mind one case where a competitive test was held at one of the larger steel plants between three different makes of torches in which the writer took part, cutting 12-inch square billets, each operator to make nine cuts. When the demonstration was completed it was found that the difference in oxygen consumption between the three torches was about 15 per cent. The lowest oxygen consumption on one 12-inch cut was 68 cu. ft. Their own operator then cut several billets with about the same oxygen consumption. The engineer in charge of the test asked his operator what size tip he always used and how much oxygen he consumed on cuts he had made before, and he frankly told that he had used a tip three sizes larger than the tip we had used and could only get one cut out of a 200 cu. ft. cylinder. From that day there is very little oxygen waste in that plant as the operators are being checked up continually. This is not an unusual case but it can plainly be seen that something out of the ordinary had to happen before this particular waste was stopped. This operator informed us that he had used a No. 10 tip with 185 lbs. oxygen pressure, and those of you who have had any experience with heavy cutting fully realize that this large pressure travelling through a narrow kerf was cooling the walls of kerf and molten oxide before it had a chance to get half way to the bottom of the billet. The test cutting was done with a No. 7 tip and 125 lbs. oxygen pressure.

It isn't a very easy job to get the officials of a large plant interested in oxygen saving, particularly those that have a great amount of emergency work, but once they do become interested there is no limit to what they will do to co-operate with you to the best of their ability, this is evidenced by the following facts of a very recent case.

(To be Continued)

In the issue of June 15 appeared an item on a Large Bucket Dredge built by Can. Vickers. The h.p. of this vessel should have been given as 1,800 and not 1,400.

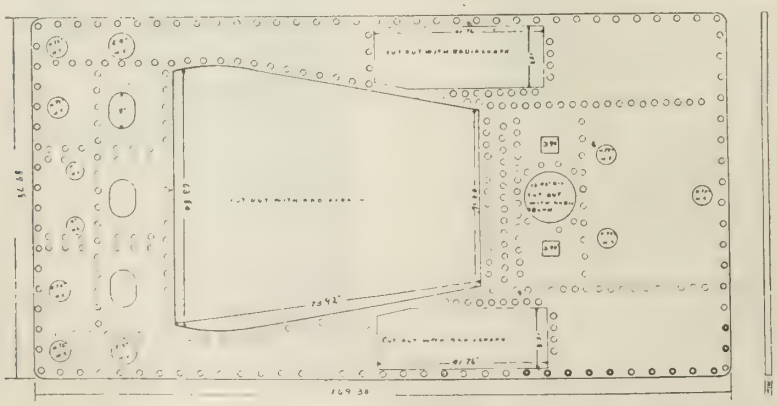


Fig. 5.—Bottom plate for gun carriage—all openings made with cutting torch controlled by radiagraph.

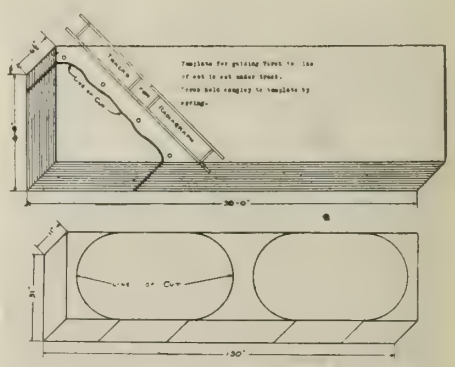


Fig. 6.—Cutting twelve plates at one operation.
Fig. 7.—Showing an 11 in. cut made at the rate of 4 in. per min.

Practical Ideas From Practical Men

MAKING FORD FRONT WHEEL HUBS

By Geo. Barrett

The sketch Fig. 1 shows the hub which is of malleable iron, and machined at points marked f, and are finished to very close limits by handy operations in Hartness flat turret lathe.

The first operation is boring the seat of outer ball cup and finish for inner ball cup A, Fig. 2. This tooling consists of indexing the turret in two positions, using Kelly adjustable boring bar B, Fig. 2, and a special fixture C, having a roughing and finishing tool as shown in the layout.

The stop on carriage of turret is set to give a standard length of hub, from front to inner ball cup seat, so as to allow enough stock to finish outer end. The small end of boring tool B is to finish the bore marked D, Fig. 2; this bore is made true with the alignment of inner ball cup seat A for accurate setting on arbor for succeeding operations. The tools E and F are to chamfer the outside and inside of ball cup seat, and also face to length. All the tools are made from stellite and compound used for lubricant. The machine runs at a high cutting speed, the average production on this operation being 60 per hour.

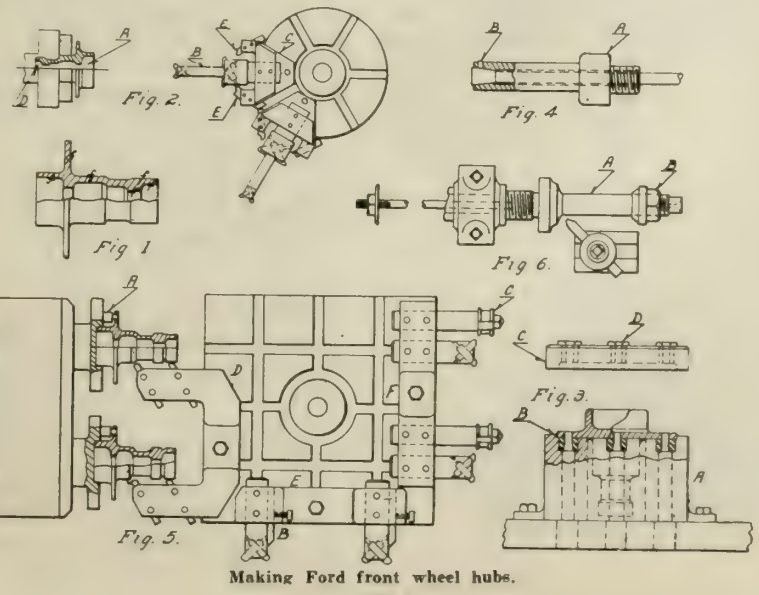
The next operation is drilling for bolt holes which are 13/32 in., and all holes are drilled at one setting, using jig as shown at Fig. 3. This is of simple construction, having a base A, Fig. 3 which is bored out at B half the depth of hub flange thickness for centering purposes. The drill guide C, Fig. 3 is placed on opposite side of flange in any position and drill spindle brought down so that drills in multiple spindle will enter guide bushings D, the output averaging 90 per hour.

The hubs are now ready for the outside finishing and consist of the following operations: turn barrel, face flange, bore outer ball cup seat and finish diameter for hub cap thread. This operation is done on a double spindle Jones and Lawson, the hubs being held on a special expanding mandril Fig. 4, which is of the ordinary type operated by air chuck. The inner ball cup seat is now finished with the limits close enough to allow the mandrel to be made a neat fit at A, Fig. 4, and gripped at D by expanding dogs B. The tooling arrangement is shown at Fig. 5. The hub is placed on mandrel and driven by pin A. At first indexing of turret the barrel is rough turned and inside of hub flange faced.

At the second position the bore of outer ball cup is roughed out and chamfered. The turret is next indexed to finish bore ball cup seat, and form outside of barrel for hub caps, using Kelly boring bars and circular forming tools C, Fig. 5. The turret is fed into the required depth and returned, after which the head of the machine is brought in contact with forming tool, using the graduations on cross feed wheel to insure the size for diameter of thread.

The fixtures D, E and F are made of cast iron and having machine head set to zero before boring for tool holders, assures alignment on indexing of turret. This operation averages 30 per hour. The hubs are now ready for the ball cups to be pressed in, which is done on a small hydraulic press. The ball bearing is then applied and retainer rings, also the dust felt. After assembling complete ball cup, they are passed on to an ordinary engine lathe where a light cut is taken off the barrel and hub flange, using a special arbor, Fig. 6.

The final operations consist of threading for hub cap, which is done on an ordinary bolt cutter using a Landis die head, the threading being performed last, so as to prevent damage while work is in transit through the different operations.

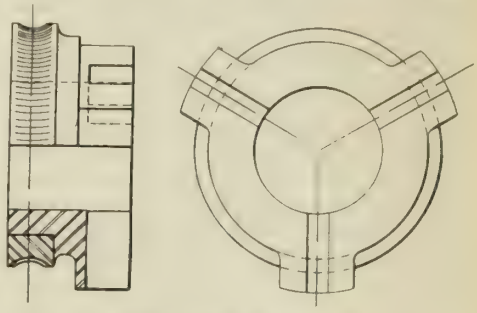


Making Ford front wheel hubs.

REPAIRS TO CUTTING OFF MACHINE

By N. F. P.

On a certain cutting off machine the retaining member that holds the jaws is made integral with the worm gear that operates it; the jaws bearing on three cams and being revolved, close upon the work. In the case of material being cut off in the machine of the same size, it soon becomes necessary to discard the steel casting and order another. If the worm gear be turned away on one casting and a worm gear cut from another, it could be shrunk upon the casting in a different position and dowelled in place.

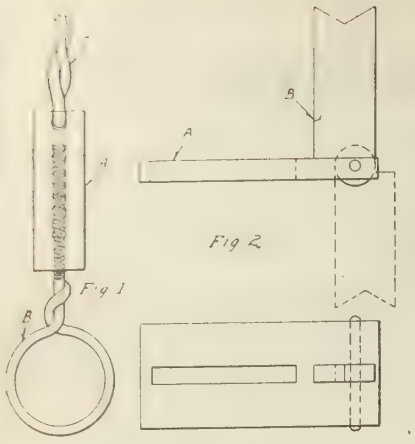


Cutting-off Machine Repairs.

SUPPORTS FOR VICE WORK

By H. M.

When doing work of any description on bars held in the vice the necessity for some kind of support arises when the work is long. This is quite apart from the actual weight as even light bars of drill rod will sag sufficiently to make it difficult to hold and adjust in the vice at the same time. The common shop support stand, made of a floor plate and several pieces of iron pipe and fittings to make it telescopic is generally used and is no doubt an excellent support to use around a shop, but when a workman desires, for instance, to saw off a short length of steel he feels disinclined to go hunting around the shop for the stand. Other instances of a similar character arise that make the adoption of some kind of permanent support a profitable undertaking providing the kind used is simple to make and operate.



Work-holding devices.

Two such supports are here illustrated. The one shown in Fig. 1 has a wider range owing to the adjustment provided by the threaded wire. The piece A is made of 1¼ in. cold rolled, drilled and tapped for the thread on the end of the loop B. The wire C, which is connected to the ceiling supports the fixture. When not in use the loop may be placed over a nail or hook on the adjoining wall.

The support shown in Fig. 2 is made of rough strap iron, the piece A being slotted as shown for adjusting to position on a bench. The swinging piece B is pivoted in an end slot and has a heel for resting on piece A when in a working position. The dotted portion shows location of support when not in use. Piece A can be made to slide beneath bench if desired.

HOW TO FIGURE THE COST OF TIGHT BELTS

By W. F. Schaphorst

In power transmission through belting we have some rather peculiar conditions to contend with. Run the belts tight and the bearings will consume too much power. Slacken the belt and it may slip and we then have the power loss due to belt slip which amounts to one per cent. of the power for each per cent. of slip. With a given belt, then, it may be possible to permit slip to some extent and still save power by running the belt rather loose. But, again, by permitting slip, we are permitting our belts to wear away faster, and the cost of belt renewal may be considerable. It is evident, then, that the ideal condition is to run belts slack if possible, at the same time preventing slip. This condition is possible and is being successfully accomplished by means of proper belt care.

To emphasize the value of running belts properly I have developed a formula which gives the money saved per year by converting a tight, slipping belt drive into a loose, non-slipping drive. This formula includes the cost due to power absorbed by the journals and the power lost through slip. It does not include the cost of belt wear, though, that is a factor that cannot easily be computed mathematically, if at all. Here is the formula:

Cost per year in dollars=

$$\left(\frac{W V^2 (T-t)}{17{,}688\ T\ t} \times \frac{S\ P}{100}\right) C\ N\ D$$

where

W = Weight in pounds of the engine flywheel;

V = Velocity in feet per second of the periphery of the flywheel while running at normal speed;

S = Per cent. of belt slip saved due to belt care and improved methods. For example, if the belt slipped 4 per cent. while running tight and 2 per cent. while running slack, the saving would be (4 minus 2 equals 2) 2 per cent., which should be used in the formula.

P = Horse power of the engine.

C = Cost of power in dollars per horse power hour.

N = Number of working hours per day.

D = Number of working days per year.

T = Time in seconds required for the engine flywheel to come to a dead stop after shutting off steam or gas. The steam or gas should be shut off as quickly as possible. Engine should be driving the belt and pulleys only and driven machinery should be thrown off of the line if possible, in order not to interfere with the test. T, then, is the time required to come to a stop with belt running slack.

t = Time in seconds required for the flywheel to come to rest with belt running tight.

It is evident that T will be greater than t, because with the lessened power consumption of the bearings it will take longer for the stored energy in the flywheel to be consumed. This formula requires at least four tests: First, the belt slip while running tight; second, the stopping time while running tight; third, the belt slip while running slack, and fourth, the stopping time while running slack. Should it be found that there is more slip when running slack than when running tight, the value $\frac{S\ P}{100}$ would be negative, and it may be found that the advantages of slack running are lost. Whatever happens, this formula will tell the truth.

Let us choose a concrete example, where:

W = 3,000 pounds.

V = a mile a minute, = 88 ft. per sec.;

S = 3 per cent;

P = 200 h. p.;

C = $.015;

N = 12;

D = 300;

T = 180 seconds;

t = 150 seconds;

$$\left(\frac{3{,}000 \times 88 \times 88\ (180-150)}{17{,}688 \times 180 \times 150} \times \frac{3 \times 200}{100}\right)$$

$.015 x 12 x 300 = $472.

A saving of four hundred and seventy-two dollars per year should make a test like this well worth the while of any power plant engineer.

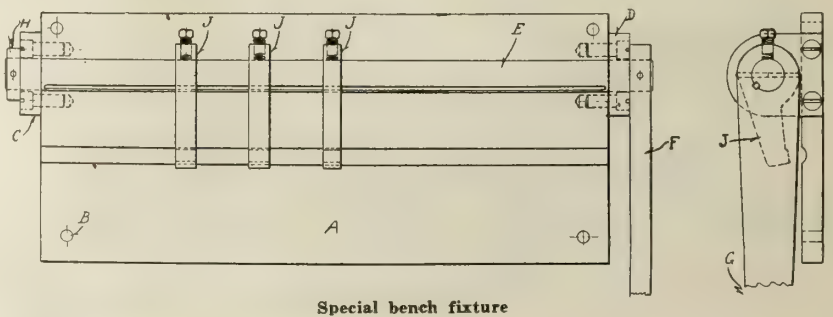
SPECIAL BENCH FIXTURE

By H. M.

An interesting fixture which was used so that an operator would be free to employ both hands on effective work without being obliged to use one hand for holding same is illustrated herewith. This shows a bench plate A which is held down by bolts through holes B. This has attached thereto a plate at each end C and D through which passes a shaft E. On the outer end of this shaft is a lever F to which is attached a foot treadle (not shown) which is connected at end G. This foot treadle could be any of the simpler types used for general manufacturing purposes its function simply being to rock the shaft radially. A collar H in combination with this lever (both being held on by pins) prevents the shaft from moving endways.

Placed at various distances along this shaft are pieces J keyed in position and adjustable on the shaft lengthwise they being held at any position by screws. Three of these are here shown although it is obvious that more could be employed if the nature of the work necessitates it. These are known as fingers, they being used to grip work placed between them and the bench plate A when the lever is caused to operate by the foot treadle. These fingers may of course be shaped so that they are adaptable to most any class of work. They could go under flanges or inside of casting webs as desired and for some classes of work it would be advisable to omit the keys so that they could be adjusted readily for accommodation to gripping irregular heights, all of which makes this simple tool a very useful one.

Fig 1.



Special bench fixture

New Things in Shop Equipment

PRESSED STEEL HANGER

There has recently been placed on the market a pressed steel hanger suitable for lineshaft work where excessive vibration is not encountered. The bearing floats in the hanger so as to align itself with the shaft. Set screws equipped with locknuts permit bringing the bearing to the proper height and lateral position. The hanger is being manufactured and marketed by the Dodge Sales and Engineering Co. of Mishawaka, Ind.

CYLINDER LAPPING DEVICE

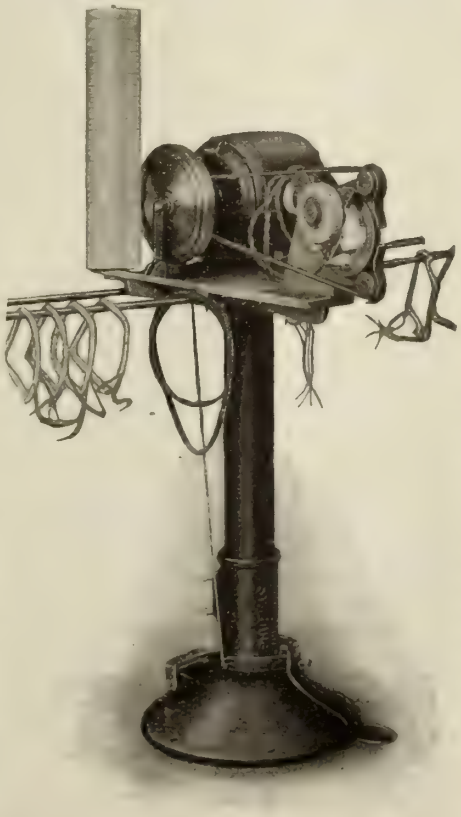
A device for lapping the bores of automotive cylinders has recently been offered to the trade. The apparatus is designed with special shoes which have contact with the cylinder bore and are held by flexible connections at one end of a shaft. Two sets of these shoes are provided and are easily removed when desired. One set bores 2¾ in. in dia. while the other set is adapted to diameters of 3½ up to 4¼ in. These shoes are adjusted to the size of the cylinder by means of a taper attachment. When adjusted to the desired size the shoes can be locked by means of lock nut clamp. A disc is mounted on a shaft to regulate the depth of the cutting tool. The shaft may be driven by an electric or air driven motor or may be attached to the tail stock of a lathe. Cylinders may be locked successfully without removal from the chassis of the automobile. The finished work is accurate both to size and parallelism. This lapping tool is being manufactured by the Stinson Engineering Co., 598 Sixty-Eighth Avenue, Milwaukee, Wis.

ANGLE-PLATE GRINDING ATTACHMENT

The principal feature of a 12-inch, motor driven angle-plate grinding attachment, which has just been placed on the market, is the inclined slide, which allows of movement in one plane for both feed and adjustment of the height of the spindle. The maximum efficiency is thus obtained with the simplicity and rigidity of a single slide. The gross shaft diameter through the motor is 1 7/16 in. while a diameter of one inch is used through the wheel. Grease lubrication is used for the heavy duty ball bearings which are mounted in dust-proof housings. These motors are especially designed and built for grinding service and operate at a normal continuous capacity of 1 1/3 h. p. and will develop a complete capacity of 2¼ h. p. The operating speed is 1,800 r. p. m. The net weight of the attachment is approximately 175 lbs. This device is being offered to the trade by Van Dorn Electric Tool Co., Cleveland, Ohio.

MOTOR-DRIVEN TAPING MACHINE

Motor-driven equipment for tape winding, consisting of an armature or field coil taping machine as selected. It is directly belted to a very slow speed motor on which is mounted a cone clutch, giving instantaneous and very fine adjustments in speed, responding to pressure on a treadle. The continually moving member of the clutch is pinned to the armature shaft, which has enough end play to allow of the clutch being disengaged. It is returned to open position by the magnetism of the motor, thus eliminating a thrust bearing and a spring. A combined self-oiling cone driving pulley, brake pulley, and clutch member rides on an extension of the phosphor bronze motor bearing. It is active only when engaged, thus eliminating troublesome "loose pulley" bearings. An automatic brake operated by the clutch treadle enables quick stopping and inching. A switch is provided, handy to the operator with plug and cord on d. c. and single phase, with switch but no plug and cord on 3 phase. Pins are provided for hanging the coils and for storing ten gross yards of tape. Ample clearance is provided for leads and for various positions of coils. The outfit is self-contained and portable, and when equipped with d. c. or single phase motors, may be operated from any light sockets, making it possible to take the machine to the job. These tools are made by the P. E. Chapman Electrical Works, St. Louis, Mo.



Motor-driven taping machine

32 INCH CRANK SHAPER

A special 32 in. crank shaper has recently been developed and placed on the market. This machine is especially designed for heavy usage, such as in railway and forge shops. The table has a vertical adjustment of 12¼ in. and a cross traverse of 30 in., the stroke of the ram being 33 in. The table is of the revolving type and a special feature in this connection is the support at the outer end. The machine is provided with a simple gear mechanism all of which is enclosed in a box. The feed cannot operate during the cutting stroke of the ram and it is not necessary to touch any moving part when changing speed. Four changes of speed are provided in a gear box and these are engaged by means of a ball lever on top of the box. The starting and stopping of the machine is under the control of the operator by means of a long lever reaching from the clutch to a point close to the operating position. The brake is automatically engaged when releasing the lever. Machines are constructed for belt drive but may be fitted with motor equipment if desired. Helical gears are used throughout and these are made of steel or semi-steel. All shafts are hardened and operate in bronze-bushed bearings. Tubing is provided for oiling the internal bearings. It is stated that these shapers work very accurately on the longest work within the range of the machine. They are manufactured by the R. A. Kelly Co., of Xenia, Ohio.

SENSITIVE DRILLING MACHINE

A new design of sensitive drilling machine has recently been offered to the trade. These machines are constructed on the unit principle and in two types, bench and pedestal, and can be made in combination of from one to eight spindles. The maximum capacity of the drill is four holes ¼ in. in dia., steel, iron or brass. The three spindle speeds provided are 5,700, 8,000 and 12,000 r.p.m. These speeds however may be altered to suit varying conditions. Dust-proof metal oil retainers are provided on all ball bearings, and the only revolving member exposed is the drill spindle. Vibration and noise is reduced to a minimum by means of helical gear drives. This speed changing arrangement is an outstanding feature, as a single turn of a handle automatically releases belt tension, shifts the belt on the cone pulleys in such a way that the belt is removed

from the large pulley first. When the belt is shifted the tension is automatically adjusted to the new position. An aluminum guard is provided for the protection of the operator. An adjustable step stop is provided for the travel of the spindle. The operator can adjust the position of the feed lever to suit his requirements. A one half h.p. motor is mounted on the machine and a drive may be obtained either through a belt or direct connected. These machines are manufactured by the Fosdick Machine Tool Co., Cincinnati, Ohio.

MEASURING WIRES

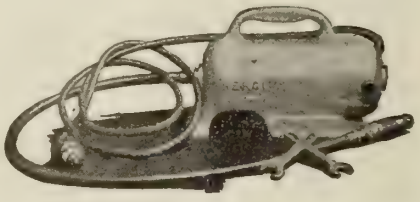
For the special purpose of measuring threads, angles and profile a set of wires has recently been placed on the market. These wires are made with great accuracy and are practically perfect as to roundness, uniformity of diameter, and size. The size of these wires is standardized by light waves. The wires are 1⅞ in. in length and are lapped the entire length. The wires provided for screw set measurement are known as "test size wires." The purpose of these wires is to detect any error in the angle of the thread, the error may be easily checked by taking a measurement with the next larger size of wire. The set of wires is placed in glass bottles thus protecting them against loss or breakage. On the outside of the bottle is a label which gives the diameter of the wire, also formula for the measurement of the pitch diameter of the screw thread. These wires are put up in small balls, 20 balls to a case, and are manufactured by the Van Keuren Co., Boston, Mass.

NEW LINE OF TAPS

A line of carbon and high speed steel taps, having a special feature known as the "sharpening face" flute has recently been introduced to the trade. When sharpening this type of tap a round faced grinding wheel is used so that a face is produced that gives a top rate to the teeth and ensures a clean and free cutting tooth. After the taps are hardened they are ground to size and final shape, thus removing all decarbonated material and eliminating errors due to distortion in hardening. It is stated that the teeth are not relieved eccentrically as is usually done in the ordinary taps but are given a special form of relief that is peculiar to this particular type of tap. With the exception of the first four or five teeth, the cutting part is concentric with the outside diameter. A peculiar feature of this tap is that the centre portion for about five teeth is parallel, after which there is a gradual taper towards the shank, so that at the very end of the thread the tap is 000125 in. under size. It is claimed that this design reduces the tendency to bind and provides a free cutting tooth, and due to the concentric shape of the body portion of the tap, these grindings may be carried to a considerable extent without diminishing the diameter of the tap. These taps are being manufactured by John Bath & Co., Worcester, Mass.

MOTOR-DRIVEN FLEXIBLE SHAFT

A motor driven flexible shaft outfit, the motor of which is enclosed in an aluminum casing having a base and handle vertical with it, has recently been placed on the market. A current of air is circulated between the wheel and the armature winding by means of a ventilating fan. The bearings are also cooled by a current of air passing between the scope of the sub-bearing and through a



Motor-driven flexible shaft.

series of holes around the bearings. The flexible portion of the shaft is ¼ in. in diameter, 3 ft. long and wound with wire. The outside covering is of whip cord; 6 ft. of drop cord with an attachment plug are provided with each motor. No external binding post is necessary as the cord is fastened inside the end plate. It is adaptable to all work ordinarily handled by flexible shafts equipment. These tools are being placed on the market by the Hergi Mfg. Co., Bridgeport, Conn.

SELF-OPENING STUD SETTER

A self-opening stud setter known as the Jarvis has recently been placed on the market. The tool is simple in design with all parts hardened, and providing a quick grip and release. These setters are made in three sizes with capacity of the small size up to ½ in. studs, the medium size taking studs up to ⅞ in., and the larger size handling studs up to 1¼ in. diam. Standard shanks are provided with these tools but shanks of special dimensions can be furnished if desired, also special sizes of jaws. These stud setters are being manufactured by the Geometric Tool Co., New Haven, Conn.

CENTRE LOCATING PUNCH

A centre-locating punch which is of great use to toolmakers and die-makers in quickly and accurately locating centres of holes has recently been placed on the market. It is really a combination prick-punch and scriber. One of the methods of using the device is to mount it on the cutter-arbor of a milling machine, with the punch perpendicular and with the part to be laid out attached to the machine table. Then the centres of holes to be bored later may be located by shifting the work beneath the punch by using the adjusting screws, of the table and saddle. By using the dials attached to these screws, centres of holes may be located within the limits of accuracy of the machine. The prick-punch is held in its upper position by means of a coil spring. When it is desired to make a prick mark the top of the punch is tapped with a hammer. When all centres have been located the work is mounted on the face plate of a lathe and bored in the usual manner after centering by means of an indicator. The tool may also be placed in a horizontal position on the cutter arbor and in this position may be used to locate work in a vertical plane. The tool may also be attached to a dividing head and used in the vertical or horizontal positions or at an angle. By pressing the lower end of the punch down against the work a scratch point is placed in contact with the work, and this sharp point may be used for scribing circles as the work is moved past the tool. This application is very useful in laying out dies. The punch is hardened and ground all over and is also lapped where it is contained in the bearing. A collar on the top and one on the bottom of the punch of the same diameter, facilitate the alignment of the device. The holes in the supporting member of the device permit the mounting on either ¾ or ⅞ in. dia. arbors. The tool is manufactured by B. F. Johnson.

Tenders are being taken for the erection of a school house at Onslow Mountain School Section, Colchester County, Jersey City, N. J.

VALUE OF KEEPING TOOLS CLEAN

(Continued from page 19)

operations as case-hardening, plating, blueing, etc. The presence of foreign matter, such as dirt, scale and other substances, will prevent the proper action of the chemicals and frequently result in the rejection of the finished work.

Systematic Cleaning Advisable

Systematic cleaning should be adopted wherever the presence of dirt or foreign matter will interfere with the efficiency of succeeding operations. Where a certain piece of work passes through several operations or departments and the same surfaces are used for locating in jigs and fixtures, it is imperative that these surfaces be thoroughly cleaned to maintain a high degree of accuracy in the details of machining performed at the various points. A cleaning tank or kettle is often used with entire satisfaction for work of this character. When a jig or fixture is taken from the store or tool room it is good practice to have a chemical solution in which to dip it so as to remove any foreign substance that may be adhering to locating surfaces.

Various methods may be adopted for cleaning of product and equipment and the best system must be determined by the individual requirements of each particular case, but whatever the conditions the practice of cleanliness is a profitable one to any firm desirous of minimizing waste and likewise presenting a more accurate product.

The braking of light loads is also of considerable importance when the crane is driven by a direct-current series motor, to prevent it running at an excessive speed.

WARNER AND SWASEY TO BUILD TELESCOPE

A contract has been awarded to the machine tool firm of Warner and Swasey Co., Cleveland, Ohio, for the construction and erection of a large reflecting telescope for the Ohio Wesleyan University at Delaware. This instrument will have a sixty-inch reflector with a tube twenty-five feet long, and will rank among the large telescopes of the world. The telescope will be purchased with money from the fund of $250,000 which has been donated for the equipment and maintenance of Perkins observatory by Prof. M. H. Perkins of Ohio Wesleyan. Prof. Perkins has been in the mathematical department of the university for many years. Announcement of the contract was made by Prof. C. C. Crump, director of the observatory. The machine will be devoted largely to the use of the students and likewise to research.

While the Warner & Swasey Co. has built a large number of notable astronomical telescopes now in use, its main business is the manufacture of machine tools, a function which officials of the company say is sometimes forgotten by scientific men in the more spectacular publicity which attends the building of a big telescope. The design of the instrument will be in charge of E. P. Burrell of the company. The Warner & Swasey Co., is to build the mounting of the telescope and will design the revolving dome in addition. The optical parts will be finished in this country and probably the materials supplied here also. The designing and building of the telescope itself will probably take a year and a half and the work on the mirror and lenses perhaps longer.

The moving parts of the instrument will weigh in excess of thirty tons, the stationary parts about ten tons and the revolving dome and shutter seventy-five tons. Extremely accurate work is required in the building of the moving parts so that the thirty or forty tons of metal can be swung by mechanism so fine that the tiny ray of a star invisible to the eye will fall on the same spot on a photographic plate for three or four hours as the star travels across the heavens.

One advantage of the reflecting type of telescope is that it can be used for photographic work without correction. By means of photography it is possible to reveal the presence of stars which the human eye could never detect even through the largest of telescopes.

The new instrument can be employed in the study of the nature sun spots, of the distant nebulae and, in connection with the spectroscope, of the heat and drift of the stars. With the spectroscope it would also be adapted to the newer method of determining the great stellar distances. The light of each star is collected, photographed and analyzed; the spectroscope measures the brilliancy of the light received. From these two it is possible to estimate the distance of the heavenly body from the earth.

Introducing

NOT so very long ago, we announced in the industrial section of our paper, the arrival of the gentleman pictured below. Mr. Williams has come to Canada as the direct representative of Messrs. Holman Bros., rock drill and mining machinery specialists of Camborne, England, and is prepared to show the advantages of his particular line.

He has been actively engaged in practical metalliferous mining operations over a varied field since graduating in 1904, from what is now the "School of Metalliferous Mining" Cornwall, England.



FRANK WILLIAMS, A. M. I. M. M.

His first appointment was as assistant manager of the West Kitty Tin Mining Co., and in 1916 he was selected as manager of the Grenville United Tin Mines, Camborne. It was in the development of these mines that Mr. Williams first obtained his intimate knowledge of the "Holman" rock drill, which is the specialty of the Holman products.

In 1909 he went to the Federated Malay States as general manager of the Raub gold mines, remaining in that capacity until September 1914, when he returned with several other mining men to England for war service.

Joining his county regiment, the Duke of Cornwall's Light Infantry, he served in France, Belgium, and in Ireland from 1915, onwards, transferring in 1917 with the rank of captain, to the newly formed Tank Corps, where he soon obtained his majority, and was mentioned in despatches by Sir Douglas Haig.

Demobilized from Ireland in 1919, Major Williams undertook the management of Aber Llyn (zinc lead) mining property in North Wales, and relinquished that position in the latter part of last year to take over the representation of Messrs. Holman Brothers in Canada, whose agency is carried by Messrs. Alfred Herbert Ltd., 1 to 3 Jarvis St., Toronto.

To meet Mr. Williams is to enjoy his company, for he is an interesting conversationalist and knows the subject of mining from A to Z.

EUROPEAN CONDITIONS

(Continued from page 26)

tomers found it so much cheaper to buy French or Belgian francs than they did Swiss francs. Even the income from tourists was seriously reduced for the same reason. Switzerland's position is sound but difficult. She followed Belgium in relaxing certain passport requirements.

How Belgium Is Faring

"This little country was the first European country to realize the necessity of getting busy and sawing wood. About six months after the armistice I personally saw in operation in Belgium heavy machinery which had been taken to Germany before the armistice. It had been located, pressure enough had been brought to bear to get it returned and placed on its old foundations. This had been accomplished by private initiative. Much more has been done in the last three years even though an enormous amount of reconstruction still remains to be done.

There is probably less unemployment in Belgium than in any other country in Europe. She was the first to withdraw the annoying war time passport regulations.

REDUCING COSTS BY MEANS OF THE PLANER

(Continued from page 21)

Co., Scotland Locomotive works, Newcastle-on-Tyne, have realized this great adaptability by rigging up a radial planing device actuated by the main stroke disc of the Hiloplane, and placing out the radial segments of boiler saddles in the manner shown in sketch Fig. 3. On this job, the almost incredible saving was achieved of reducing the previous 90 hours, to 19.

It will be seen that a great contributory factor in the foregoing economies is the stirk split field reversing motor drive. This is fitted to all sizes of stirk Veloplanes and Hiloplanes, and is also supplied as a self-contained unit for conversion and existing machines. Fig. 4 shows the unit in question which is furnished with motor generator, reversing motor, and switch-gear, all mounted on one bed plate and wired up complete. The stroke disc being also mounted on the job and driven direct from the reversing motor, no dogs or levers on the planer table are required. Assuming the gear ratio of the machine to be reasonably suitable the only cost of conversion, beyond the actual purchase price of the set, is that incurred in removing pulleys, shortening pulley shaft, setting the equipment in correct alignment, leading in the electric cables to the main switch, and immediately the concrete has set the machine is ready for work.

In other words it is a feasible proposition to run a machine on its old drive up to Saturday noon, and have it running again on Monday morning on its new drive. This is an example of despatch in conversion to my mind unapproached by any other system of reversing motor drive.

CANADIAN MACHINERY
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Courtesy is Essential

WE HAVE often emphasized on this page the value of courtesy in business. Richard T. Stanley of Toronto is the latest to back us up in our contention, and before the Kiwanians at Toronto the other day he said, "Courtesy costs nothing and it is one of the best business getters we can have."

He later mentioned that he noted a glaring lack of courtesy throughout the business-professional life of America, and at the conclusion of his remarks, the International Kiwanis adopted the idea of "courtesy in business" unanimously. This is a good start, and it is now up to every other society, be it industrial or social, to follow this lead.

The Business Outlook

THE RECENT storm, which spent its fury over certain portions of Western Canada, unfortunately did considerable damage to the crop in some localities. Just how great the loss has not yet been ascertained, but taken as a whole, this unfortunate occurrence should not discourage business men in the East, for good crop reports continue to come in from other parts of the country. The loss incurred will be but a small portion of the total harvest. As far as can be judged at this season, a good harvest appears reasonably sure.

This news is gratifying to the Canadian manufacturer who recognizes that his own prosperity depends upon that of the agricultural community. It will be well, however, to sound a note of warning to those who are too readily inclined to place credence in the view that a good harvest will mean the return of boom times and boom prices.

Whether agricultural prices are likely to decline in the next year or two would be difficult to predict, but in all probability it is safe to say that, unless there is a crop shortage, they are not likely to rise to any great extent. Farmers in the West have, generally speaking, had two or three poor years and the financial gains of a good season would more likely be used in paying off mortgages and other indebtedness than in purchasing the products of the Eastern manufacturers.

Another factor in the situation is the necessity of European markets for a part at least of our agricultural products. Now Europe will be better supplied with farm products than with other things. Although not as yet so well supplied as before the war, her agriculture will be more nearly normal than will be her industrial operations. This means that though she might gladly buy our food products, her industrial position will leave her without means to pay for them, and the tariff wall erected against her by the United States is likely to intensify this position.

The European demand being lacking, or only slight, will tend to depress prices here rather than to raise them; this, in despite of all that the Western farmer seems to expect from that "deus ex machina" the Wheat Board.

The probabilities are then that with good crops the farmer will use the results to pay off his indebtedness to the bank and elsewhere and that any demand that may come for manufactured goods will not be large enough to raise prices above their present level, but will be met by the manufacturer increasing his production if necessary but without increasing the prices of his foods. In other words the prospects are for a period of quiet prosperity, but not for a boom.

Keep Your Appointments

"I LIKE CANADA very much indeed. I have enjoyed my visits to your various lovely cities, but must frankly admit I am horribly disappointed at the way your business men fail to keep their appointments," remarked an English visitor to Canadian Machinery a few days ago.

Upon investigation we found this gentleman had good cause for complaint. He cited case after case, where he had made an appointment for a specified time, arriving there only to find that his party was in some cases too busy to see him, and in other cases had seemingly forgotten the engagemnt entirely and gone elsewhere.

These incidents did not all occur in the same line of business, but embraced about six different fields of activity. Here was a man, with only a certain amount of time on his hands trying to make the most of it. He had planned his interviews carefully, and enacted promises ahead of time. Unfortunately, his plans were rudely shattered, he did not see as many as he wished, and has returned to his country, convinced that Canadians lack that very essential business necessity, "courtesy."

Do we really lack courtesy, or is it the breaking of appointments largely a matter of habit? Luckily, we are not all guilty, but those reading this edition, who have broken engagements, be they important or otherwise, should take stock of themselves for a moment. Would they have liked to be in the other man's place? Certainly not. Well then, if they had no intention of seeing the caller, they should not have made an appointment.

How often we hear the expression: "Oh, I don't want to see that man. I wish I had not promised to see him; tell him I am out." There are other stock excuses but the one quoted is sufficient. The man who forgets a business engagement is not attending to his business, and deserves all the harsh statements one might make regarding such a person. Let Canadian business men take a hint from our English visitor, and once having made an engagement, stick to it. If you do not want to meet some one who is most anxious to see you, have courage to refuse him, but do not lead him on, later failing to keep the appointment, in order to sidestep an awkward situation.

Steel Prices Reflect Firming Conditions

Production Reported to be Upward—Mills Have Situation Well in Hand—Demand for Building Materials—U. S. Railways Heavy Buyers on Car Materials—Jute Twines Up

SMALL TOOLS SHOW INCREASE FOR JUNE

GENERAL firmness in the steel market seems to be due as much to improving conditions in industrial activity generally, as to any fear that the coal strike is going to cause a difficult situation. Reports from Pittsburg and other American points would seem to indicate the period of dulness that marks July and August is going to show a lightness of demand in the open market that is quite seasonal and that buyers are not imbued with all the fear that should seem to exist. Even on the Canadian market one is surprised to find a lessened degree of importance attaching to the struggle now going on.

Among the bright spots in the week's news is the fact that the Canadian agricultural implement industry has made its appearance in the market for pig iron and although tonnages are moderate they show a considerable improvement. Requirements are less for domestic purposes than for export, the feeling in some quarters is that this may presage more permanent business in that direction.

A very strong demand continues for all kinds of material entering into building operations. Metal, lath, structural steel, pipe and in fact all sections show the benefit of this movement and it is not surprising to find a firmness in price trends. Competition among steel mills on this business, however, is developing a marked keenness and there is a tendency here to go after business on lines which, in normal times, are not sought after particularly.

Pig iron markets on the whole show little change. Such movements as that noted in connection with the agricultural implement industry warrant a feeling that the general demand is better. There are good stocks on hand and mills are fully awake to problems that may be created by any aggravated situation emanating from the coal strike and the threatened railway strike. In short they may be said to be in very good position.

Steel and iron bars are holding the advancing tendency noted in last week's issue, with a trend toward the 3.15 mark although the sounder feeling seems to be that such a movement will at best be very gradual, if it does develop headway at all.

Montreal reports activity on part of British mills in galvanized sheets. Large shipments are being rapidly absorbed. There was an advance of 25 cents in 10/16 gauge blue sheets during the week. The automotive industry accounts for ever increasing tonnages on steel sheets and here British costs to the jobbers are steady while reports from United States indicate advances.

In non-ferrous metals there is an unchanged situation. There may be undercurrent of price manipulation but nothing of sufficient importance to work to the surface or to have a direct bearing upon the market.

The machine tool demand continues quiet. Some contracts on technical school equipment have been released. In this business naturally competition has been exceptionally keen and prices not far from rock bottom. Dealers report that May will show marked improvement in the demand for small tools and supplies.

Purchasing agents will be interested in the fact that jute twines for the first time in many moons, are showing an advance from 12½ to 14 cents per pound. It is stated that owing to keen competition, prices in Canada have been somewhat below normal and the change seems to indicate among other things that the market is coming to its senses.

Turpentine, in response to the inevitable law of limited supply and heavy demand, reports an advance of 15 cents gallon.

Toronto

June 28

THAT United States railways are in the market for enormous quantities of material, is a fact that seems to stand out in strong contrast to the Canadian situation. There has been comparatively little buying either by government or privately owned lines here and one explanation may be found in the feeling that the necessity may be postponed until the menace to prices created by the coal strike is over. Moreover, the Canadian railways may feel that the temporary urgency created by a bumper crop can be satisfactorily met. The situation promises some interesting developments and will claim the attention of industry generally. Activity in railway work means much to many concerns, for it goes almost without saying that, when the railways are in the market for large quantities of supplies, there cannot be much wrong with the general situation.

There can be no question that steel prices to-day are firm and that the tendency is upward. Steel bars seem to be an outstanding example. The price is centering about the $3 mark but a very cautious movement towards $3.15 is already indicated. There is no danger of the market at present doing anything irrational for the feeling is that, while business is coming back and the demand improving, it must be welcomed in a sensible way. Following are present quotations, including sheets, which are also in strong demand:

Iron bars	2 90 to 3 00
Steel bars	2 90 to 3 00
Reinforcing bars	2 90 to 3 00
Steel hoops	4 00
Tire steel	3 15
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in base	3 50
Small shapes	3 00
Sheets, black, No. 28	5 00
Sheets, blue ann., No. 10	4 00
Canada plates, dull, 52 sheets	6 00
Canada plates, all bright	6 00
Galvanized Sheets, No. 28	6 00

Pig Iron—No price changes are reported here but demand is developing in quarters that have been more or less dormant. The agricultural implement industry has made its appearance in the market for moderate tonnages apparently to meet an improved export demand. Mill reports indicate good stocks and a problem that is exceedingly well in hand in view of the situation aggravated as it is by the strike outlook.

Non-Ferrous Metals— If anything there is a weakening tendency in this department, but dealers declare that anything might happen. To the average buyer, the undercurrents in the market cannot have much significanre. In a great many instances, the development reaches him only as a slight fluctuation in either direction. The market, meantime, seems to be fairly well supplied. Local quotations:

Lake Copper	17 00
Electric Copper	17 00
Castings, copper	16 50
Tin	34 00
Spelter	7 25
Lead	6 75
Antimony	6 75
Aluminum	26 00

Scrap Metals.—Some improvement in the foundry situation is developing. Plants at many points are operating on a much better scale than, say, one year ago, and this naturally has had its effect on the demand for scrap. The situation may, therefore, be described as a developing one with no change in prices. Following are local quotations:

Copper, light per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 composition	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	4 85
Light brass	3 50
Medium brass	4 50
Scrap zinc	4 00
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton	9 00
Heavy melting steel	11 00
Axles (wrought iron)	16 00
Rails (scrap)	11 00
Malleable	11 00
No. 1 machine cast iron	16 00
Pipe, wrought	6 00
Car wheel	16 00
Steel axles	15 00

Mach. shop turnings	6 00
Sheet plate	14 00
Cast borings	5 00

Machine Tools.—The market continues quiet with now and then a bright spot. June it appears, will shape up as a good month in small tools and supplies. At least that is the report in some quarters. Demand for radio equipment is responsible for some improvement in the demand for certain attachments. In fact this is a field that is not without definite promise in this department.

By some dealers and manufacturers it is felt that the months of September or October should show much better feeling in the machinery demand.

Jute Twines are showing an advance from 12 1/2 to 14 cents. Prices in this department are reported as having been quite below normal owing to what is called "misdirected competition." The firming process is described as more or less a return to reason.

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	0 20
Palacine	0 23
Machine oil, per gal.	33 00
Black oil, per gal	17 50
Cylinder oil, Capital	61 50
Petroleum fuel oil bbls., net	10 80
Pure turp., single bbls. gal.	1 40
Linseed oil, raw, single bbls.	1 15

WASTE

XXX Extra	16	Atlas	13
Peerless	21	X Empire	13
XX Grand	15	Ideal	15
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	30	Anvil	20
Axle	25		

Washed Wipers

Select White	18	Dark colored	16
Mixed colored	14		

Montreal

June 28

IRON and steel industry activity in the local markets shows no important changes for the last week. Quotations continue to be firm, and in the case of blue annealed sheets, an advance of twenty-five cents is quoted. The base price of steel remains at $2.90, and there does not appear, at the moment, that there is likely to be any change. The new rates on ore and basic steel commodities have not had any direct influence on the local market. Pig iron is not showing much activity and machine tools are quiet. Supplies are moving about the same as usual. The non-ferrous metals are somewhat weaker after their firmness of the past two weeks. The volume of sales is being maintained about as usual. The scrap metal markets are quiet.

Iron and steel—Galvanized sheets continue to be the most active of all the steel products. Large shipments continue to arrive from the British mills but the demand is so great that they are immediately absorbed, a large proportion of them never reaching the warehouse. Tin plates are also arriving in large quantities and are being disposed of nearly as quickly. Prices remain firm in spite of these heavy shipments, as stocks in the warehouses are low, and it appears to be impossible to increase them. Black and blue annealed sheets are also moving well, blue annealed sheets 10/16 gauge advanced twenty-five cents during the week, the improved demand and delayed delivery being responsible for the revision. In this connection, the factors that have been to a large extent responsible for the stiffness in quotations, are that the deliveries of coal and raw materials to the mills have been somewhat uncertain, all of which has tended to hamper production.

The automotive industry is demanding large tonnages of steel sheets, and this demand is increasing from year to year. The delayed deliveries from the point of view of demand, have been caused principally by this factor. British costs to the jobber on steel sheets remain steady while the United States costs are mounting slightly. For that reason jobbers and consumers are directing their attention to the British sources of supply. Only a nominal relief through this channel can be obtained at the moment, as those British mills operating on sheets are well booked with orders, principally from the Orient. It is understood that this market gives a little better return than that of the Canadian field, and as the quantities required in the East are from eight to ten times those required for local consumption, it is thought that there will be experienced great difficulty in diverting much tonnage on short notice.

One jobber has sample sheets on the way out from England, which sheets he expects to use as samples to secure orders from the automotive industry. The sheets are especially rolled for this purpose and it is hoped that a certain share of the auto body and mud-guard business can be secured.

Plates are very quiet. Structural steel and merchant bars are enjoying a littlel better demand. Small steel products are moving well. No general advance in prices has been made. Building operations are still to the fore and contribute in no small way to the demand for sheets, heavy hardware, and small steel products. On the whole, the week has been one of the best for some time past. Local quotations are as follows:

Iron bars	2 90
Steel bars	2 90
Reinforcing bars	2 90
Steel hoops	4 00
Tire steel	3 00
Spring steel	6 00
Band steel, No. 10 gauge and 3-16 in. base	3 25
Small shapes	3 00

Pig Iron.—There is no great change in the pig iron market. Quotations on No. 1 iron still remain at $31.80. The demand is not showing any appreciable improvement, the consumption being rated at nominally ten per cent. of normal. The inquiries and orders come principally from the smaller shops doing jobbing and contract work. The larger foundries are doing little or nothing. The railways themselves are only absorbing a small tonnage. The present demand is far from satisfactory, and in addition to that, there exists very keen competition, as British pig is being offered at a figure slightly below that of local producers. Should the same condition prevail when the demand reaches larger proportions interesting developments would occur, and undoubtedly a buyers' market would be created.

Machine Tools. — Quiet conditions prevail in the machine tool market. During the week no important sales have been made. Inquiries and sales are only for smaller tools and for one only. All orders are very keenly sought. Aggressive sales campaigns are being maintained but the volume of sales does not materially increase.

Shop Supplies.— The demand for small tools and shop supplies is being maintained about as usual. The small contract and jobbing shops are coming into the market fairly freely and there is some demand from the railways and larger corporations. No important price changes have been made during the week.

Non-Ferrous Metals. — A general weakness is shown in this market. Foreign markets are weak and it is their influence that is reflected in the local markets. The volume of business is not falling off, but there is no great improvement. No actual change in quotations has been made. Local quotations are as follows:

Lake Copper	17 50
Electric Copper	17 25
Castings, Copper	17 00
Tin	35 00
Lead	6 75
Spelter	7 75
Antimony	6 50
Aluminum	23 00

Scrap Metal Markets.—Very little activity is shown locally in the scrap metal market. There is some demand for the non-ferrous metal scraps from United States markets, and some small shipments are being made. There is but little demand for the ferrous scraps locally. Some of this scrap is finding its way to Ontario consumers but this business is small. Some figures have been reduced this week but the reduction has no direct bearing on business moving. The holdings locally are small as the dealers do not consider the demand at present warrants them in carrying heavy stocks. The local quotations are as follows:

Copper, light, per 100 lbs.	8 50
Copper, crucible	11 00
Copper, heavy	11 00
Copper Wire	11 00
No. 1 compositon	9 00
New brass cuttings	6 00
Red brass turnings	6 50
Yellow brass turnings	5 00
Light brass	4 00
Medium brass	5 50
Scrap zinc	3 50
Heavy lead	4 50
Tea lead	3 00
Aluminum	11 00
Boiler plate, per gross ton.	9 00
Heavy melting steel	10 00
Axles (wrought iron)	20 00
Rails (scrap)	11 00
Malleable	10 00
No. 1 machine cast iron	20 00
Pipe, wrought	7 00

Car wheel	17 00
Steel axles	15 50
Mach. shop turnings	4 00
Stove plate	16 00
Cast boring	4 00

Pittsburg

June 28

PRODUCTION of steel continues at a rate of about 39,000,000 gross tons a year, against rates of about 35,000,000 tons on April 1, when the coal strike started, and 20,000,000 tons last December. While production is almost stationary, the trend is upwards rather than downwards, a very significant thing, seeing that the coal strike has now lasted almost three months and the steel industry can still function. Indeed, one observes no signs of uneasiness among steel manufacturers as to their ability to continue operating and complete their orders, even though they are on the whole, pretty well booked up for the next couple of months or more.

The strike at the union coal mines had been fully expected for many months, while the non-union strikes, in the Connellsville and other districts, were unexpected. Hence if there were any restriction of production on account of the strikes in general, it should be looked for among consumers who were depending on non-union production, as the consumers of union coal knew perfectly well that their supplies were going to be shut off and that they must have stocks. There was, in fact, much stocking. Now the Carnegie Steel Co. normally operates its blast furnaces almost exclusively on Connellsville coke and by-product coke made from Connellsville coal, hence its experience is crucial. The Carnegie company has just blown in a third blast furnace at the Farrell works, furnishing the steel department enough pig iron to operate in full. This makes 38 Carnegie furnaces in blast, against 35 at the middle of May and 34 on April 1, when the coal strike started. Of course unusual expedients have been resorted to in accomplishing these results.

Steel Prices.—Not much change is to be noted in the week in the situation as to prices, but there are some slight changes. Bars, shapes and plates, which were occasionally going up to 1.80c., now generally find their maximum at 1.70c while the basis price of 1.60c remains. This is done by the Steel Corporation on such deliveries as it can make, usually far into the future, and occasionally by an independent. Early deliveries ordinarily obtainable only from independents, generally go at 1.65c or 1.70c.

Hoops and bands are firm at a minimum of 2.40c, it having been possible until quite recently to do 2.25c on attractive orders with the leading interests, while some small lots with undesirable specifications go at 2.50c. The hot rolled strip mills, which used to get more for their product than the hoop mills, but when prices were weak all around a few months ago were quoting below the hoop mills, are now above again, and have gotten 2.75c in some cases. Cold rolled strips remain at 3.75c by the American Steel & Wire Co. and 4.00c by the independents.

In the direction of stabilization of prices is the opening of sheet order books by the American Sheet & Tin Plate Co. (Steel Corporation) for August and September at old prices, the company's opening on June 2 having been for July only. Independents had been quoting, and securing in many cases, advanced prices, and most of them are disposed still to ask higher prices, believing that the leading interest will soon be sold out. The leading interest's prices are those made by the $3 a ton advance early in April, and are the lower of the prices following, the higher being the usual quotations of independents: Blue annealed sheets, 2.40c to 2.50c; black sheets, 3.15c to 3.30c; galvanized sheets, 4.15c to 4.30c. antomobile sheets, 4.50c to 4.75c. It is possible to obtain even 5.00c on prompt deliveries of automobile sheets, and some sales have been made at the price.

As to the coal strike, the strike is still on in full force at the union mines, except for various defections in West Virginia. In the non-union fields the strikes have been waning very slowly. In the Connellsville region men have been returning to work in larger numbers in the past fortnight than formerly, but production in the region is still far below the rate of last March and still farther below the capacity. Connellsville steam coal is a shade easier in the week, at $3.40 to $3.65 for mine-run.

Steel Market Prospects— While the steel mills are exhibiting no uneasiness as to their ability to continue production, despite the coal strike, and fill their orders, buyers of steel also exhibit a feeling of contentment and are not pressing to make further purchases for late deliveries, except in the case of new wants arising, involving steel for freight cars, buildings, bridges, etc. Buyers still show an eagerness to receive deliveries of steel already bought, and the mills are under considerable delivery pressure.

July and August, the "midsummer period" are always dull months in the steel market and as the period is now at hand the question is whether the lightness of demand in the open market is due to this seasonal condition or is a reflection of a general conclusion on the part of buyers that the coal strike is not to be feared after all. This question could be answered, probably, if there were complete and accurate information as to stocks of steel in buyers' hands. The deliveries are well known, as the rate of steel production from time to time has been known, but the rate of steel consumption has not been known. There is much talk on the subject of stocks of steel but hardly anything is known. Some observers insist that obviously the ultimate consumption of steel has been much less than the deliveries in the past four months, while mills rejoin that buyers can hardly have much steel or they would not be pressing for deliveries as they are.

Mills are well sold up at present, but it is plain that the steel market will have to make a new start after the summer dulness, and what kind of a market, in general, there will be in the Autumn will probably be disclosed at the outset according to whether sellers or buyers make the first move to resume business on an active scale. Meanwhile the situation is that buyers are well covered, so that things will run along for a few weeks without any change. The market will probably be quite dull in July and some may reason from this that the situation is weaker, but that will be a false showing.

Pig iron remains practically stagnant prices being largely nominal and unchanged at $25 for Bessemer and basic and $24 to $25 foundry, f. o. b. valley furnaces.

CONDITIONS IN NON-FERROUS MARKETS

SPEAKING to Ernest W. Knight, of Frankel Bros., Toronto, on the non-ferrous metal situation, he said that domestic copper is selling at not less than 13.87½c, with a great many producers holding to 14c. He mentioned that the immediate spot market seems to have all the copper required, but some interests have recently been testing the market for third and fourth quarter delivery.

Continuing, he said, "The foreign market is stronger and higher and would seem to indicate a brisk export business for July and August. It has not yet been recognized that Germany is the most important factor in export buying. More than half of the red metal exported from the port of New York during the current year, has gone to Germany. The May shipments of copper for Europe from the port of New York alone, were over 20,000 tons. There are likely to be increased prices in the immediate future, and I would recommend purchasing as early as possible for from 3 to 6 months ahead.

"The tin situation is extremely peculiar. In figuring the likelihood of an advance or decline in the price of tin, it must be remembered that by August, the tin plate manufacturers will have ceased their operations for several months and as soon as these works are closed down, lower prices will probably be the order of the day. On the other hand, it must be remembered that the bulk of the tin for tin plate operations is already purchased to cover the balance of the year.

"Mr. A. G. Glenister, chairman of the federated Malay States chamber of mines, in his address to a general meeting in Panang, some few weeks ago, stated definitely that the council, was opposed to a restriction of output. 'Such a policy,' he said, 'would raise prices and it would be very difficult to enforce. Moreover, any system which in-

volved an increase in unemployment, would not be advisable. From this it would appear as if tin is likely to remain at round about its present position until August or September, when a slight decline may be looked for.

Aluminum Situation

"Aluminum still remains firm and shows a tendency toward higher prices —particularly does this apply to sheet and wire. The electrical trades are still taking large quantities of cable, and the aluminum utensils business is snapping up practically all the sheet they can lay their hands on. No. 1 Virgin is now quoted at 20c, and the outside price has been advanced 1c per pound for all positions. The production of aluminum during the 12 months just passed, has shown a decrease of approximately $41,000,000.00 in comparison with the same period of last year. The market is firm and higher prices are likely to prevail in the near future.

"The nickle market is still stagnant and producers have enough on hand to take care of the demand for this year and next, if they do not mine another ounce. Spelter is firm with an upward tendency. An advance of 20c per 100 lbs. has taken place since last month's report, and stocks are being held at 5.25 East St. Louis for June shipment. There is every indication that this price may be increased in the immediate future. Buyers would do well to lay in stocks for at least 3 months ahead.

"Lead is also firm and likely to be higher. The market is held at round about 5.45 East St. Louis, which is an advance of 20c per 100 over the last figures. There is no likelihood of any decrease and buyers would be well advised to cover requirements for at least 3 months. A great many offers were recently made to purchase July supplies at 5.62 1/2, New York but the offers met with no response from sellers, 5.75 in carload lots, New York City, being demanded. Sales have been exceedingly heavy for this time of the year at the figures quoted.

"From the foregoing, it will be noted that the non-ferrous metals in general, show an increased activity, with the corresponding advance in price. Metals of all descriptions are cheap at to-day's figures."

PIG IRON PRODUCTION

May Figures at Lowest Level in Several Years

The production of pig iron during May declined to the lowest level which has been reached in several years. The tonnage was 23,363, representing a decrease of 9,209 tons from the April production. The record for the corresponding month last year was 56,091 tons. About 73% of the May production was foundry and malleable iron, intended for direct sale, while the remaining 27 per cent. chiefly basic iron was made for the use of the producing companies.

An interesting development was the increase in the output of ferro-alloys. The tonnage of 3,397 was the greatest since January, 1921, when, 3,941 tons were reported. The output was augmented by the 2,499 tons of spiegeleisen manufactured for further use. The remainder, comprising 181 tons made in blast furnaces and 717 tons principally 75 per cent. and 80 per cent. ferro-silicon manufactured in electric furnaces, was intended for direct sale.

FACTS OF BUSINESS SITUATION OF TO-DAY

BUSNIESS is better. The depression which began in the United States in 1920 and continued throughout 1921 has passed, and substantial progress has already been made toward normal activity and a new business cycle has been entered upon. Adverse conditions, as the coal strike, may temporarily retard the upward swing. Other factors, such as wide-spread crop failures, might even result in recession for a time, but no circumstances can alter the fact that there is now an unassailable basis for confidence in slow and steady expansion of the commercial and financial activities of this country.

"This basis for confidence is fivefold," continues Stevenson E. Ward, vice-president of the National Bank of Commerce, in Commerce Monthly. Here is how he divides the reason for confidence: First, there is plenty of money to be had at reasonable rates both for short-time and long-time requirements. Second, stocks of finished goods and of raw materials have been reduced to reasonable proportions. Third, commodity prices are stabilizing. Fourth, conditions in basic industries, including agriculture, are improving, and production is expanding. Fifth, gains are not confined to the United States. Conditions are improving throughout the world. Some countries constitute exceptions to this statement, but their bearing on the international situation is not great enough to alter the fact that the world outlook is better, with the United States and Canada in the forefront of improvement.

CHEMISTS CAN HELP PURCHASING AGENTS

WE WOULD like to call your attention to some of the ways in which we believe chemists can be of service to those supervising the purchasing of large organizations, writes J. T. Donald & Co., Montreal, chemical engineers, and consulting chemists. A great many materials sold to-day are subject to great differences in quality," they continue, "and in many instances these differences are only accurately estimated by chemical analysis. Further, although a cheaper article may appear to mean a saving, on carefully looking into the matter it is frequently found that the higher priced material is really the cheaper. As an example of this, take the case of coal. Some time ago we received two samples of coal showing the following analyses and prices, f. o. b., Montreal.

	Moisture	Ash	B. T. U.	Price
No. 1.—	2%	10%	13,000	$9.50
No. 2.—	2%	5%	14,000	$10.25

"In the case of the better grade coal No. 2, the price is $10.25 for 14,000 b. t. u. In the case of the lower grade coal the price is $\frac{\$9.50}{13,000} \times 14,000 = \$10.23$ for 14,000 B. t. u. or the two coals are approximately the same price. That is to say the cheaper coal costs just as much for the heating value received to use more of it and extra expense is incurred in freight, labor of unloading, firing, and labor in removing the extra ash, you will note that there is twice as much ash in the poorer coal as against the better coal. In other words, if your coal supply is 14 cars and you bought the poorer grade, it would be necessary for you to handle one more car of coal than if you bought the better grade of coal. The poorer the coal the larger these losses. Similar conditions exist in such materials as paints, oils, soaps, and other products too numerous to mention."

HEAVY EQUIPMENT FOR SEAMLESS STEEL TUBES

SINCE taking over the plant of the Welland Machine and Foundries for Lackawanna Tubes, Limited, L. R. Weeks, manager, has made several important changes. In the first place, the foundry which had been dormant for some time, has been placed in operation on jobbing work and, Mr. Weeks declares, is paying for itself. A machine shop 35x70, is being built, and this will also contain a galvanizing tank. The new order of things includes a building where coke will be kept under cover and an enclosure for pig iron, where a supply properly graded may be carried and easily handled.

The foundation of the main building, where the company will manufacture seamless steel tubing, has been completed. It provides for a building four hundred feet long and eighty feet wide, the height to the eaves being 27 feet with 21 feet of sash and a Robinson process roof.

The manufacture of seamless steel tubing calls for exceptionally heavy equipment. The prime machinery alone represents a total weight of 1,319,000 lbs. The reducing machine weighs 410,000 lbs. This is the machine that performs the main operation in the production of tubes to size.

Mr. Weeks expects that he will have the plant in operation by Sept 15. The outlook, he states, is exceptionally promising. This will be the first tube mill of its kind in Canada. The country's requirement in boiler tubes up to the present time has been imported, and it is stated that 1/5 of the quantities of the tubes imported in the course of a year would keep a mill busy 24 hours a day for a year.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Toronto price:—	
Silicon, 2.25% to 2.75%	29 15
Grey forge, Pittsburgh	$19 00
Lake Superior, charcoal, Chicago	30 00
Standard low phos., Philadelphia	31 50
Bessemer, Pittsburgh	26 96
Basic, Valley furnace	25 00

IRON AND STEEL

Per 100 lbs. to Large Buyers	Cents
Iron bars, base, Toronto	$2 90 3 00
Steel bars, base, Toronto	2 90 3 00
Iron bars, base, Montreal	2 90
Steel bars, base, Montreal	2 90
Reinforcing bars, base	2 90
Steel hoops	4 00
Tire steel	3 15
Spring steel	7 00
Band steel, No. 10 gauge and 3-16 in. base	3 40 3 50
Chequered floor plate ¼" and heavier	5 00
Bessemer rails, heavy, at mill	2 35
Steel bars, Pittsburgh mill prices	1 70
Tank plates, Pittsburgh mill price	1 70
Structural shapes, Pittsburgh mill prices	1 70
Steel hoops, Pittsburg	3 07
F.O.B., Toronto Warehouse	
Small shapes	3 00
F.O.B. Chicago Warehouse	
Steel bars	2 48
Structural shapes	2 58
Plates	2 58
Small shapes under 3-in	2 48

FREIGHT RATES

Per 100 Pounds.

Pittsburgh to Following Points

	C.L.	L.C.L.
Montreal	58	73
St. John, N.B.	84½	106½
Halifax	86	108
Toronto	38	54
Guelph	38	54
London	38	54
Windsor	35	50½

Current surcharge 1 per cent.

METALS

	Montreal	Toronto
Lake copper	$17 50	$17 00
Electrolytic copper	17 25	17 00
Castings, copper	17 00	17 00
Tin	35 00	34 00
Spelter	7 75	7 25
Lead	6 75	7 00
Antimony	6 50	7 40
Aluminum	23 00	21 00

Prices per 100 lbs.

PLATES

Plates, 3-16 in.	$3 75	$3 50
Plates, ¼ up	3 40	3 25

PIPE--WROUGHT

Standard Buttweld Pipe S/C

Per 100 feet

	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk.	Gen. Wrot Iron Galv.
⅛ inch	$ 6.00	$ 8.00	$	$ ....
¼ inch	3.84	5.94	7.20	9.30
⅜ inch	3.84	5.94	7.20	9.30
½ inch	4.85	6.46	7.31	8.93
¾ inch	5.87	7.71	8.86	10.70
1 inch	8.16	11.05	12.58	15 20
1¼ inch	11.04	14.95	17.02	20.70
1½ inch	13.20	17.88	20.35	24.75
2 inch	17.76	24.05	27.38	30.30
2½ inch	28.08	38.03	.....	.....
3 inch	36.72	49.73	.....	.....
3½ inch	47.84	63.48	.....	.....
4 inch	56.68	75.21	.....	.....

Standard Lapweld Pipe S/C

Per 100 feet.

Below Dividing Line—Price Per Foot.

Size	Steel Blk.	Steel Galv.	Gen. Wrot Iron Blk	Gen. Wrot Iron Galv.
2 inch	$21.46	$27.38	$31.08	$37.00
2½ inch	31.50	40.95	46.80	56.16
3 inch	41.31	53.55	61.20	73.44
3½ inch	48.76	66.32	72.68	89.24
4 inch	57.77	77.39	86.11	105.73
4½ inch	66.04	86.36	1.04	1.24
5 inch	76.96	100.64	1.21	1.45
6 inch	1.00	1.31	1.57	1.88
7 inch	1.22	1.76	2.02	2.45
8L inch	1.40	1.85	2.13	2.58
8 inch	1.61	2.13	2.45	2.97
9 inch	1.97	2.59	2.97	3.59
10L inch	1.82	2.40	2.75	3.33
10 inch	2.35	3.09	3.54	4.28

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4-in. and under 60 per cent.
4½-in. and larger, 50 per cent.
4-in. and under, running thread, 40%.
Standard couplings, 4-in. and under, 30%
Do., 4½-in. and larger, 10%.

OLD MATERIAL

Dealers' Average Buying Prices

	Per 100 Pounds. Montreal	Toronto
Copper, light	$ 8 50	$ 8 50
Copper, crucible	11 00	11 00
Copper, heavy	11 00	11 00
Copper, wire	11 00	11 00
No. 1 machine composition	9 00	9 00
New brass cuttings	6 00	6 00
Red brass turnings	6 50	6 50
Yellow brass turnings	5 00	4 85
Light brass	4 00	3 50
Medium brass	5 50	4 50
Scrap zinc	3 50	4 00
Heavy lead	4 50	4 50
Tea lead	3 00	3 00
Aluminum	11 00	11 00

	Per Ton	Gross
Boiler plate	$9 00	$ 7 00
Heavy melting steel	10 00	10 00
Axles (wrought iron)	20 00	16 00
Rails (scrap)	11 00	11 00
Malleable scrap	10 00	11 00
No. 1 machine cast iron	20 00	16 00
Pipe, wrought	7 00	6 00
Car wheel	17 00	16 00
Steel axles	15 50	15 00
Machine shop turnings	4 00	6 00
Stove plate	16 00	14 00
Cast boring	4 00	5 00

BOLTS, NUTS AND SCREWS

	Per Cent
Carriage bolts, 7-16 and up	40
Carriage bolts, ⅜ in. and smaller 6 in. and shorter	47½
Coach and lag screws	55
Stove bolts	72½
Wrought Washers	60
Do., coru. head	60
Machine bolts, 7-16 and over	42½
Machine bolts, ⅜-in. and less	42½
Blank bolts	42½
Bolt ends	42½
Machine Screws, fl. and rd hd., steel cut thread	37½ & 10
Machine screws, o. and fil. hd., steel cut thread	30
Machine Screws, fl. and rd hd., brass cut thread	15
Machine screws, o. and fil. hd., brass cut thread	30
Nuts, square, blank off net list	$1.25
Nuts, square, tapped off net list	75c.
Nuts, hex., blank off net list	75c.
Nuts, hex., tapped off net list	25c.
Copper rivets and burrs, list less	32½
Burrs only, list plus	10%
Iron rivets and burrs	52½
Boiler rivets, base ¾ in and larger	$5.50
Structural rivets, as above	5 40
Wood screws, O. & R., bright	80
Wood screws, flat, bright	82½
Wood screws, flat, brass	77½
Wood screws, O. & R., brass	75
Wood screws, flat, bronze	72½
Wood screws, O. & R., bronze	70

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent
Set screws	Less 55%
Square and hexagon head cap screws	Less 50%
Round head cap screws	Plus 10%
Fillister head cap screws	Less 10%
Flat head screws	Net list
Button head cap screws	Plus 10%
Studs	Less 35%
Semi-finished nuts up to and including 1-in.	Less 60%
Semi-finished nuts 1⅛ to 1¼ in.	Less 55%
Semi-finished nuts 1⅜ to 2 in.	Less 25%
Coupling bolts	Less 10%
Taper pins, No. 2 to No. 5	Less 60%
Planer bolts without fillet.	Plus 20%
Patch bolts	Plus 50%
Hollow set screws	Plus 10%
Thumb screws	Less 85%
Thumb nuts	Less 60%

BILLETS

F.O.B. Pittsburgh

	Per gross ton
Bessemer billets, 4 in x 4 in. and larger	$35 00
Open hearth billets	35 00
O. H. sheet bars	35 00
Forging billets	40 00
Bessemer rods	38 00

NAILS AND SPIKES

Wire nails, base	$3 65
Cut nails, base	4 35
Miscellaneous wire nails	72½%

ROPE AND PACKING

Plumbers' oakum, per cwt.	6 30
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 23
British Manila rope	0 20
New Zealand hemp	0 20

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	Net

Solder, strictly	$0 22½
Solder, guaranteed	0 24
Soldering coppers, lb.	0 62½
White lead, pure, cwt.	13 20
Red dry lead, 100-lb. kegs, per cwt.	10 75
Wood alcohol, per gal.	1.75
Whiting, plain, per 100 lbs.	3 00

CARBON DRILLS AND REAMERS

S. S. drills, wire size	55
Can. carbon cutters,	10
Standard drills, all sizes	60
3-fluted drills, plus	10
Jobbers and letter sizes	55
Bit stock	60
Ratchet drills	10
S.S. drills for wood	10
Wood boring brace drills	55
Electricians' bits	30
Sockets	60
Sleeves	50
Taper pin reamers	25 off
Drills and countersinks	Net
Bridge reamers, carbon	50
Centre reamers	5
Taps, machine screw	less 50-60
Taps, hand, under 1"	less 40-50
Chucking reamers	30 off
Hand reamers	25
High speed drills, list	30 to 40 off
Can. high speed cutters, less	10
American	plus 40

COLD ROLLED STEEL

[At Warehouse]

Rounds and squares	$4.50 base
Hexagons and flats	$5.00 base

MALLEABLE FITTING LIST

1 in. elbow	.32	.53
2 in. elbow	1.05	1.70
1 in. tee	.43	.70
2 in. tee	1.45	2.40
1 in. coupling	.33	.53
1 in. locknut	.15	.23

Discount to dealers 70/5 off list.

SHEET

	Montreal	Toronto
Sheets, black, No. 28	$4 40	$5 00
Sheets, blue ann., No. 10	4 05	4 00
Canada plates, dull, 52 sheets	5 50	6 00
Can. plates all bright	7 00	....
Galvanized sheets, No. 28	....	6 00
Queen's Head, 28 B.W.G.	7 25	
Fleur de Lis, 28 B.W.G.	7 00	
Gorbal's Best, No 28	....	....
Colbornes Crown, No. 28.	....	....
Premier, No. 28, U. S.	6 45	6 00
Premier 10¾ oz.	6 00	6 40
Zinc sheets	9 00	10 00

PROOF COIL CHAIN

(Warehouse Price)

B. B. B. CHAIN

⅜ in., $16.45; 7-16 in. $14.00; ½ in. $12.95; 5-8 in., $13.15; ¾ in. $12.75; 7-8 in. $12.25; 1 in. $11.85; 1⅛ and 1¼ in. $10.50. Fire weld chain same sizes respectively are $14.00; $11.50; $10.40; $10.55; $10.15; $9.75; $9.35; and $8.25.

ELECTRIC WELD COIL CHAIN B.B.B.

⅛ in. $20.00; 3-16 in. $16.50; ¼ in. $15.50; 5-16 in. $12.70.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	60/5
Vulcan	50
P.H. and Imperial	60/5
Nicholson	40
Black Diamond	40
J. Barton Smith, Eagle	50
McClennand, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	'60
Great Western-American	50
Kearney & Foot, Arcade	60/5

BOILER TUBES

Size	Seamless	Lapweld
1 in.	18.00	$
1¼ in.	20.00	
1½ in.	19.00	
1¾ in.	20.00	
2 in.	19.00	16.00
2¼ in.	22.00	19.00
2½ in.	25.00	19.00
3 in.	29 00	24 50
3½ in.	34 00	25 00
4 in.	43 00	36 00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS

Castor oil, per lb.	34½
Royalite, per gal., bulk	20
Palacine	23
Machine oil, per gal.	33
Black oil, per gal. (Summer)	19
Cylinder oil, Capital	61½
Petroleum fuel oil bbls., net	10.80
Pure turp., single bbls., gal	1 65
Linseed oil, raw, single bbls.	1 10

BELTING—No. 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30 and 10%
Cut leather lacing, No. 1	1 80
Leather in side, (Lacing)	1 60

TAPES

Chesterman Metallic, 50 ft.	$5 00
Lufkin Metallic, 603, 50 ft	3 17
Admiral Steel Tape, 50 ft.	3 00
Admiral Steel Tape, 100 ft.	4 50
Major Jun. Steel Tape, 50 ft.	3 75
Rival Steel Tape, 50 ft.	4 40
Rival Steel Tape, 100 ft.	8 75
Reliable Jun. Steel Tape, 50 ft.	5 25

PLATING SUPPLIES

Polishing wheels, felt	$3 80
Polishing wheels, bull-neck	1.50
Emery in kegs, Turkish	08
Pumice, ground	05
Emery glue	25
Tripoli composition	08
Crocus composition	12
Emery composition	11
Rouge, silver	64
Rouge, powder, nickel	38

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	8½
Grits, 80 and finer	6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	19
Brass sheets, 24 gauge and heavier, base	21
Brass tubing, seamless	23

WASTE

XXX Extra	16	Atlas	18
Peerless	21	X Empire	13
XX Grand	15	Ideal	18
Superior	20	X Press	11½
X L C R	14		

Colored

Lion	12	Fancy	13½
Standard	10½	Popular	9
No. 1	13	Keen	7½

Wool Packing

Arrow	24	Anvil	16
Axle	20		

Washed Wipers

Select White 18 Dark colored.13

Mixed colored.14

This list subject to trade discount

RUBBER BELTING

Standard 36 .. 28% Best grades 28%

ANODES

Nickel	.55 to .60
Copper	.38 to .40
Tin	.70 to .70
Zinc	.16 to .17

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Copper Bars, ½ to 2 in	$29 00	$28 00
Brass Tube		25
Plain sheets, 16 oz., in. 30 x 72	30 00	29 00
Copper sheet, tinned, 16 oz.	37 00	41 00
Copper sheet, planished, 16 oz. base	42 00	41 00
Braziers', in sheets, 6 x 4 base	30 00	29 00
Copper tubing, seamless		29

LEAD SHEETS

	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$ 8 75	$ 9 00
Sheets, 3 1-2 lbs sq. ft.	8 50	8 75
Sheets, 4 to 6 lbs. sq. ft.	8 25	9 00

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	.23
Acid, hydrochloric	.03¾
Acid, nitric	.10¼
Acid, sulphuric	.03¾
Ammonia, aqua	.20
Ammonium, carbonate	.15
Ammonium, chloride	.18
Ammonium, hydrosulphuret	.75
Ammonium sulphate	.10
Arsenic, white	.18
Copper, carbonate, anhy.	.32
Copper, sulphate	.08
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulphate	.14
Nickel carbonate	.32
Nickel sulphate	.14
Potassium sulphide (substitute)	.40
Silver chloride (per oz.)	.85
Silver nitrate (per oz.)	.65
Sodium bisulphate	.13
Sodium carbonate crystals	.04
Sodium cyanide, 127-130%	.35
Sodium hyposulphite per 100 lb.	6.50
Sodium phosphate	.15
Tin chloride	.80
Zinc chloride, C.P.	.30
Zinc sulphate	.06

Prices per lb. unless otherwise stated

News From the Industrial Field

Steel Bridge.—Joliceur & Veilleux Beauceville Co., Beauce, will construct a steel bridge at St. Malachie, Que., at a cost of $40,000.

The erection of several schools is being planned throughout the country. Following are a few of those contemplated: A high school to cost $32,000 will be built in Burnaby, B. C., McCarter & Naine, 509 Richmond St., Vancouver, architects. De Salles, P. Q., are going to erect a school, G. Gobel being the party to write to. Newmarket, Ont., is planning erection of school to cost $54,000. K. N. Robertson, is secretary-treasurer of board. The Toronto University is also planning to build a Forestry and Bottany building at a cost of $200,000. In the latter case Mr. Le Pan, superintendent of buildings, is the man to send correspondence to.

Dam to be built.—Plans are being prepared for a dam to cost $13,000 for Dominion government and provincial government. Port Haney, B. C., will be the site of the new dam.

Toronto, Ont.—The Architectural Bronze & Iron Works, Lansdowne Ave., have secured the steel sash and glazing contracts on the preparatory school building at Upper Canada College. This firm have also secured similar contracts on the Riverdale Technical School.

Toronto, Ont.—Tenders will be called shortly for re-building grain elevator, chutes and bins for Faramel Lt., Dupont St. The cost will be around $35,000.

The Ford Motor Co., Ford, Ont., are contemplating the erection of a new additional building.

The Canadian Aloxite Co., Montrose, Ont., have an addition made to their machine shop. The Robertson Construction Co., Niagara Falls, have secured general building contract.

The machinery used in new pulp mill at Three Rivers, will cost over $40,000. The Dominion Engineering Works, Lachine, have secured contract for the majority of work, while the Waterous Engine Works Co., Brantford, have secured contract for magazine grinder and all equipment for the same.

An electric lighting and power distribution system will soon be installed by Derby Township, Ont.

The Rockland Electric Light Co., is constructing an electric lighting system at Rockland, Ont., at a cost of $10,000. Another lighting system is contemplated at Yarmouth, N. S., and by the Yarmouth Light & Power Co.

Will Make Addition.—The collegiate institute at Galt will construct a new addition, which will cost approximately $335,000.

H. L. Burke has been appointed general superintendent in charge of the canal and river sections of the Queenstown-Chippewa power development.

The Carswell Construction Co., Toronto, has been incorporated as a limited company, with a capital of $100,000, and will continue to carry on a general contracting business.

According to reports, the Peter Lyall Construction Co., Montreal, have secured the contract for completion of sections 3 and 4 of the Welland Ship Canal. Representatives of the company are expected to take over the work shortly, which, up to a few weeks ago, was carried on under the cost-plus basis for the government. This should mean the employment of quite a number of men.

A glass factory to make all the glass used in Ford automobiles is to be built at Flat Rock, 23 miles south-west of Detroit, on Henry Ford's railroad, the Detroit, Toledo & Ironton, according to reports. The site has already been obtained and plans are now being drawn for the factory. A small part of the companies' glass is now being made at the River Rouge plant. It is planned to manufacture cement also at the Rouge plant, utilizing slag from the blast furnaces there. The plant, it is estimated, will cost one million dollars.

If gold output continues at anything like its present rate, more of this metal will be produced this year in British Columbia than during any year in the history of the province. In fact, the gold production of the entire dominion will be the greatest on record, even exceeding the output of the banner first year of the Yukon gold rush. The province of Ontario will be the main factor in the latter calculation.

Matachewan Power .Co., expect to have power available for distribution from the first unit of their Montreal River development by the end of the year. The first installation is being made at Indian Chutes.. A dam is to be constructed at Big Bend. Some 80 men are now working on the property and satisfactory progress is being made.

Request has been made to the federal authorities at Ottawa for the establishment of a government terminal elevator in Ontario. Toronto Harbor Commission, grain section Toronto Board of Trade, provincial Minister of Agriculture, and United Farmers of Ontario joined in making representations in support of this request, for which careful consideration is promised.

Reports state that a bill will be brought down in the house at Ottawa to permit the manufacture and importation or oleomargarine until August 31, 1923. This, if passed, means an extension of one year.

Production of portland cement during May 1922 was 11,176,000 barrels, which is the largest amount ever produced in any single month. However, the outstanding feature of the situation is disclosed by the indicated movement of cement, May shipments being in excess of any preceding month; and for the five months ending May 31 they were greater than during any similar period in past years. Shipments for the period were more than 5,000,000 barrels ahead of last year and nearly 4,000,000 barrels in excess of 1920 which was the largest year for the industry. The great demand is attributed to the record breaking proportions of the building boom which is under way and to increased municipal improvements. The construction of concrete pavements is also an important factor as the yardage under contract this year is greater than ever.

Montreal, Que.—Addressing the parliamentary committee of the League of Nations, Sir Charles Gordon, one of the Canadian delegates, stated that in volume of imports and exports Canada stood fourth among the thirty-four nations represented. In volume of commerce per head of population Canada stands first, and in export trade third, being exceeded only by Great Britain and France.

Three Rivers, P. Q.—It is expected that early in July the newsprint mill of the St. Maurice Lumber Company (a sibsidiary of the International Paper Company, of New York) will bring its fourth paper machine into operation and will then constitute one of the largest single paper mills on the North American continent, with a newsprint capacity of approximately 340 tons a day. The mill is also equipped with a wrapping machine capable of turning out 30 tons a day and has an excess of pulp production of some 200 tons.

Victoria, B. C.—Approximately $1,500,000 will be spent on highways in British Columbia this year, Hon. W. H. Sutherland, Minister of Public Works, announced. The work includes the Pacific Highway paving in the municipality of Surrey; the Nelson-Ymir road $80,000; Cascade-Rossland road $230,000; Similkameen district roadwork $80,000; Columbia Valley $62,000; Yellow Head Pass project $68,000, etc.

Vancouver, B. C.—A syndicate of British and California business men are organizing a ten million dollar undertaking which will be a holding and operating company of large British Columbia properties. It is to acquire the property and assets of the Masset Timber

Co., the Puget Sound Box Co., and the Western Marine Supply Co. The company will build and operate large sawmills and operate a large fleet of lumber-carrying ships. Many prominent men from both sides are behind the project.

Ford, Ont.—The Ford Motor Company of Canada, has been experiencing an active demand for its product. The company has maintained an almost uniform production of more than 200 cars a day since December, 1921, the greater part of the time turning out 225 a day, while from December, 1920, to December, 1921, production averaged about 150 a day. The increase in the current fiscal year, it is estimated, will bring the output near 60,000 cars, as against 46,832 for the preceding fiscal year, and 55 616 for the year ending July 31, 1920.

Ottawa, Ont.—Tenders for repairs to breakwaters at Port Colborne, Ont., are called for by the Department of Public Works and must be received by noon, July 4.

The Ottawa Public School Board, has accepted the bulk tender of the Gilmour Construction Co., amounting to $72,582 for the construction of an addition to the Kent Street school.

Ottawa, Ont.—The city council has awarded the following contracts for the civic hospital: plumbing and draining Garth Co., Montreal, $111,000; heating and ventilation W. G. Edge Lt., Ottawa, $105,581; electrical wiring, Fred Wilson, Ottawa, $33,527.

Plans for the construction of the big stadium of Ottawa Ltd., building are now complete. A site has been secured on King Edward avenue and building operations will commence as soon as possible. It is proposed to erect a building that will cost in the neighborhood of $300,000.

Ottawa, Ont.—An option on 33 feet of Queen Street property has been secured by M. J. Armstrong, machinist, who is shortly to erect a large modern machine shop on the site which is immediately west of the premises occupied by Just Motors. The property is 90 feet deep. It is estimated the new machine shop will cost in the neighborhood of $10,000.

T. P. Thompson, inspector of engines and boilers of steamboats, Kingston district, for the past thirty years, has resigned owing to ill-health.

The steamer Ferdinand of the Prescott-Ogdensburg Ferry Co., is undergoing repairs at the Cornwall drydock. She is being enlarged to carry at least two more automobiles to cope with extensive automobile traffic.

Willing to Trade.—Vancouver, B. C. —M. de Redon, president of a large coal mining company in French Indo-China, says the French colony will trade tis high grade anthracite coal for British Columbia lumber to a total of half a million tons a year.

Marysville, N. B.—It was announced at the annual meeting of the Canadian Cottons, Limited, that the company has at the present time 500 per cent. more orders than at the same time last year and sufficient to keep the mills fully occupied for the next four months.

Sydney, N. S.—Nineteen hundred men are now working at the Dominion Steel plant here, as against 1,200 at the first of May, according to information given out at British Empire Steel Corporation headquarters.

Walsh Plate and Structural Works of Drummondville, Que., have secured the contracts for steel on the following structures: New city hall and fire station, St. Guillaume, Que.,; college Immaculate Conception, Montreal; Riviere Rouge bridge, Valleyfield, Que.; extension to Montreal Cottons plant, Valleyfield, Que.; bridge at Bagot, Que.

The Steel Trough and Machine Co., of Tweed, Ont., are building two additions to their factory to take care of rapidly growing business. The firm has also established a Montreal office to supervise the work in Quebec and the Eastern provinces. Offices are also located in Toronto, Winnipeg and Vancouver.

A company has been formed under the name of the A. D. Porter Mfg., Co., for the purpose of engaging in the production of pressed brass and steel goods for the plumbing, shoe and furniture trades. The company will commence operations soon in Galt, Ont., having acquired a building on Hobson street. The place is now being remodeled and machinery installed.

Supplies Ltd. of Kentville, N. S., are in the market for machinery to equip a small aerated water plant.

In an article on the development of Ontario's iron ore resources in The Northern Miner, the importance of iron as a factor in national development is emphasized. Among other important matters, the writer says:

"In 1921 the value of coal, iron ore and iron and steel products imported into Canada exceeded $356,000,000; which was about 80 per cent. of the value of the whole grain crop produced in the whole of Western Canada. During the last five years, the imports of iron and steel products into Canada aggregated $932,902,271, of which $896,372,209 came from the United States. With slight assistance from either the Ontario or Dominion Governments, our iron mines can be developed extensively and our iron and steel industry become the most important industry in Canada."

FINDS BUSINESS BETTER IN OTTAWA

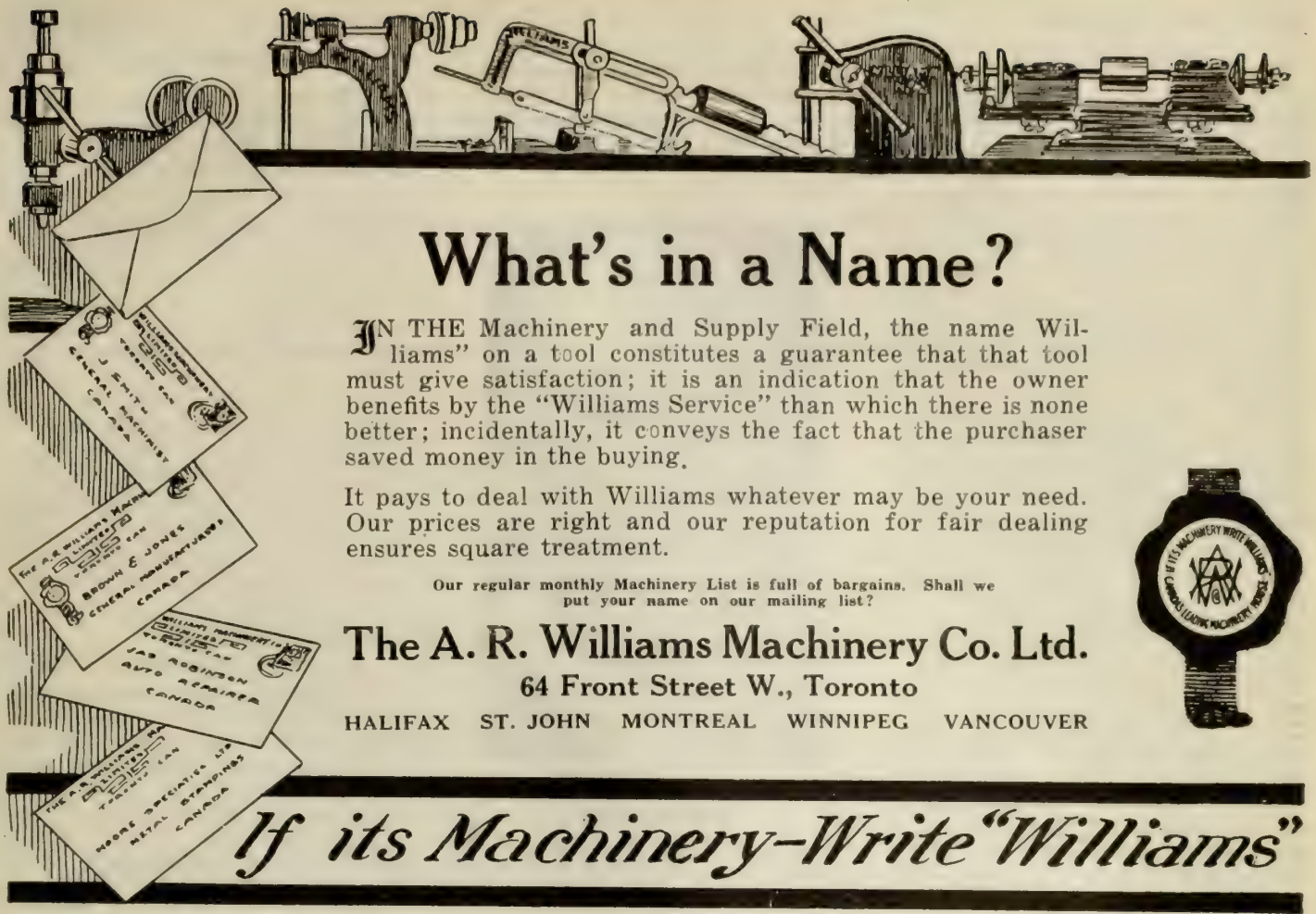
A survey of the machinery and metal trades in the Ottawa district shows rather a contradictory state of affairs for, whereas trade in medium work appears to be "booming," trade in large work is decidedly quiet, and small work is sandwiched in between the two, being fairly good. Of these machine shops specializing in medium work which were visited, all report trade either good, improving, or excellent. McMullen Perkins Ltd., have been enjoying a big volume of business. This firm installed two new grinders and a new lathe last year but their business is such that they are putting in another new grinder and have taken on two extra hands. Mr. McMullen reports that even in the usually slack months of January and February the works were kept going at full capacity and that he was employing more men than at the busiest time last year. Armstrong & Co. is another firm in the booming category. Mr. Armstrong has recently taken on two extra hands and is putting in a new grinder, three more lathes, and a new milling machine, which, when installed, will call for the employment of an additional three men. This firm finds its present premises altogether too small for its growing business and, as already announced, has secured a site on which an up-to-date large machine shop will be erected at once.

Mr. Lawson, of T. Lawson & Sons declares business to be improving. He has increased his staff by two but says that as yet the volume of increased trade is not sufficient to warrant the installation of any new equipment. The Victoria Foundry reports business as quiet with no large contracts in sight. Business in supplies is rather above the average.

CANADA MAKES GOOD SHOWING IN GREAT BRITAIN

Official monthly returns for the first quarter of 1922 indicate that British imports of passenger cars, trucks, and chassis are again on the increase, writes W. H. Park, secretary to the trade commissioner at London, England. The total number of passenger cars and trucks imported during this period was 2,495, valued at £461,328; chassis numbered 2,370, valued at £479,009. During the corresponding quarter of 1921 the total number of passenger cars and trucks imported amounted to 2,914, valued at £681,156; but imported chassis numbered only 963, valued at £314,863. Canada ranked first as a source for the number of finished cars and fourth with respect to chassis. France ranked second with regard to both finished cars and chassis. Italy was third for finished cars and first for chassis, while the United States was fourth in finished cars and third in chassis. Germany also made a good showing, although imports from that country were rather irregular.

A total of 2,448 automobile licenses were issued by the Province of Manitoba license department up to the end of April this year, according to statistics made public. Dealers' licenses total 244, motorcycles 465, chauffeurs 2,394, sales representatives 171, and permits 3,642. Revenue for the department so far this year amounts to $394,104, it is stated.



What's in a Name?

IN THE Machinery and Supply Field, the name Williams" on a tool constitutes a guarantee that that tool must give satisfaction; it is an indication that the owner benefits by the "Williams Service" than which there is none better; incidentally, it conveys the fact that the purchaser saved money in the buying.

It pays to deal with Williams whatever may be your need. Our prices are right and our reputation for fair dealing ensures square treatment.

Our regular monthly Machinery List is full of bargains. Shall we put your name on our mailing list?

The A. R. Williams Machinery Co. Ltd.

64 Front Street W., Toronto

HALIFAX ST. JOHN MONTREAL WINNIPEG VANCOUVER

If its Machinery—Write "Williams"

Don't Keep It--Sell It!

If you have a lathe
a drill
a milling machine
a planer
a chain block
a chuck
a motor
a crane
a stock of belting
an engine
a compressor

or any other machine shop equipment for which you really have no further use, why not turn it into *cash?*

Someone may be looking for just the machine you may want to sell. Let us bring you together.

A "classified" ad. in CANADIAN MACHINERY, costing a few cents per issue, has done wonders for others. Why not try it?

Turn to the "Classified" section in this issue and see what is being offered and what is wanted at present.

CANADIAN MACHINERY

Classified Advertising Section

143-153 University Avenue TORONTO, ONT.



—you can take your holidays—if—

YOUR MACHINERY

is babbitted with

Harris Heavy Pressure Babbitt

and your biggest engines with

Imperial Genuine Bearing Metal

Thirty-five years on the market

British Standard Metals

THE CANADA METAL CO., LIMITED

TORONTO HAMILTON MONTREAL
WINNIPEG VANCOUVER

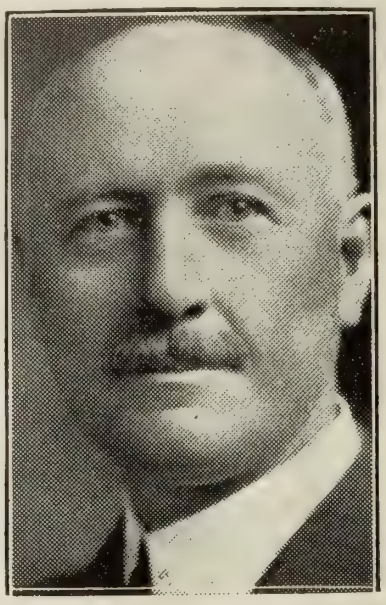
NEW PRESIDENT CHOSEN FOR C.M.A.

JOHN R. SHAW, vice-president and general manager of Canada Furniture Ltd., Woodstock, Ont., has been elected president of the Canadian Manufacturers' Association for the coming year.

C. Howard Smith, president of the Howard Smith Paper Mills, Montreal, has been elected first vice-president, while Henry Bertram, secretary-treasurer of John Bertram & Sons, Dundas, Ont., has been appointed second vice-president.

Other officers elected are as follows: Thomas Roden, Toronto, Ont., (re-elected), treasurer; John D. Palmer, Fredericton, chairman executive committee; Joseph Picard, Quebec, chairman tariff committee; W. S. Campbell, Toronto, chairman transportation committee; Arthur Hewitt, Toronto, chairman membership committee; J. C. McFarlane, Toronto, chairman legislation committee; W. C. Coulter, Toronto, chairman industrial relations committee; W. H. Miner, Granby, P. Q., chairman education committee; L. L. McMurray, Toronto, chairman commercial intelligence committee; J. F. M. Stewart, Toronto, chairman publishing committee.

John R. Shaw, the new president, is not only interested in the Canada Furniture Manufacturers, Ltd., but is also connected with many other companies as official or director including the Canadian Linderman Co., Canadian Austin Machinery Co., Hastings Furniture Co., Vancouver, B. C., Macey-Abell Co., Victoria, B. C.; Overland House Furniture Co., Winnipeg; Canada Spool and Bobbin Co., Ltd., Walkerton; Oxford Cobalt Silver Mining Co.; British National Assurance Co., Toronto; Toledo Bridge and Crane Co., Toledo, Ohio. Mr. Shaw was born in Bruce county, was educated at Walkerton High School, the University of Toronto, and Osgoode Hall. He practised law in Walkerton and Toronto and later organized Canada Furniture Manufacturers, Ltd. He is vice-president of the associated Children's Aid Societies of Ontario and a member of the board of trustees of Woodstock General Hospital.



JOHN R. SHAW
President C.M.A.

C. Howard Smith, the new first vice-president, was born in St. Johns, Que., and went into the paper business as a youth.

Henry Bertram, the second vice-president, was born in Dundas and was educated in Dundas public and high schools. He entered his father's business in 1871 and 15 years later became a partner. In 1901, he was made secretary-treasurer. He belongs to the Engineers' club, Ontario, of Toronto, and the Engineers' Club, Montreal. Mr. Bertram is a director of several companies.

According to the arrangement made, C. Howard Smith becomes president in 1923, while Henry Bertram will fill the president's chair in 1924.

A shipment of 6,000 tons of Caucasian manganese ore has just arrived at Baltimore, said to be the first shipment from Russia since before the war. The manganese ore just brought in was ordered some time ago, and the transaction handled by Charles Hardy & Ruperti, Inc. Iron & Ore Corporation of America has since secured exclusive agency for output of the Caucasian mines.

The many friends of H. W. Petrie, Sr., president of the W. H. Petrie Machinery Co., Toronto, will have heard with regret of the death of Mrs. Petrie on Sunday last. The funeral was held from the family residence, 17 Heathdale Road, on Tuesday, June 27.

IMPORTANT EXTENSIONS DURANT MOTOR PLANT

Durant Motors of Canada Ltd., Toronto, in operation on the manufacture of motor cars since March 1, announce that they are planning the erection of extensive additions to their plant. They will include two new buildings, each 400 feet long, 100 feet wide and 6 stories high. Another building for crane and storage purposes, will be 500 feet long and one storey. These additions will more than double present capacity and it is expected will be completed by Jan. 1, 1923.

The first financial satement of the Company shows that $45,011.94 have been spent on land and buildings; $149,762.10 for machinery and equipment and $596,543.71 for materials and supplies for plant operations. The initial year's output of cars will approximate 25,000 with the demand showing some preference for the covered type of cars.

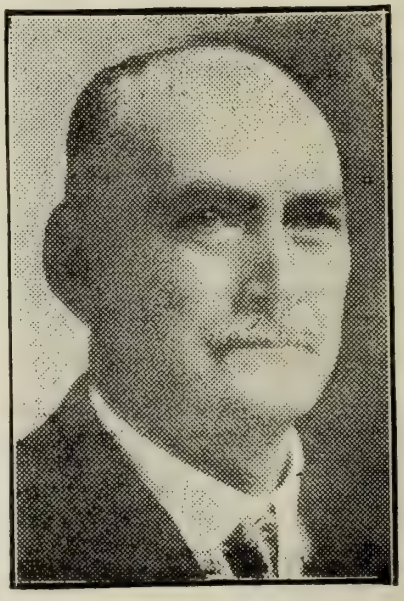
NEW AUTO FACTORY PLANNED FOR WINDSOR

If present plans go through Windsor, Ont., will have another automobile industry added to her already large list. The Windsor Steam Motors, have opened temporary offices at 6 London St., E, and intend producing a steam car. This company is a branch of the Trask-Detroit Steamer now producing a moderately priced steam car in Detroit.

H. B. Muir is president of the Canadian concern, and until the plant is ready, it is the intention to export machines from Detroit to take care of the Canadian market. Several claims are made for this type of steam car, one being that there are less than forty moving parts in the entire mechanism, and that either gasoline, kerosene or distillate can be burned.



C. HOWARD SMITH
1st Vice-President C.M.A.



HENRY BERTRAM
2nd Vice-President C.M.A.

Make it Snappy with a Jarvis

The Jarvis Self Opening Stud Setter is the Coming Tool

It is new
You May Not Have Heard of It, But You Will.

One of the first of these Stud Setters was demonstrated at the Indiana Factory of an Engine Builder. If you had seen it in operation, you would have said it was one of the snappiest jobs you had ever seen.

They were setting studs in Engine Blocks. The Stud Setter was put in an Air Chuck. A boy started the studs in the block by just a turn, to hold them.

The stop collar was slipped over the stud (this being the positive type Stud Setter). The Stud Setter was allowed to drop down on the stud.

Zip!

It was ready for the next stud.
There was no slowing down of the Air Chuck.

Tested for tightness, with a wrench, there was nothing for the wrench to do.

Tested for height, all studs showed an exactly uniform setting.



The Jarvis Self Opening Stud Setters, equipped with Morse Taper Shanks, are adapted for use on Drilling Machine, Air Drill, or Electric Drill.

They are made in two styles, Positive and Friction.

There are four sizes, Nos. 1-1/2, 2, 3 and 4.

Capacity: 0 to ½″
0 to ⅞″
0 to 1¼″
1″ to 2″

Simple in design.
Quick Grip and Ready Release.
Easy-working.
Jaws built for Long Service.
High Grade Material, Hardened and Thoroughly Tested.

Different size jaws may be supplied for any size stud within the capacity of each tool.

The Jarvis Stud Setters can be fitted to the Jarvis Quick Change Chucks.

Expensive?

Not a Bit of It. That is Another Interesting Feature. It has Everything Beaten in Price, Too.

Write for Leaflet and Price

SOLE DISTRIBUTORS

THE GEOMETRIC TOOL COMPANY

NEW HAVEN **CONNECTICUT**

Canadian Agents:

Williams & Wilson, Ltd. Montreal. The A. R. Williams Machinery Co., Ltd., Toronto, St. John, N.B., Halifax, N.S., Vancouver, B.C.

William A. Law, president of the First National Bank, discussing the business and financial outlook, says: "Hard work and plenty of it is bringing the world back to a normal basis."

Fort William, Ont.—John East and Co., contractors, have been awarded the contract for the erection of a high school building at Fort Francis. The amount of their tender was $62,700. R. E. Mason, of Fort William is the architect.

Fort William, Ont.—John East and the power-driven pulpwood loaded upon the south bank of the Mission river for the Detroit Sulphite company, is nearing completion and should be finished shortly. The construction involves an expenditure of $20.000.

Mr. Goodwin, of Ker & Goodwin Machine Co., Brantford, Ont., speaking to one of Canadian Machinery's representatives, said: "We have received an order for 54 oil engines from Quebec, and should complete this work in about six weeks' time." He also mentioned that business in general was much better.

Fort William, Ont.—It is estimated that $100,000 will be spent in the Fort William district this summer by the Nipigon prospecting company, in exploration work for oil. A test well down over five hundred feet on the Garver farm near Fort William, where good surface indications of oil have been found, will be completed, and a second well will be drilled at Squaw Bay.

T. A. Russell, well known in automotive and industrial circles has been appointed a director of Stewart Scully Co., a new investment house which opened up in Toronto a few days ago. J. F. M. Stewart, who is director in the Home Bank of Canada, Dominion Steel Corporation and other concerns, is to be president of the new firm which will speculate in real estate and high grade industrial issues.

Hamilton, Ont.—In spite of general depression and conservatism of action on the part of business men in 1921, Hamilton in that year added 24 new industries most of the newcomers being from the United States or British Isles. Six more have come to the city since the opening of the new year, and they now have nearly eight hundred industrial establishments covering in the activities a wide range of manufacture.

At the end of 1919, when the last industrial statistics were published, Hamilton had a total of 746 industrial plants, in which was invested a total of $165,500,399, giving employment to 30,293 people, receiving in salaries and wages the sum of $32,997,963, and accounting in that year for a production of $149,767,630 in value.

Although Samuel M. Vauclain, president of the Baldwin Locomotive Works, has denied that his company is seeking control of the Canadian Locomotive Co. there is still a possibility that a measure of control in the Canadian company may shift to interests closely associated with the American enterprise. We published last week a statement from W. Casey, president of the Canadian Co. at Kingston, to the effect there was nothing in the rumor, but while there have been no negotiations between the company and other interests tending to a change in control, it is known that a certain amount of stock has been taken up under option by American interests. The negotiations have been of a private character but as yet no transfer has taken place, but according to information, the option still holds good.

The Volta Manufacturing Co., Welland, Ontario, have recently booked an order from Renton & Fisher of the Hopetown Steel Works, Bathgate, Scotland, for one of their standard 3-ton capacity Heroult type electric steel furnaces, with transformer and switchboard equipment complete. This firm also build the "Duplex Voltage" or "Quick-Melting" type of furnaces for melting steel and grey iron, as well as three-phase furnaces, of an improved design, for melting brass, aluminum, etc. Some of their more recent developments include electric annealing furnaces, electric core baking ovens, electric babbitt heaters, electric water heaters, etc.

Toronto, Ont.—G. T. Pendrith, for 40 years a manufacturer of machinery supplies, died at his home a few days ago. Mr. Pendrith retired from business just a year ago, and made an unqualified success of his career. He came to Toronto from England when he was only ten years of age, and was in his sixty-fourth year when he died. He has always resided in Toronto since coming to Canada, and has been an active worker in various fraternal societies. He was a Pastmaster of Zeta Masonic Lodge, a Past First Principal of the Antiquity Royal Arch Chapter and a P. D. D. G. M. of Independent Oddfellows.

Imports of German goods into Great Britain during 1921 were valued at £20,550,000 nearly a third less than the total of £30,252,000 in the previous year. The value of British exports to Germany also declined from £21,707,000 in 1920 to £17,831,000 in 1921, while re-exports of foreign and colonial goods decreased in value from £29,382,000 to £22,897,000 Germany has been the most important factor in Great Britain's wool trade. During 1921, Germany was the destination for 116,409,000 pounds of British re-exports of raw wool, compared with 25,013,000 pounds in 1920, and 93,197,000 pounds in 1913, and in addition took seven million pounds of British home-grown wool.

Washington, D. C.—Sales of fabricated structural steel during May amounted to 82 per cent. of fabricating capacity, according to reports made to the department of commerce by firms comprising 70 per cent. of the fabricating capacity of the United States. The May business reported by 82 firms, having a capacity of 130,600 tons, totaled 106,620 tons as against April sales of these same firms amounting to 121,211 tons, or at the rate of 93 per cent. of capacity. Total sales throughout the United States, based on the reported percentage and a total capacity of 180,000 tons, amounted to 146,900 tons in May, while revised figures for April give a total of 165,900 tons. The April figures are based on reports from 87 firms, having a total capacity of 132,600 tons, whose sales amounted to 122,198 tons, or at the rate of 92 per cent. of capacity.

The Graham Nail Works, Toronto, are in the market for scrap ends of steel plate, 9, 10 and 11 gauge, carload lots or less.

Turpentine, owing to light supply and heavy demand, is credited this week with an advance of 15 cents the gallon.

Steel Pipe—The demand here shows the almost direct result of improvement in the building field. From Atlantic to the Pacific, industry then is well employed and prices on pipe are reported as tending upwards.

Ottawa.—Major T. E. Pooley, representing Vickers Ltd., of London, England, owners of a shipyard in Montreal, is in the Dominion for the purpose of looking over sites and conditions with a view to the establishment of branch factories. He is also investigating financial propositions, chiefly in Western Canada. He was in the capital during the week ending June 19 and met Premier King and several members of the house. He is now on his way to Vancouver, making stop-overs en route.

OVERCOMING HEAVY COSTS

(Continued from page 23)

the most of your belts and to safeguard against the possibility of a sudden shut-down in some department on account of belts going wrong, have all being overhauled periodically. Have greasy belts cleaned up. Have the spices looked over and the laps that have picked up carefully cemented down again. Have worn out belts cut down to a narrower width and use them over again. In this article we have briefly indicated several ways to keep belting equipment in trim. To summarize: Place a responsible man in complete charge of all transmission equipment; standardize belting as to type, brand, width and weight for every drive; demand regular inspection and reports as to condition of belts; run belting at a uniform tension and as slack as possible; eliminate injurious dressings and use a little good dressing; keep pulleys and belts clean and smooth; make sure that shafts and pulleys and belts are in constant alignment; overhaul belting periodically. If these suggestions are faithfully adhered to it will mean less power used, less work for mechanics and millwrights, uninterrupted operation of machines, increased output, lower cost of power transmission, and more profits for the firm.

ATKINS SAWS

METAL CUTTING

Present Conditions

Don't let present-day conditions worry you: everything is fundamentally sound. More economy is being called for, use

Atkins Metal Cutting Saws

Conditions are such that quality and quantity production is essential. The use of Atkins AAA Non-Breakable Hack Saw Blade and Frames, Circular Metal and Slitting Saws, Hot Saws, Cold Saws, Kwick-Kut Hack Saw Machines and Blades and Metal Band Saw Machines, will assure you of efficient, economical operation and give you quality and quantity production.

Write for descriptive Literature and prices on any of the above

"A Better Saw for Every Use"

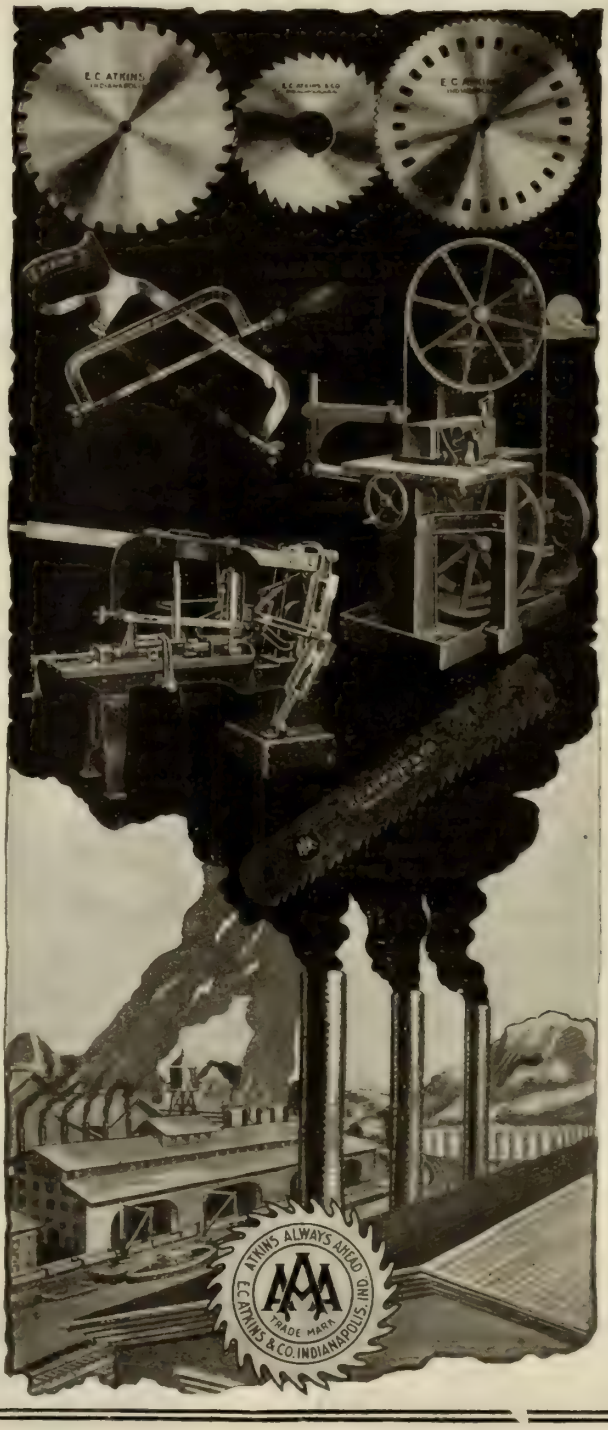
E. C. ATKINS & Co.,

Est. 1857 "The Sterling Quality Saw People"

Home Office and Factory, Indianapolis, Indiana

Canadian Factory, HAMILTON, Ontario

Branch carrying complete stock, VANCOUVER, B. C.



Classified Opportunities

Two cents a word, including "Canadian Machinery" box numbers; minimum charge is $1.00 per insertion for 50 words or less, set in 6-pt. type. Each figure counts as a word. Display ads., or ads. set in border, are at the card rates.

PATENTS

The old established firm. Patents everywhere. Head Office, Royal Bank Bldg., Toronto. Ottawa Office, 5 Elgin St. Offices throughout Canada.—Booklet free.
FETHERSTONHAUGH & CO.

PATTERNS

TORONTO PATTERN WORKS, 65 JARVIS Street, Toronto. Patterns in wood and metal for all kinds of machinery. (ctfm)

BRANTFORD PATTERN WORKS ARE PREpared to make up patterns of any kind—including marine works—to sketches, blue prints or sample castings. Prompt, efficient service. Bell 'Phone 631; Machine 'Phone 733. Brantford Pattern Works, 49 George St., Brantford, Ont. (ctfm)

FOR SALE

"RICARDO" ENGINES, PETROL OR PARAFfin, excellent for marine, commercial or stationary use. Brand new. 100 h.p. 4-cylinder, 150 h.p. and 250 h.p. 6-cylinder, 300 h.p. 12-cylinder, Thirty shillings per horse-power sterling London. Sykes, Patching, Sussex, England.

FOR SALE:—COMPLETE EQUIPMENT FOR small machine shop, consisting of 16" Davis screw-cutting lathe, hack saw, shaper, drill, buffer, grinder, and forge. Will sell reasonably and terms to responsible party. This is a snap for someone starting in business. Would sell separately. Apply Box 811, Canadian Machinery. (C23M.)

CLOSING TIME

Advertisements for this section must be in our composing room Tuesday morning prior to day of issue.

In order that the announcements of your wants, machinery for sale, etc., etc., shall not be delayed, please try to have them in our office with the Tuesday morning mail.

Canadian Machinery

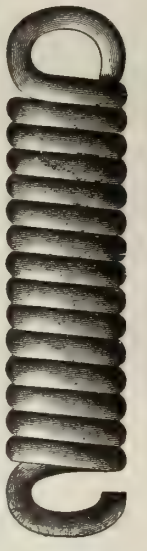
OPPORTUNITIES

FOR SALE OR ROYALTY—CANADIAN PATent No. 214964 on resilient wheel for automobiles and trucks, absorbs the shock in the leaf spring spokes of the wheel, either hard rubber or pneumatic tires may be used; simple, practical and substantial in construction. Reasonable terms. Wm. H. Schlake, Yuma, Colo.

Grey Iron Castings

Light and Medium-Bench and Floor Repetition Castings. Capacity 15 tons per day.
Expert Metal and Wood Pattern Work. Our advice and estimates will save you money.
Semi-finishing operations on Lathe or Grill on Castings supplied if required.
ASK US
THE KATIE FOUNDRY, GALT, ONT.

Oil Tempered Steel Springs



for every purpose and the best for each use.

Special styles of all kinds to order.

THE CLEVELAND WIRE SPRING COMPANY
Cleveland, Ohio U.S.A.

SITUATIONS WANTED

SITUATION WANTED AS SUPERINTENDENT or general foreman of machine shop, twenty years' experience. At present employed; best of references. Box 861T. Canadian Machinery. (c23m)

PRACTICAL FOUNDRYMAN, 25 YEARS ON light, medium and heavy work, green and dry sand. Bench, floor and machine molding, melt by analysis, and thoroughly competent on cupola practice. Good reference. Box 804, Canadian Machinery. (C11M.)

WANTED

CASH REGISTER WANTED—SINGLE DRAWer. Receipt printer. Must be in excellent condition. Box No. 807L Canadian Machinery.

MECHANICAL DRAFTSMAN AND DESIGNER desires position, preferably firm where advancement and responsibility is given. Competent chief draftsman with machine shop experience, well educated. Box 810, Canadian Machinery, Toronto. (C.18M.)

SALESMAN, 6 YEARS' MACHINE TOOL EXperience 10 years' general engineering with A1 practical and theoretical knowledge of mechanics, open to represent manufacturer in Toronto and district. Box 805L, Canadian Machinery.

REGO WELDING *and* CUTTING APPARATUS

Oxygen, Acetylene, and a complete line of Welding and Cutting Supplies.

Carter Welding Co. of Toronto, Limited
7-11 Sheppard St., Toronto, Ont.
Phones: Adelaide 2841 and 1524
(TF)

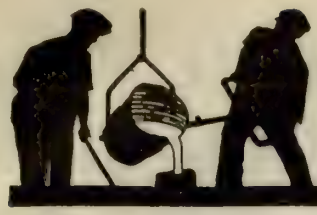
NOW!

YOU'VE been going to send in that ad for weeks, so why not mail it now for next week's issue?

CANADIAN MACHINERY & MANUFACTURING NEWS

Classified Advertising Section

143-153 University Ave. **Toronto, Ontario**



Where To Buy Your CASTINGS



The Brown-Boggs Co., Limited
HAMILTON, ONT.
Grey Iron.

John T. Hepburn, Limited
TORONTO, ONT.
Grey Iron.

Sully Brass Foundry, Limited
618 Brock Ave., TORONTO, ONT.
Brass, Bronze, Copper and Aluminum.

Canadian Rumley Co., Limited
Queen West and Abell Streets,
TORONTO, ONT.
Grey Iron.

Galt Malleable Iron Co., Ltd.
GALT, ONT.
Malleable.

S. Vessot & Company
JOLIETTE, QUE.,
Grey Iron, Brass and Aluminum.

Miller Bros. & Sons, Limited,
120 Dalhousie St., MONTREAL.
Grey Iron, Semi-Steel Castings up to 10 tons.

Can. Mead-Morrison Co., Ltd.,
MONTREAL, P.Q. WELLAND, ONT.
Grey Iron Machinery Castings.

Hugh Park Foundry Co., Ltd.,
OSHAWA, ONT.
Grey Iron, Patterns, Etc.

Hull Iron & Steel Foundries Ltd.
HULL, CANADA.
Steel, Manganese, Chrome.

Aurora Foundries, Limited,
AURORA, ONT.
Grey Iron.

Can. Hanson & VanWinkle Co.
LIMITED
TORONTO, ONT.
Monel, Aluminum, Brass, Bronze, Grey Iron.

Tallman Brass & Metal, Ltd.
HAMILTON, CANADA
Brass, Bronze, Manganese Bronze, Aluminum.

Dom. Foundries & Steel, Ltd.
HAMILTON, CANADA.
Steel Castings all sizes.

Manitoba Steel Foundries, Ltd.
Office Winnipeg. Works Selkirk, Man.
Steel Castings up to 5,000 lbs.

Brantford Brass Foundry Co.
BRANTFORD, ONT.
Aluminum, Brass, Bronze, Specialty.

The Katie Foundry
GALT, ONT.
Grey Iron, Semi-Steel, Brass, Aluminum.

William Kennedy & Sons, Ltd.
OWEN SOUND, ONT.
Steel, Malleable and Heavy Grey Iron.
See Advertisement Page 8

Machinery & Foundries, Ltd.
BROCKVILLE, ONT.
Light and Medium Grey Iron.

A. F. McCulloch
OSHAWA, ONT.
Brass, Alum. Castings—Wood, Metal Patterns.

Corbet Foundry & Machine Co. Ltd.
OWEN SOUND, ONT.
Grey Iron, Brass.

Fittings Limited,
OSHAWA, ONT.
Malleable, Grey Iron, Brass, Aluminum.

W. W. Wells
370 Victoria Street, TORONTO, ONT.
Nickel and Monel Metal.

The Robert Mitchell Co., Ltd.
64 Belair Ave., MONTREAL.
Light Grey Iron.

Canadian Steel Foundries, Ltd.
MONTREAL, QUE.
Steel and Ferro-Alloy.

Langley & Austin,
GALT, ONT.
Copper, Bronze, Brass and Aluminum.

Maxwells, Limited
ST. MARYS, ONT.
Light Grey Iron, Tinning same a specialty.

The Eureka Planter Co., Ltd.,
WOODSTOCK, ONT.
Specialty Light Grey Iron.

Lindsay Foundry and Pattern Works, Limited
Victoria Avenue, LINDSAY, ONT.
Grey Iron.

Dominion Engineering Works, Limited
MONTREAL, QUE.
Grey Iron.

Smith's Falls Malleable Castings, Limited
SMITH'S FALLS, ONT.
Malleable.

Joliette Steel Co.
JOLIETTE, QUE.
Electric Steel and Ferro-Alloy.

International Malleable Iron Company, Limited
GUELPH, ONT.
Malleable.

After the Contract

Service-after-the-order follows the signature on every order accepted by the Hanna organization—in fact, is pledged by the act of acceptance. It is upon this fact more than any other that the growth and success of M. A. Hanna & Co. have been built.

HANNA

HANNA

M.A.HANNA&CO.

Chicago Toronto Cincinnati
Pittsburgh Buffalo Detroit
Philadelphia New York Toledo
Williamsport, Pa.

Canadian Machinery BUYERS DIRECTORY

If what you want is not here, write us, and we will tell you where to get it. Let us suggest that you consult also the advertisers' index— last page of book, after having secured advertisers' names from this directory. The information you desire may be found in the advertising pages. This department is maintained for the benefit and convenience of our readers. The insertion of our advertisers' names undr proper headings is gladly undertaken, but does not become part of an advertising contract.

ABRASIVE DISCS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ABRASIVE MATERIALS
J. R. Baxter & Co., Ltd., Montreal, Que.
Norton Co. of Can., Ltd., Hamilton, Ont.
Oakey & Sons, Ltd., John, London, S.E., Eng.

ACETYLENE, DISSOLVED
Carter Welding Co. Ltd., Toronto.
Dominion Oxygen Co., Toronto.
Liquide Air Company, Toronto.

ANCHOR BELTS
Steel Co. of Can. Ltd., Hamilton, Ont

ANGLE BARS
Steel Co. of Can. Ltd., Hamilton, Ont.

ANVILS
Atkins & Co., Inc., E.C., Indianapolis, I.
Petrie, Ltd., H. W., Toronto, Ont.

ANCHOR BOLTS
Steel Co. of Can., Ltd., Hamilton, Ont.

ANGULAR HOLE DRILLING TOOL
Globe Engineering Co., Ltd., Hamilton, Ont.

ARBORS
Atkins & Co., Inc., E. C., Indianapolis,
Brown & Sharrpe Mfg.Co., Providence,R.I
Jacobs Mfg. Co., Hartford, Con.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.

BELLS, BRASS, BRONZE and STEEL
Canada Foundries & Forgings Co., Welland, Ont.
Canadian SKF Co., Toronto, Ont.

BARRELS, TUMBLING
McDougall Co., Ltd., R., Galt, Ont.

BARS, BORING
Armstrong Bros. Tool Co., Chicago, Ill.
Bertram & Son Co., td., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BARS, BORING, PORTABLE
Underwood Corp., H. B., Philadelphia.

BARS, STEEL
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
British Empire Steel Corporation, Montreal, Que.

BEARINGS, BALL
Canadian SKF Co., Toronto, Ont.

BEARINGS, DIE-CAST
Fisher Motor Co., Ltd., Orillia, Ont.

BEARINGS, JOURNAL
Fisher Motor Co., Ltd., Orillia, Ont.

BEARINGS, ROLLER
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BELT CEMENT
McLaren Belting Co., J. C., Montreal, Que.

BELT DRESSINGS AND FILLERS
Dom. Belting Co., Ltd., Hamilton, Ont.

BELT FASTENERS
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J.C., Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.

BELT HOOKS
Bristol Co., Waterbury, Conn.

BELT LACING
Bristol Company, Waterbury, Conn.
McLaren Belting Co., J. C., Montreal,

BELT LACING, STEEL
Bristol Company, Waterbury, Conn.

BELT LACING MACHINES
McLaren Belting Co., J. C., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

BELTING, CHAIN
Can. Link-Belt Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.

BELTING, FABRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dom. Belting Co., Ltd., Hamilton, Ont
McLaren Belting Co., J. C., Montreal, Que.

BELTING, LEATHER
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Ltd., Montreal, Q.
McLaren Belting Co., J. C., Montreal, Que.
Smith Belting Co., Toronto, Ont.

BOLTS AND NUTS
British Empire Steel Corporation, Montreal, Que.
Fittings, Limited, Oshawa, Ont.
National Acme Co., Montreal, Que
Petrie, Ltd., H. W., Toronto, Ont

BOLT THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro Pa.

BOLTS, TRACK
Steel Co. of Canada, Ltd., Hamilton Ont.

BORING and TURNING MILLS, Vertical
Bertram & Sons Co., Ltd., The John Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

BORING, DRILLING and MILLING MACHINES, Horizontal.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
Landis Tool Co., Waynesboro, Pa.
Vertical
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont
Rockford Drilling Machine Co., Rockford,

BORING TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.

CASTINGS, ALUMINUM, BRASS, BRONZE, COPPER, DIE-MOLDED, FERRO-ALLOY, IRON, SEMI-STEEL, STEEL.
See "Where to buy your castings" Section. Page number may be found by turning to Advertisers' Index.

CHAINS, DRIVING
Can. Link-Belt Co., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont
Jones & Glassco, Montreal, Que.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHASERS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, a.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKING MACHINES
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

CHUCKS, DRILL AND TAP
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canadian SKF Co., Toronto, Ont.
Cushman Chuck Co., Hartford, Conn.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Skinner Chuck Co., New Britain, Conn.
Union Mfg., New Britain, Conn.

CHUCKS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cushman Chuck Co., Hartford, Conn.
Geometric Tool Co., New Haven, Conn.
Gisholt Machine Co., Madison, Wis.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, MAGNETIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CHUCKS, PLANER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

CHUCKS, TAPPING
William L. Procunier, Chicago, Ill.

CHUCKS, VERTICAL BORING MILL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.
Skinner Chuck Co., New Britain, Conn
Union Mfg. Co., New Britain, Conn.

CLAMPS, MACHINISTS'
Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

CLEANERS, METAL, WASTE, GENERAL
Oakley Chemical Co., New York, N. Y.

CLOCKS
Chicago Watchman's Clock Co., Chicago.
Hardinge Bros., Limited, Toronto, Ont.

CLOCKS, TIME
Gisholt Machine Co., Madison, Wis.

CLOCKS, WATCHMEN'S
Chicago Watchman's Clock Co., Chicago, Ill.
Hardinge Bros., Limited, Toronto, Ont.

For list of Dealers see the last page of This Buyers Directory

BELTS, ABRASIVE
Oakey & Sons, Ltd., John, London, S.E., Eng.

BENDING MACHINES, POWER
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Bertrams Ltd., Edinburgh, Scotland.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

BILLETS, BLOOMS and SLABS
Steel Co., of Can. Ltd., Hamilton, Ont.

BLOCKS
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, CHAIN (See Hoists, Hand)
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio.

BLOCKS, DIE
Canada Foundries & Forgings Co., Welland, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

BLOCKS, PILLOW
Can. Link-Belt Co., Toronto, Ont.

BLOWERS
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

BOILERS, LOCOMOTIVE
Goldie & McCulloch Co., Ltd., Galt,

BOLT AND NUT MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Montreal, Que.

BOLT AND NUT MACHINERY, Automatic
National Acme Co., Cleveland, Ohio.

BUCKET CARRIERS, Pivoted
Can. Link-Belt Co., Toronto, Ont.

BUFFERS
Pryibil Machine Co., New York, N.Y.

BUFFING OR POLISHING MACHINES
(See Polishing and Buffing Machines)
Blount Co., J. G., Everett, Mass.
Petrie, Ltd., H. W., Toronto, Ont.
Pryibil Machine Co., New York, N.Y.
U. S. Electrical Tool Co., Cincinnati, O.

BUILDING MATERIALS
Bertram & Son Co., Ltd., The John Dundas, Ont.

BURNERS, OIL AND GAS
Rockwell Co., W.S., New York City.

BURRS
Steel Co. of Can. Ltd., Hamilton, Ont.

BUSHINGS
Fisher Motor Co., Ltd., Orillia, Ont.

CABINETS, OIL
S. F. Bowser & Co., Ltd., Toronto, Ont

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

CAMS
Canada Foundries & Forgings Co., Welland, Ont.

CAN-MAKING MACHINERY
(See Sheet Metal Working Machinery)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Bliss Co., E. W., Brooklyn, N. Y.
Smooth Mfg. Co., Jersey City, N. J.

CEMENTS, IRON
CENTERING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.

CHAINS (See Sprockets and Chains)
Reynold (Hans) of Canada, Ltd., Montreal, Que.
Wright Mfg. Co., Lisbon, Ohio.

CHUCKS, DRILL
Jacobs Mfg. Co., Hartford, Conn.

BUYERS' DIRECTORY

CLUTCHES, FRICTION
Can.-Link-Belt Co., Toronto, Ont.
Johnson Machine Co., Carlyle, Manchester, Conn.

COAL AND ASH HANDLING MACHINERY
Can.-Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

COAL-STORAGE SYSTEMS
Can. Link-Belt Co., Toronto, Ont.

COLLARS, SHAFT OR SET
Canada Foundries & Forgings Co., Welland, Ont.
Can. Link-Belt Co., Toronto, Ont.

COLLETS
Butterfield & Co., Inc., Rock Island, Que.
Hardinge Bros., Inc., Chicago, Ill.
Hendley Machine Co., Torrington Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COMPOUNDS, CLEANING
Oakley Chemical Co., New York, N.Y.

COMPOUNDS—CUTTING, DRILLING, GRINDING, SCREW CUTTING
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Oakley Chemical Co., New York, N.Y.

COMPRESSORS, AIR AND GAS
Can. Fairbanks-Morse Co., Ltd., Montreal.
Petrie, Ltd., H. W., Toronto, Ont.

CONES, FRICTION
Norton Co., of Can. Ltd., Hamilton, Ont.

CONNECTING RODS AND STRAPS
Canada Foundries & Forgings Co., Welland, Ont.

CONTRACT WORK
Victoria Foundry Co., Ltd., Ottawa, Ont.

CONVEYORS AND ELEVATORS (SEE ELEVATORS)
Jones & Glassco, Montreal, Que.

COTTERS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUNTERBORES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

COUNTERS, REVOLUTION
Starrett Co., L. S., Athol, Mass.

COUNTERSHAFTS
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Canada Foundries & Forgings Co., Welland, Ont.
Johnson Machine Co., Carlyle, Man-
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

COUNTERSINKS
Butterfield & Co., Inc., Rock Island, Que.
Pratt &Whitney Co., of Canada, Ltd., Dundas, Ont.

COUPLERS, CAR AND LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

COUPLINGS
Steel Co. of Canada, Ltd., Hamilton, Ont.

COUPLINGS, PIPE
Fittings, Limited, Oshawa, Ont.

COUPLINGS, SHAFT
Can. Link-Belt Co., Toronto, Ont.

CRANES, ELECTRIC
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can.-Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls Ont.
Northern Crane Works, Walkerville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.

Bertram & Son Co., td., The John, Dundas, Ont.
Can. Link-Belt Co., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

CRANK PIN TURNING MACHINE
Underwood Corp., H.B., Philadelphia, Pa.

CUTTERS, GEAR
Brown & Sharpe Mfg. Co., Providence R. I.
Butterfield & Co., Inc., Rock Island, Q. Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, HIGH SPEED
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

CUTTERS, MILLING
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Greenfield Tap & Die Corp., Galt, Ont.
Kearney & Trecker Co., Milwaukee, Wis.
Morse Twist Drill & Machine Co., New Bedford, Mass.

CUTTERS, STAY BOLT
Acme Machinery Co., Cleveland, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.

CUTTING-OFF MACHINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg Co., Providence, Rhode Island
Petrie, Ltd., H. W., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.

CUTTING OFF MACHINES, PIPE (SEE PIPE-CUTTING AND THREADING MACHINES)
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.

CUTTING-OFF TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.

CUTTING OIL FILTERS (SEE OIL FILTERING SYSTEMS
Bowser, S. F. & Co., Ltd., Toronto.

CUTTING, OXY-HYDROGEN
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Ltd., Toronto, Ont.

DEALERS, MACHINERY (SEE SEARCHLIGHT SECTION)
Petrie, Ltd., H. W., Toronto, Ont.

DETACHABLE CHAIN
International Malleable Iron Co., Guelph, Ont.

DIAMONDS, BLACK AND ROUGH
Can. Desmond-Stephan Mfg Co., Hamilton, Ont.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND TOOLS
Can. Desmond-Stephan Co., Hamilton.
Wheel Trueing Tool Co., Windsor, Ont.

DIAMOND CROSSINGS
Can. Steel Foundries, Montreal, Que.

DIAMONDS, IMPORTERS
Can. Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DIES, SCREW AND THREAD CUTTING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.

DIES, SHEET-METAL AND SUB-PRESS (See Tool Work)
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Fisher Motor Co., Ltd., Orillia, Ont.

DIES, FORGING
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

DIES, SELF-OPENING, ADJUSTABLE
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Landis Machine Co., Inc., Waynesboro,
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIES, THREADING-OPENING
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DIVIDING HEADS
Burke Machine Tool Co., Conneaut, Ohio
Hendley Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis.
Petrie, Ltd., H. W. Toronto, Ont.

DOGS, LATHE AND MILLING MACHINE
Armstrong Bros. Tool Co., Chicago, Ill.

DRAFTING MATERIALS
American Lead Pencil Co., New York City, N.Y.

DRESSERS, GRINDING WHEEL
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Norton Co., of Can., Ltd., Hamilton.
Wheel Trueing Co., Windsor, Ont.

DRESSING TOOLS
Canadian Desmond-Stephan Mfg. Co., Hamilton, Ont.
Wheel Trueing Co., Windsor, Ont.

DRILL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill

DRILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut, Ohio.
Can Blower & Forge Co., Ltd., Kitchner, Ont.
Can Fairbanks-Morse Co., Ltd., Montreal, Que.
Hardinge Bros., Inc., Chicago, Ill.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, ELECTRIC AND HAND
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, GANG
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Garlock Machinery, Ltd., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

DRILLING MACHINES, HEAVY DUTY
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Rockford Drilling Machine Co., Rockford, Ill.

BORING, DRILLING AND MILLING MACHINES, (HORIZONTAL.)
Gisholt Machine Co., Madison, Wis.

DRILLING MACHINES, Multiple Spindle
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
National Acme Co., Cleveland, Ohio.

DRILLING MACHINES, Pneumatic
Cleveland Pneumatic Tool Co., Toronto Ont.

DRILLING MACHINES, PORTABLE
Jardine & Co., A. B., Hespeler, Ont.
Wisconsin Electric Co., Racine, Wis.

DRILLING MACHINES, RADIAL
Bertram & Son Co., Ltd., The John Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, SENSITIVE
Burke Machine Tool Co., Conneaut, O.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Williams Machinery Co., A. R., Toronto.
Wisconsin Electric Co., Racine Wis

DRILLING MACHINES, TURRET
Gisholt Machine Co., Madison, Wis.
Steinle Turret Machine Co., Madison, Wisconsin
Williams Machinery Co., A. R., Toronto.

DRILLING MACHINES, VERTICAL
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

DRILLS, CENTRE
Butterfield & Co., Inc., Rock Island, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, HIGH SPEED TWIST
Butterfield & Co., Inc., Rock Island, Que.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Galt, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

DRILLS, RATCHET
Armstrong Bros Tool Co., Chicago, Ill.
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont
Morse Twist Drill & Machine Co., New Bedford, Mass.

DRILLS, TWIST AND FLAT
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Galt, Ont

DROP FORGINGS
Steel Co of Canada, Ltd, Hamilton

DUST HANDLING EQUIPMENT
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

ELECTRICAL INSTRUMENTS
Bristol Co., Waterbury, Conn.

ELECTRICAL SUPPLIES
Atkins & Co., Inc., E. C., Indianapolis.
Diamond State Fibre Co., Toronto, Ont.
U S Electrical Tool Co., Cincinnati, O.

ELEVATING TRUCKS (See Trucks)
Morris Crane & Hoist Co., Ltd, Niagara Falls, Ont.

ELEVATORS AND CONVEYORS
Can. Link-Belt C., Toronto, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.

EQUIPMENT, ELEVATOR SAFETY
Jones & Glassco, Montreal, Que.

EMERY WHEELS (See Grinding Wheels)
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., E. C., Indianapolis, I.
Norton Co., of Canada., Ltd., Hamilton.

ENGINES, CAPSTAN
Kennedy & Sons, Wm., Owen Sound, Ont.

ENGINEERS, MECHANICAL
Dominion Engineering Works, Limited, Montreal, Que.
Gisholt Machine Co., Madison, Wis.
Hamilton Gear & Machine Co., Toronto.

EXPANDERS, TUBE
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FANS, ELECTRIC
Can. Blower & Forge Co., Ltd., Kitchner, Ont.
Can. Fairbank.-Morse Co., Ltd., Montreal, Que.

FANS, EXHAUST
Can Blower & Forge Co., Ltd., Kitchner, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Sturtevant Co., B. F., Boston, Mass.

FANS, VENTILATING
Can. Blower & Forge Co., Ltd., Kitchener, Ont
Petrie, Ltd., H. W., Toronto, Ont.

FIBRE
Diamond State Fibre Co., of Can. Ltd., Toronto, Ont.

FILES AND RASPS
Nicholson File Co., Port Hope, Ont.
Simmons Canada Saw Co., Montreal, Que.

FILLER, IRON (See Cements, Iron)
Smooth Mfg. Co., Jersey City, N.J

FIRE ESCAPES
Roelofson Elevator Co., Galt, Ont.

FITTINGS, PIPE
International Malleable Iron Co., Guelph.
Fittings, Limited, Oshawa, Ont.

FLEXIBLE SHAFTS
Strand & Co., N. A., Chicago, Ill

FLUXES, WELDING
Carter Welding Co., Ltd., Toronto, Ont
Dominion Oxygen Co., Ltd, Toronto
Liquide Air Company, Toronto, Ont.

FORGING MACHINERY
Acme Machinery Co., Cleveland, Ohio
Bertram & Son Co., Ltd., The John, Dundas, Ont
Brown Boggs & Co., Ltd., Montreal.
National Machinery Co., Tiffin, Ohio.
Steel Co. of Canada, Ltd., Hamilton.

BUYERS' DIRECTORY

FORGINGS, DROP
Canada Foundries & Forgings Co., Welland, Ont.
Dominion Forge & Stamping Co., Ltd., Toronto, Ont.

FORGINGS, HAMMER
[illegible] Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Hepburn Ltd., John T., Toronto, Ont.

FOUNDRY EQUIPMENT
McDougall Co., Ltd., R., Galt, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

FOUNDRY SUPPLIES
Rice Lewis & Son, Ltd., Toronto, Ont.

FROGS, SPRING OR RIGID
Can. Steel Foundries, Montreal, Que.

FURNACES, ELECTRIC
Rockwell Co., W. S. New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES, HEAT TREATING COAL
Rockwell Co., W. S., New York City.

FURNACES, HEAT TREATING OIL AND GAS
Bellevue Industrial Furnace Co., Detroit, Michigan.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Rockwell Co., W. R., New York City.

FURNACES TEMPERING AND ANNEALING
Bellevue Industrial Furnace Co., Detriot, Mich.
Brown & Sharpe Mfg., Co., Providence R. I.
Rockwell Co., W. S., New York City.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

FURNACES AND OVENS, ELECTRIC
Petrie, Ltd., H. W., Toronto, Ont.
Rockwell & Co., W. S., New York city.
Starrett Co., L. S., Athol, Mass.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

GAGES, MEASURING (See Tool Work)
Brown & Sharpe Mfg. Co., Providence, R. I.
Greenfield Tap & Die Corp., Galt, Ont.
Lufkin Rule Co., Windsor, Ont.
Starrett Co., L. S., Athol, Mass.

GAGES, RECORDING
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, SPECIAL MEASURING (See Tool Work)
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GAGES, THREAD
Brown & Sharpe Mfg. Co., Providence R. I.
Starrett Co., L. S., Athol, Mass.

GALVANIZING
Fittings, Limited, Oshawa, Ont.

GAS, COAL COMPRESSED
L'Air Liquid Society, Toronto, Ont.

GAS, COMPRESSED
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GASKETS
Diamond State Fibre Co. of Ca., Ltd., Toronto, Ont.
Smooth Mfg. Co., Jersey City, N. J.

GAUGES VACUUM AND PRESSURE
Taylor Instrument Co., Toronto, Ont.

GEAR BLANKS
Canada Foundries & Forgings Co., Welland, Ont.
Can. Steel Foundries, Montreal, Que.
Diamond State Fibre Co. of Can., Ltd., Toronto, Ont.
Hamilton Gear & Machine Co., Toronto, Ontario.
Dominion Engineering Works, Limited, Montreal, Que.

GEAR COUNTERS
Hart Mfg. Co., R. A., Battle Creek, Michigan.

GEAR-CUTTING MACHINES
Bertram & Sons Co., Ltd., The John, Dundas, Ont.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Fellows Gear Shaper Co., Springfield, Vt.
Petrie, Ltd., H. W., Toronto, Ont.
Whiton Machine Co., D. E., New London, Conn.

GEAR TESTING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.

GEARS, CAST
Can. Link-Belt Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.
Hull Iron & Steel Foundries, Hull, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, CUT
Brown & Sharpe Mfg. Co., Providence, R. I.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Gardner & Son, Robt., Montreal, Que.
Hamilton Gear & Machine Co., Toronto, Ont.
Hepburn Ltd., John T. Toronto, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Jones & Glassco, Montreal, Que.
McDougall Co., Ltd., R., Galt, Ont.
Renold (Hans) of Canada, Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

GEARS, DRESSED
Kennedy & Sons, Wm., Owen Sound, Ontario.

GEARS, FORGED
Canada Foundries & Forgings Co., Welland, Ont.

GEARS, HERRINGBONE
Hamilton Gear & Machine Co., Toronto, Ont.

GEARS, RAWHIDE (See Gears, Cut)
Hamilton Gear & Machine Co., Toronto.

GEAR, SILENT CHAIN
Gardner & Son, Robt., Montreal, Que.
Can. Link-Belt Co., Ltd., Toronto, Can.
Hans Renold of Canada, Ltd., Montreal, Quebec.

GEARS, WORM
Dom. Steel Products Co., Brantford, Ont.
Hamilton Gear & Machine Co., Toronto.

GENERATORS, ACETYLENE
L'Air Liquide Society, Toronto, Ont.

GLOVES, PROTECTIVE
Industrial Glove Co., Toronto, Ont.

GOGGLES, SAFETY
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.

GRAB BUCKETS
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Cleveland Twist Drill Co., Cleveland, O.

GREASE CUPS, PRESSED STEEL AND BRASS
Can. Winkley Co., Ltd., Windsor, Ont.

GREASES, LUBRICATING
Canadian SKF Co., Toronto, Ont.

GRINDING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Ford-Smith Co., Hamilton, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, ABRASIVE BELT
Norton Co. of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, AUTOMATIC
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, BENCH
Blount Co., J. G., Everett, Mass.
Geometric Tool Co., New Haven, Conn.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
McDougall Co., Ltd., R., Galt, Ont.
Norton Co. of Canada, Ltd., Hamilton, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CENTER
U.S. Electrical Tool Co., Cincinnati, O.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, CUTTER AND REAMER
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, CYLINDRICAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.
Norton Co., of Canada, Ltd., Hamilton.

GRINDING MACHINES, DIE
National Acme Co., Cleveland, O.
National Machinery Co., Tiffin, Ohio.

GRINDING MACHINES, DRILL
Bellevue Industrial Furnace Co., Detroit, Mich.
Bertram & Son Co., Ltd., The John, Dundas, Ont.

GRINDING MACHINES, ELECTRIC
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, FLOOR AND TOOL
Blount Co., J. G., Everett, Mass.
National Acme Co., Cleveland, Ohio.
Norton Co. of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.

GRINDING MACHINES, INTERNAL
Garlock Machinery Ltd., Toronto, Ont.
Greenfield Tap & Die Corp., Galt, Ont.
Cleveland Pneumatic Tool Co., Toronto, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES PORTABLE
Strand & Co., N. A., Chicago, Ill.

GRINDING MACHINES, SNAGGING
Blount Co., J. G., Everett, Mass.
Norton Co., of Can. Ltd., Hamilton, Ont.

GRINDING MACHINES, SURFACE
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

GRINDING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd.,

GRINDING MACHINERY, TOOL POST
Gisholt Machine Co., Madison, Wis.
Grenfield Tap & Die Corp., Galt, Ont.
Wisconsin Electric Co., Racine, Wis.

GRINDING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Gisholt Machine Co., Madison, Wis.
Greenfield Tap & Die Corp., Galt, Ont.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Norton Co., of Canada, Ltd., Hamilton, Ontario.
Petrie, Ltd., H. W., Toronto, Ont.

GRINDING WHEELS
J. R. Baxter & Co., Ltd., Montreal, Que.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Norton Co. of Can., Ltd., Hamilton, Ont.

GUN-BARREL MACHINERY
Steinle Turret Machine Co., Madison, Wisconsin.

HACK SAWS, POWER
Atkins & Co., Inc., E.C., Indianapolis, Indiana.
Petrie, Ltd., H. W., Toronto, Ont.
Simonds Canada Saw Co., Montreal, Que.
Starrett Co., L. S., Athol, Mass.

HAMMERS, CHIPPING
Cleveland Pneumatic Tool Co., Toronto, Ont.
High Speed Hammer Co., Rochester.

HAMMERS, DROP
Bertram & Son Co., Ltd., The John Dundas, Ont.
Bliss Co., E. W., Brooklyn, N.Y.
Brown Boggs & Co., Ltd., Hamilton, Ont.
Canada Foundries & Forgings Co., Welland, Ont.

HAMMERS, ELECTRIC
Brown, Boggs & Co., Ltd., Hamilton, Ont.

HAMMERS, PNEUMATIC
Can. Steel Foundries, Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto Ont.

HANGERS, SHAFTING
Canadian SKF Co., Toronto, Ont.
Brown & Sharpe Mfg. Co., Providence, R.I.
Hamilton Gear & Machine Co., Toronto.

HOBBING MACHINES
Shore Instrument Co., Jamaica, N.Y.

HARDENING, CASE-HARDENING AND TEMPERING
Barnes Company, Wallace, Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.
Gisholt Machine Co., Madison, Wis.
Cleveland Pneumatic Tool Co., Toronto Ont.

HAMMERS, POWER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

HOBS
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, ELECTRIC
Can. Link-Belt Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOISTS, HAND
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Wright Mfg. Co., Lisbon, Ohio

HOISTS, PNEUMATIC
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.

HOLDERS-ON, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto Ont.

HYDRAULIC MACHINERY
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Dominion Engineering Works, Limited, Montreal, Que.

IGNITERS, GAS ENGINE
Canada Foundries & Forgings Co., Welland, Ont.
Burke Machine Tool Co., Conneaut, O.

INDICATORS, SPEED AND TEST
Brown & Sharpe Mfg. Co., Providence, R.I.

INSULATION
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

IRON BARS
Steel Co. of Canada, Ltd., Hamilton, Ont.

JACKS, HYDRAULIC
Norton, A. O., Boston, Mass.

JACKS, PLANER
Armstrong Bros. Tool Co., Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

JAPANNING AND VARNISHING OVENS
Prantford Oven & Rack Co., Brantford, Ont.

JIGS AND FIXTURES (SEE TOOL WORK)
Fisher Motor Co., Ltd., Orillia, Ont.
Gisholt Machine Co., Madison, Wis.
Preston & Schwartz, Galt, Ont.

KEYSEATING MACHINES
Morton Mfg. Co., Muskegon, Mich.

BUYERS' DIRECTORY

Petrie, Ltd., H. W., Toronto, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

KEYS, MACHINE
Can. Dranw Steel Co., Hamilton, Ont.
Morton Mfg. Co., Muskegon, Mich

KNIVES, MACHINE
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Que.

KNURL HOLDERS
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHE ATTACHMENTS
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Petrie, Ltd., H. W., Toronto, Ont.

LATHE TOOLS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Hendey Machine Co., Torrington, Conn.

LATHES, AUTOMATIC AND SEMI-AUTOMATIC
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, BENCH
Hardinge Bros., Inc., Chicago, Ill.
Perfect Machine Co., Ltd., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

LATHES, BORING
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, CHUCKING (SEE LATHES, HORIZONTAL TURRET, AND LATHES, VERTICAL TURRET)
Acme Machine Tool Co., Cincinnati, O.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gisholt Machine Co., Madison, Wis.
McDougall Co., Ltd., R., Galt, Ont.
Steinle Turret Machine Co., Madison, Wisconsin.

LATHES, ENGINE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd, H. W., Toronto, Ont
Rockford Lathe & Drill Co., Rockford, Illinois.

LATHES, EXTENSION AND GAP
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison Wis.
McDougall Co., Ltd., R., Galt, Ont.
National Acme Co., Cleveland, O.
Petrie, Ltd., H. W., Toronto, Ont.
Steinle Turret Machine Co., Madison, Wis.

LATHES, PRECISION
Hardinge Bros., Chicago.

LATHES, RELIEVING
Hendey Machine Co., Torrington, Conn.
McDougall Co., Ltd., R., Galt, Ont.

LATHE, UNIVERSAL HAND
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

LATHE, SPEED AND HAND
Blount Co., J. G., Everett, Mass.

LATHES, SPINNING
Pryibil Machine Co., Torrington, Conn.

LATHES, VERTICAL TURRET
Bertram & Son, Co., Ltd., The John, Dundas, Ont.
Gisholt Machine Co., Madison, Wis.

LATHES, WOOD TURNING
Blount, Co., J. G., Everett, Mass.
Perfect Machine Co., Ltd., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.

LEAD PIPE
Canada Metal Co., Ltd., Toronto, Ont.
Steel Co. of Canada, Ltd., Hamilton, Ont.

LIGHTING AND GENERATING SETS
Beardmore & Co., Ltd., Wm., Montreal, Que.

LINOLEUM MILL MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.

LIQUID AIR PLANTS
L'Air Liquide Society, Toronto, Ont.

LOCKERS, CLOTHES
Dennis Wire and Iron Works, London, Ont.

LUBRICANTS
Oakley Chemical Co., New York, N.Y.

LUBRICATING SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto, Canada.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Canada Foundries & Forgings Co., Ltd., Welland, Ont.
Ker & Goodwin Machine Co., Brantford, Ont.
Petrie Ltd., H. W., Toronto, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont
Williams Machinery Co., A. R. Toronto Ont.

MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

MANDRELS, EXPANDING
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MANDRELS, SOLID
Greenfield Tap & Die Corp., Galt, Ont.
Atkins & Co., Inc., E. C., Indianapolis, Indiana.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MEASURING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MECHANICS' FINE TOOLS
Lufkin Rule Co., Windsor, Ont.

METALS, ALLOY
Canada Metal Co., Toronto, Ont.
Can. Steel Foundries, Montreal, Que.
Fisher Motor Co., Ltd., Orillia, Ont.

METAL WORKERS
Parker Co., Charles, Meriden, Conn.

MICROMETER CALIPERS
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Rice Lewis & Son, Ltd., Toronto, Ont.

MILLING ATTACHMENTS
Purke Machine Tool Co., Conneaut, O.
Hendey Machine Co., Torrington, Conn.
Hinckley Machine Works, Hinckley, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES
Brown & Sharpe Mfg. Co., Providence, R. I.
Burke Machine Tool Co., Conneaut, O

MILLING MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, R. I.
Hardinge Bros., Inc., Chicago, Ill.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.

MILLING MACHINES, BENCH
Burke Machine Tool Co., Conneaut. O.
Hardinge Bros., Inc., Chicago, Ill.

MILLING MACHINES, HAND
Brown & Sharpe Mfg. Co., Providence
Burke Machine Tool Co., Conneaut, Ohio
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, HORIZONTAL PLANER TYPE.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Kearney & Trecker Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MILLING MACHINES, PLAIN
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O
Hendey Machine Co., Torrington, Conn
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, THREAD
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

MILLING MACHINES, UNIVERSAL
Brown & Sharpe Mfg. Co., Providence,
Hendey Machine Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Petrie, Ltd., H. W., Toronto, Ont.

MILLING MACHINES, VERTICAL
Brown & Sharpe Mfg. Co., Providence,
Burke Machine Tool Co., Conneaut, O.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
Williams Machinery Co., A. R., Toronto.

MOTORS, ELECTRIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.
Roelofson Elevator Co., Galt, Ont.
Williams Machinery Co., A. R., Toronto
Wisconsin Electric Co., Racine Wis.

NAILS AND STAPLES
Canada Metal Co., Ltd., Toronto, Ont.

NIPPLES
Canada Metal Co., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

NITROGEN
Carter Welding Co. Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

NUT TAPPERS
(See Bolt and Nut Machinery)
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
National Acme Co., Cleveland, Ohio.

NUTS, FINISHED and SEMI-FINISHED
Galt Macine Screw Co., Galt, Ont.
National Acme Co., Montreal, ue.

NUTS (Up to 4-in.)
Steel Co. of Canada, Ltd., Hamilton.

NUTS, S.A.E., PLAIN AND CASTELLATED
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

OIL FILTERING AND STORAGE SYSTEMS
Bowser, S. F., & Co., Ltd., Toronto,

OIL STORAGE ENGINEERS
Bowser, S. F., & Co., Ltd., Toronto,

OIL HOLE COVERS
Can. Whitney Co., Ltd., Windsor, Ont.

OILS, SOLUABLE
Brantford Oven & Rack Co., Brantford, Ontario.

OXYGEN
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,

OXY-ACETYLENE APPARATUS
Carter Welding Co., Ltd., Toronto.
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto.
National Electro Products Co., Ltd.,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Atlas Press Co., Kalamazoo, Mich.

PAPER MILL CONVEYORS
Bertram Ltd., Edinburgh, Scotland.
Dominion Engineering Works, Ltd., Montreal, Que.

PATTERNS, WOOD AND METAL
Fittings, Limited, Oshawa, Ont.
Victoria Foundry Co., Ltd., Ottawa.

PHOSPHOR TIN
Canada Metal Co., Ltd., Toronto, Ont.

PHOTOGRAPHIC DUPLICATING MACHINES
Photostat Corp., Providence, R. I.

PIPE BENDING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Underwood Corp., H. R., Philadelphia, Pa.
Williams Machinery Co., A. R., Toronto.

PIPE CUTTING AND THREADING MACHINES
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Jardine & Co., A. B., Hespeler, Ont.
Landis Machine Co., Inc., Waynesboro, Pa.
McDougall Co., Ltd., R., Galt, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PIPE
Canada Metal Co., Toronto, Ont.
Steel Co. of Can., Ltd., Hamilton, Ont.

PIPE FITTINGS
Canada Metal Co., Toronto, Ont.
Fittings, Limited, Oshawa, Ont.
International Malleable Iron Co., Guelph Ont.

PIPE AND NIPPLE THREADING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE FITTERS' TOOLS
Rice Lewis & Son, Ltd., Toronto, Ont.

PIPE THREADING DIE HEADS
Landis Machine Co., Inc., Waynesboro, Pa.

PISTON-RING MACHINES
National Acme Co., Cleveland, Ohio
Steinle Turret Machine Co., Madison, Wis.

PLANING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont
Morton Mfg. Co., Muskegon, Mich.
Williams Machinery Co., A. R., Toronto

PLANING MACHINES, ROTARY
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATE ROLLS
Bertram & Son Co., Ltd., The John, Dundas, Ont.

PLATES, BOILER AND SHEET
Beardmore & Co., Ltd., Wm., Montreal, Que.

PNEUMATIC TOOLS
Beardmore & Co., Ltd., Wm. Montreal.

PNEUMATIC TOOLS
Cleveland Pneumatic Tool Co., Toronto.

POLISHING AND BUFFING MACHINES
J. R. Baxter & Co., Ltd., Montreal, Q.
Blount Co., J. G. Everett, Mass.
Brown & Sharpe Mfg. Co., Providence.
Pryibil Machine Co., New York, N.Y.

PRESSED STEEL PARTS
American Pulley Co., Philadelphia, Pa.
Fisher Motor Co., Ltd., Orillia, Ont.

PRESSES, ARBOR
Atlas Press Co., Kalamazoo, Mich.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Petrie, Ltd., H. W., Toronto, Ont.

PRESSES, DROP AND FORGING
Brown, Boggs & Co., Ltd., Hamilton.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

PRESSES, FOOT AND HAND
Brown, Boggs & Co., Ltd., Hamilton.

PRESSES, HYDRAULIC
Bertram & Son Co., Ltd., The John, Dunidas, Ont.
Cleveland Twist Drill Co., Cleveland, O.
Perrin Ltd., W. R., Toronto, Ont.
Williams Machinery Co., A. R., Toronto, Ont.

PRESSES, POWER
Bliss Co., E. W., Prooklyn, N. Y.
Brown, Boggs, & Co., Ltd., Hamilton
Hepburn Ltd., John T., Toronto, Ont.
Petrie, Ltd., H. W., Toronto, Ont.
Stoll Co., Inc., D. H., Buffalo, N.Y.

PRESSES, SCREW
Brown, Boggs & Co., Ltd., Hamilton.
Petrie, Ltd., H. W., Toronto, Ont.

PROFILING MACHINES
Prtt & Whitney Co., of Canada, Ltd., Dundas, Ont.

PROTRACTORS
Brown & Sharpe Mfg. Co., Providence
Lufkin Rule Co., Windsor, Ont.

PROPELLERS
Kennedy & Sons, Wm., Owen Sound Ontario.

PULLEYS, CORK INSERT
American Pulley Co., Philadelphia, Pa

PULLEYS, METAL AND FIBRE
American Pulley Co., Philadelphia, Pa.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Canadian SKF Co., Toronto, Ont.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Johnson Machine Co., Carlyle, Manchester, Conn.
Kennedy & Sons, Wm., Owen Sound Ont.

PULP AND PAPER MILL EQUIPMENT
Dominion Engineering Works, Ltd., Montreal, Que.

PUMPS, CENTRIFUGAL
Beardmore & Co., Ltd., Wm., Montreal

PUMPS, HYDRAULIC
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Ltd., Montreal, Que.
Hepburn Ltd., John T., Toronto, Ont.

BUYERS' DIRECTORY

PUMPS, LUBRICANT AND OIL
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Pratt & Whitney Co., Ltd., R., Galt, Ont.

PUMPS, POWER
Bowser, S. F., & Co., Ltd., Toronto.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal.
Hepburn Ltd., John T., Toronto, Ont.

PUNCHES, CENTER
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd. Dundas, Ont.
Starrett Co., L. S., Athol, Mass.

PUNCHES, HAND
Brown, Boggs & Co., Ltd., Hamilton.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Jardine & Co., A. B., Hespeler, Ont.

PUNCHES, POWER
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener, Ont.
Petrie, Ltd., H. W., Toronto, Ont.

PUNCHING MACHINES, HORIZONTAL
Bertrams Ltd., Edinburgh, Scotland.

PYROMETERS, ELECTRIC
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Hiram Walker & Sons Metal Products Co., Walkerville, Ont.

RACKS, CUT
Hamilton Gear & Machine Co., Toronto.

RACKS, STORAGE
(See Furniture, Machine Shop)
Brantford Oven & Rack Co., Brantford, Ontario.

REAMER HOLDERS
Simonds Canada Saw Co., Montreal, Q.

REAMERS, EXPANDING
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

REAMERS, SOLID
Butterfield & Co., Inc., Rock Island, Q.
Morse Twist Drill & Machine Co., New Bedford, Mass.

REAMERS, TAPER
Brown & Sharpe Mfg. Co., Providence, R. I.
Butterfield & Co., Inc., Rock Island, Q.
Cleveland Twist Drill Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
Pratt & Whitney Co., of Canad, Ltd., Dundas, Ont.

RECORDERS, TEMPERATURE
Taylor Instrument Co., Rochester, N. Y.

RECORDERS, TIME
Gisholt Machine Co., Rochester, N. Y.
Taylor Instrument Co., Toronto, Ont.

REGULATORS, TEMPERATURE
Taylor Instrument Co., Toronto, Ont.

RIVETS AND BURRS
Parmenter & Bulloch Co., Gananoque, Ont.
Steel Co., of Canada, Ltd., Hamilton,

RIVETS, CHAIN
Fittings, Limited, Oshawa, Ont.

RIVET-MAKING MACHINERY
Acme Machinery Co., Cleveland, Ohio.
Bertram & Son Co., Ltd., The John, Dundas, Ont.
National Machinery Co., Tiffin, Ohio.

RIVETING MACHINES
Can. Fairbanks-Morse Ltd., Montreal, Q.
High Speed Hammer Co., Rochester, N.Y.
Parmenter & Bulloch Co., Gananoque Ont.
Petrie, Ltd., H. W., Toronto, Ont.

RUDDER FRAMES, STEEL
Can. Steel Foundries, Montreal, Que.

RUBBER MILL MACHINERY
Bertram Ltd., Edinburgh, Scotland.

RULES, STEEL AND WOOD
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Windsor, Ont.

RUST PREVENTATIVES
Oakley Chemical Co., New York, N. Y.

SAND EQUIPMENT
Can. Link-Belt Co., Toronto, Ont.

SAND RAMMERS, PNEUMATIC
Cleveland Pneumatic Tool Co., Toronto.

SAW FRAMES AND BLADES, HACK
Atkins & Co., Inc., E. C., Indianapolis,
Diamond Saw & Stamping Works, Buffalo, N. Y.
Rice Lewis & Sons, Ltd., Tornto, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWING MACHINES, POWER HACK
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis,
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.

SAW SHARPENING MACHINES
Atkins & Co., Inc., E. C., Indianapolis.

SAW TABLES, UNIVERSAL
Petrie, Ltd., H. W., Toronto, Ont.

SAWS, CIRCULAR METAL
Atkins & Co., Inc., E. C., Indianapolis.
Pryibil Machine Co., New York, N. Y.
Gisholt Machine Co., Madison, Wis.

SAWS, HAND
Atkins & Co., Inc., E. C., Indianapolis
Simonds Canada Saw Co., Montreal, Q.

SAWS, HOT AND COLD
Atkins & Co., E. C., Indianapolis, I.
Simonds Canada Saw Co., Montreal, Q.

SAWS, HIGH SPEED STEEL
Atkins & Co., Inc., E.C., Indianapolis, I.
Butterfield & Co. Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, METAL BAND
Atkins & Co., E. C., Indianapolis, I.

SAWS, METAL CUTTING
Brown & Sharpe Mfg. Co., Providence,
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.
Starrett Co., L. S., Athol, Mass.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E., C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap & Die Corp., Galt, Ont.
Pratt & Whitney Co., of Canda, Ltd., Dundas, Ont.

SAWS, SCREW SLOTTING
Atkins & Co., Inc., E. C., Indianapolis.
Butterfield & Co., Inc., Rock Island, Q.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
Simonds Canada Saw Co., Montreal, Q.

SAWS, WOOD
E. C. Atkins & Co., Indianapolis, Ind.

SCALES
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Ltd., Montreal, Q.
Lufkin Rule Co., Windsor, Ont.

SCREENS
Dominion Engineering Works, Ltd., Montreal, Que.

SCREW DRIVERS, OPTICAL, JEWELRY AND NOVELTY
Strand & Co., N. A., Chicago, Ill.

SCREW MACHINE WORK
Cook Co., Asa S., Hartford, Conn.
National Acme Co., Montreal, Que.

SCREW MACHINERY, WOOD AND LAG
Cook Co., Asa S., Hartford, Conn.

SCREW MACHINES
Brown & Sharpe Mfg. Co., Providence, Rhode Island.

SCREW MACHINES, AUTOMATIC
Brown & Sharpe Mfg. Co., Providence, Rhode Island.
Pratt & Whitney Co. of Canada, Ltd., Dundas, Ont.

SCREW MACHINE PRODUCTS
National Acme Co., Montreal, Que.

SCREW PLATES
Butterfield & Co., Inc., Rock Island. Que.
Jardine & Co., A. B., Hespeler, Ont.

SCREWS, CAP AND SET
Galt Machine Screw Co., Galt, Ont.
National Acme Co., Montreal, Que.

SCREWS, SAFETY, SET
Galt Machine Screw Co., Galt, Ont.

SECOND-HAND MACHINERY
See last page of directory.
Petrie, Ltd., H. W., Toronto, Ont.

SEPARATORS, MOISTURE AND OIL
Bowser, S. F., & Co., Ltd., Toronto, Canada.

SEPARATORS, OIL AND WASTE
Bowser, S. F., & Co., Ltd., Toronto.

SHAFTS, FLEXIBLE
Strand & Co., N. A., Chicago, Ill.

SHAFTING
British Empire Steel Corporation, Montreal, Que.
Canada Foundries & Forgings Co., Welland, Ont.
Can. Drawn Steel Co., Hamilton, Ont.
Williams Machinery Co., A. R., Toronto.

SHAPES, COLD-DRAWN SPECIAL STEEL
Union Drawn Steel Co., Hamilton, Ont.

SHAPING MACHINES
Hendey Machine Co., Torrington, Conn.
Morton Mfg. Co., Muskegon, Mich.
McDougall Co., Ltd., R., Galt, Ont.
Williams Machinery Co., A. R. Toronto.

SHEARS HAND
Can. Blower & Forge Co., Ltd., Kitchener, Ont.

SHEARS, POWER
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Ltd., Kitchener.
Stoll Co., Inc., D. H., Buffalo, N. Y.
Williams Machinery Co., A. R., Toronto, Ont.

SHEARING MACHINES, ANGLE, IRON BAR AND GATE
Bertrams Ltd., Edinburgh, Scotland.

SHEET LEAD
Canada Metal Co., Ltd., Toronto, Ont.

SHEET METAL WORKING MACHINERY
Bliss Co., E. W., Brooklyn, N. Y.
Brown, Boggs & Co., Ltd., Hamilton, Ont.
Stoll Co., Inc., D. H, Buffalo, N.Y.

SHEETS, NICKEL, MONEL AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.

SHEETS, O.P.C.R. & B. A. AND BLUE ANNEALED
Steel Co., of Canada, Ltd., Hamilton, Ont.

SIDE FRAMES, LOCOMOTIVE
Can. Steel Foundries, Montreal, Que.

SLOTTING ATTACHMENTS
Brown & Sharpe Mfg. Co., Providence, R.I.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
National Acme Co., Cleveland, Ohio.

SLOTTING MACHINES
Bertram & Son Co., Ltd., The John, Dundas, Ont.

SOLDERS
Canada Metal Co., Ltd., Toronto, Ont.

SPECIAL MACHINERY AND TOOLS
Brown Engineering Corp., Ltd., Toronto.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Cleveland, O.

SPIKES, RAILWAY AND PRESSED
Steel Co. of Canada, Ltd., Hamilton, Ont.

SPINNING LATHES
Prybil Machine Co., P., New York City.

SPRING, MILLED
Barnes & Co., Wallace, Hamilton, Ont.

SPRINGS, SMALL SPIRAL HELICAL, COMPRESSION, EXTENSION, TORSION AND SPECIAL
Barnes Company, Wallace, Hamilton,

SPRINGS
Barnes Company, Wallace, Hamilton.
Cleveland Wire Spring Co., Clevleand, O.
Steele Ltd., James, Guelph, Ont.

SPRINGS, FLAT STEEL, BRUSH HOLDER, CLOCK, SMALL FLAT SPRINGS
Barnes Company, Wallace, Hamilton.

SPROCKETS AND CHAINS
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Renold Hanson of Canada, Ltd., Montreal, Que.

SQUARES
Brown & Sharpe Mfg. Co., Providence, R.I.
Lufkin Rule Co., Windsor, Ont.
Steel Co. of Canada, Ltd., Hamilton. Ont.

STAMPING, METAL
American Pulley Co., Philadelphia, Pa.
Barnes Company, Wallace, Hamilton.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Parmenter & Bulloch Co., Gananoque, Ont.

STAMPS, STEEL
Diamond Saw & Stamping Works, Buffalo, N. Y.

STEEL CONCRETE REINFORCEMENT
Steel Co. of Canada, Ltd., Hamilton.

STEEL PLATE
British Empire Steel Co., Montreal, Que.

STEEL AND IRON BARS
Steel Co. of Canada, Ltd., Hamilton.

STEELS TOOL
British Empire Steel Co. Montreal Q.

STEEL, COLD-ROLLED STRIP
British Empire Steel Co., Montreal, Q.
Barnes Company, Wallace, Hamilton.

STEEL, CRUCIBLE, SPRING
Barnes, Company, Wallace, Hamilton.
British Empire Steel Co., Montreal, Q.

SHEETS, OPEN HEARTH STEEL
Steel Co., of Canada, Ltd., Hamilton.

STEEL, SHAFTING AND FREE CUTTING SCREW
Union Drawn Steel Co., Hamilton, Ont.

STEEL, SHEET
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.

STEEL, STAINLESS
Steel Co., of Can. Ltd., Hamilton, Ont.

STEELS, ALLOY AND CARBON
Algoma Steel Corp., Ltd., Sault Ste. Marie, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Can. Steel Foundries, Montreal, Que.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton. Ont.

STEELS, HIGH-SPEED
Armstrong Bros. Tool Co., Chicago, Ill.
Atkins & Co., Ltd., Wm., Sheffield, England.
British Empire Steel Co., Montreal, Q.
Rice Lewis & Son, Ltd., Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.

STEEL TUBING, CLOSE JOINT AND WELDED
Standard Tube & Fence Co., Ltd., Woodstock, Ont.

STERN FRAMES, CAST STEEL
Can. Steel Foundries, Montreal, Que.

STRAIGHTENING MACHINERY
Bertram Ltd., Edinburgh, Scotland.
Williams & Co., J. H., Brooklyn, N.Y.

STUDS
Galt Machine Screw Co., Galt, Ont.

BUYERS' DIRECTORY

STUD SETTERS, SELF-OPENING
Geometric Tool Co., New Haven, Conn.

SWAGING MACHINES
Atkins & Co., Inc., E. C., Indianapolis, Indiana.

SWITCHES, RAILWAY
Can. Steel Foundries, Montreal, Que.

TACHOMETERS
Bristol Co., Waterbury, Conn.

TANKS AND PUMPS, OIL
Bowser, S. F., & Co., Ltd., Toronto.

TAP HOLDERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.
William L. Procunier, Chicago, Ill.

TAPER PINS
Galt Machine Screw Co., Galt, Ont.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPES, MEASURING
Starrett Co., L. S., Athol, Mass.
Lufkin, Rule Co., Windsor, Ont.

TAPPING MACHINES AND ATTACHMENTS
Burke Machine Tool Co., Conneaut, O.
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.
Petrie, Ltd., H. W., Toronto, Ont.
Wm. L. Procunier, Chicago, Ill.
Starrett Co., L. S., Athol, Mass.

TAPS AND DIES
Butterfield & Co., Inc., Rock Island, Q.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Greenfield Tap & Die Corp., Galt, Ont.
Jardine & Co., A. B., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

TAPS, COLLAPSING
Geometric Tool Co., New Haven, Conn.
Jardine & Co., A. B., Hespeler, Ont.
National Acme Co., Cleveland, Ohio.

TEETH, DREDGE BUCKET
Kennedy & Sons, W., Owen Sound, Ont.

THERMOMETERS
Bristol Co., Waterbury, Conn.
Taylor Instrument Co., Toronto, Ont.
Greenfield Tap and Die Corp., Galt, Ontario.

THREAD-CUTTING TOOLS
Butterfield & Co., Inc., Rock Island, Q.
Greenfield Tap and Die Corp., Galt, Ont.
National Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

THREADING MACHINES
Acme Machinery Co., Cleveland, Ohio.
Geometric Tool Co., New Haven, Conn.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams Tool Corp., of Can. Ltd., Brantford, Ont.

THREAD LEAD TESTING MACHINES
Pratt & Whitney Co., of Canada, Ltd., Dundas, Ont.

THREAD-ROLLING MACHINES
Bliss Co., E. W., Brooklyn, N. Y.

TIE PLATES
Steel Co. of Canada, Ltd., Hamilton.

TIME RECORDERS
International Business Machine Co., Ltd., Toronto, Ont.

TONGS
Hepburn Ltd., John T., Toronto, Ont.

TOOL CASES
Rice Lewis & Son, Ltd., Toronto, Ont.

TOOL HOLDERS
Armstrong Bros. Tool Co., Chicago, Ill.
Gisholt Machine Co., Madison, Wis.
Bertrams Ltd., Edinburgh, Scotland.

TOOL POSTS, LATHE
Bertram & Son Co., Ltd., The John, Dundas, Ont.
Williams & Co., J. H., Brooklyn, N. Y.

TOOLS, SMALL
(See Machinists' Small Tools)
Armstrong Bros. Tool Co., Chicago, Ill.
Bertrams Ltd., Edinburgh, Scotland.
Brown & Sharpe Mfg. Co., Providence, R. I.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Geometric Tool Co., New Haven, Conn.
Lufkin Rule Co., Windsor, Ont.
National Machine Tool Co., Racine, Wis.
Rice Lewis & Son, Ltd., Toronto, Ont.
Starrett Co., L. S., Athol, Mass.
Wheel Trueing Tool Co., Windsor, Ont.
Williams Machinery Co., A. R., Toronto,

TOOL WORK
Brown Engineering Corp., Ltd., Toronto, Ontario.

TORCHES, BLOW
Rice Lewis & Son, Ltd., Toronto, Ont.

TRACKWORK, RAILWAY
Can. Steel Foundries, Montreal, Que.

TRACKWORK, MANGANESE STEEL
Can. Steel Foundries, Montreal, Que.

TRANSMISSION MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Kennedy & Sons, Wm., Owen Sound.
Petrie, Ltd., H. W., Toronto, Ont.
Renold, (Hans) of Canada, Ltd., Montreal, Que.

TROLLEYS AND TRAMWAYS
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Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Wright Mfg. Co., Lisbon, Ohio.

TROLLEY WHEELS
Langley & Austin, Galt, Ont.

TROWELS, PLASTERING
E. C. Atkins & Co., Indianapolis, Ind.

WRENCHES, MACHINISTS'
Armstrong Bros. Tool Co., Chicago, Ill.

TRUCKS
Can. Fairbanks-Morse Ltd., Montreal, Q.
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Hepburn Ltd., John T., Toronto, Ont.
Morris Crane & Hoist Co., Ltd., Niagara Falls, Ont.

TUBING, SEAMLESS STEEL, BRASS AND COPPER AND FIBRE
Diamond State Fibre Co., of Can., Ltd., Toronto, Ont.
Dominion Engineering Works, Limited, Montreal, Que.
Goldstein Mfg. Co., Ltd., Toronto, Ont.

TURRET HEADS
Bertram & Son Co., Ltd., The John Dundas, Ont.

TURRET MACHINES
(See Lathes, Horizontal Turret)
Acme Machine Tool Co., Cincinnati, O.
Cook Co., Asa S., Hartford, Conn.
Gisholt Machine Co. Madison Wis.
National Acme Co. Cleveland O.
Pratt & Whitney Co. of Canada Ltd., Dundas, Ont.
Sterling Turret Machine Co., Madison, Wisconsin.

TURRETS, TOOL POST
Gisholt Machine Co. Madison, Wis.

UNIONS, PIPE
Fittings, Limited, Oshawa, Ont.

VALVES
Canada Metal Co., Toronto, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Dominion Engineering Works, Limited, Montreal, Que.

VISES, DRILLING MACHINE
Burke Machine Tool Co., Conneaut, Ohio.
Charles Parker Co., Meriden, Conn.
Cleveland Pneumatic Tool Co., Toronto, Ontario.
Kempsmith Mfg. Co., Milwaukee, Wis.

VISES, PIPE
Charles Parker Co., Meriden, Conn.

VISES, PLANER AND SHAPER
Bertram & Son Co., Ltd., The John Dundas, Ont.
Philip Gies Foundry, Kitchener, Ont.
Hendley Machine Co., Torrington, Conn.
Kempsmith Mfg. Co., Milwaukee, Wis.
McDougall Co., Ltd., R., Galt, Ont.

VISES, WOOD WORKERS'
Charles Parker Co., Meriden, Conn.
Parmenter & Bulloch Co., Gananoque, Ontario.

VOLTMETERS
Bristol Co., Waterbury, Conn.

WAGON LEADERS
Can. Link-Belt Co., Toronto, Ont.

WASHERS, LOCK, SPLIT AND SPRING
Barnes Company, Wallace, Hamilton.

WELDING APPARATUS, OXY-ACETYLENE
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto, Ont.
Imperial Brass Mfg. Co., Chicago, Ill.

WELDING APPARATUS
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC, ARC, SPOT AND BUTT
International Malleable Iron Co., Guelph, Ont.

WELDING MACHINES, OXY-ACETYLENE
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Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WELDING, ELECTRIC
McLaren Belting Co., J. C., Montreal, Que.
Steel Co. of Canada, Ltd., Hamilton.

WELDING ROD, TOBIN, MANGANESE, BRONZE AND ALUMINUM
Dominion Oxygen Co., Ltd., Toronto.
Liquide Air Company, Toronto, Ont.

WELDING SUPPLIES
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.
L'Air Liquide Society, Toronto, Ont.

WHEELS, INDUSTRIAL
American Pulley Co., Philadelphia, Pa.
Hull Iron & Steel Foundries, Hull, Que.
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, HEADGATE
Kennedy & Sons, Wm., Owen Sound, Ontario.

WINCHES, STOPLOG
Kennedy & Sons, Wm., Owen Sound, Ontario.

WIRE
Barnes Company, Wallace, Hamilton.
Canada Metal Co., Ltd., Toronto, Ont.
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.
Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

WIRE, BLACK TEMPERED, MUSIC PHOSPHOR BRONZE AND PREMIER
Barnes Company, Wallace, Hamilton.

WIRE, COPPER AND BRASS, FINE AND HEAVY
Steel Co., of Canada, Ltd., Hamilton, Ontario.

WIRE STRAIGHTENING AND CUTTING MACHINERY
Brown, Boggs & Co., Ltd., Hamilton, Ontario.

WIRE, WELDING
L'Air Liquide Society, Toronto, Ont.
Carter Welding Co., Ltd., Toronto, Ont.
Dominion Oxygen Co., Ltd., Toronto.

WIRES, SPECIAL
Dennis Wire & Iron Works, London, Ontario.
Greening Wire Co., B., Hamilton, Ont.

WOODWORKING MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto, Ontario.

WRENCHES, DROP FORGED
Armstrong Bros. Tool Co., Chicago, Ill.
Canada Foundries & Forgings Co., Welland, Ont.

List of Directory of Dealers will be Found above Advertising Index

When answering advertisements kindly mention Canadian Machinery

DIRECTORY OF DEALERS

THE Buyers' Directory of CANADIAN MACHINERY was originally intended to contain information regarding lines actually manufactured by our advertisers. We now carry the advertising of leading machinery dealers, some of whom represent scores of manufacturers in addition to being manufacturers themselves in some cases. We recommend, therefore, if our subscribers cannot find what they want in our Directory that they communicate with the dealers whose names appear herewith.

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The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie, Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

Yeates Machinery Co., London, Ont.

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H. W. Petrie Ltd., Toronto, Ont.

WOODWORKING MACHINERY

The Canadian Fairbanks-Morse Co., Montreal, Que.

Garlock Machinery Ltd., Toronto.

H. W. Petrie Ltd., Toronto, Ont.

A. R. Williams Machinery Co., Toronto, Ont.

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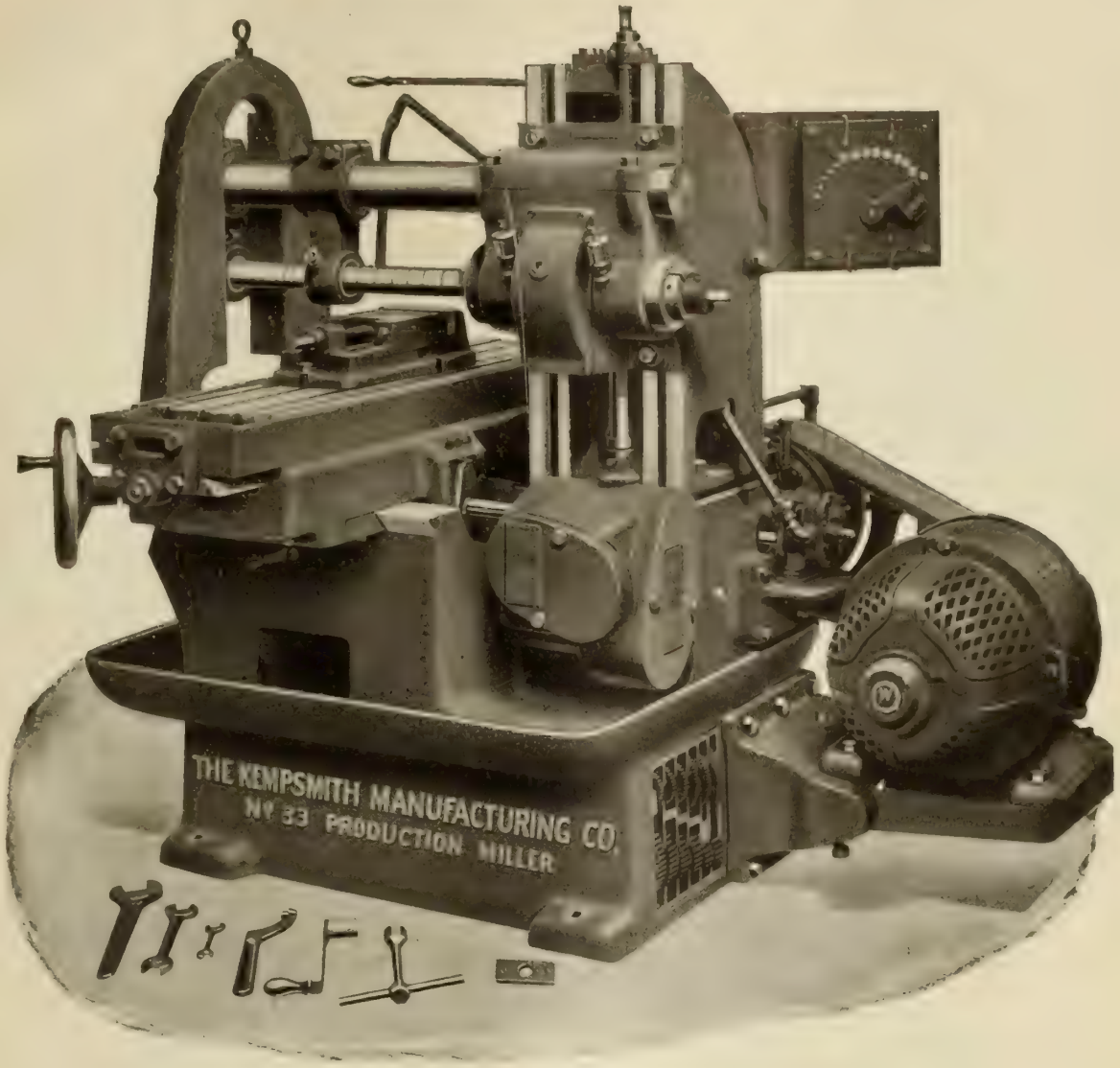
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